Santos

Varanus Island Hub

Varanus Island Hub Operations EP for Commonwealth Waters

25 November 2024

Santos

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Rev	Owner	Reviewer(s) *Managerial/Technical/Site*	Approver
	Operations Superintendent WA, NT & TL Operations VI/DC	Manager Environment WA, NT & TL	Production Manager WA, NT & TL Operations VI/DC
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Rev	Rev Date	Author / Editor	Amendment
0	6 Sept 2013	Apache Energy Ltd	Submission to NOPSEMA
1	27 May 2014	Apache Energy Ltd	Revised Submission to NOPSEMA incorporating comments received on Rev 0 from NOPSEMA
1.1	11 Sept 2014	Apache Energy Ltd	Minor Internal Revision as per MoC-58
1.2	16 June 2017	Quadrant Energy	Minor revision to incorporate temporary changes to EP for Greater East Spar Phase 1 Activities in June 2017 as per MOC-173
1.2A	3 May 2019	Santos	Draft issued for internal review
1.2 B	21 June 2019	Santos	Draft issued for internal review
2	31 July 2019	Santos	Submission to NOPSEMA - 5 yearly revision
2A	13 December 2019	CDM Smith	Draft issued for internal review
3	16 December 2019	Santos	Response to NOPSEMA comments – 5 yearly revisions
3A	30 March 2020	Santos	Addressed comments from NOPSEMA, issued for Santos review. Note: material deleted text will appear as ~~highlighted strikethrough~~ all new text appears as highlighted text.
4	6 April 2020	Santos	Response to NOPSEMA comments – 5 yearly revisions
4A	June 2020	Santos	Addressed comments from NOPSEMA RFFWI dated 5 May 2020, issued for Santos review. Note: material deleted text will appear as ~~highlighted strikethrough~~ all new text appears as highlighted text.
5	July 2020	Santos	Response to NOPSEMA comments – 5 yearly revisions
6	January 2021	Santos	Inclusion of Spartan Development infrastructure. Inclusion of updated Santos Risk Matrix and Management System
7	May 2022	Santos	Response to NOPSEMA RFFWI
8	June 2022	Santos	Response to NOPSEMA RFFWI. Accepted 30 June 2022 as a 5 year revision
9	July 2024	Santos	Update in response to NOPSEMA Opportunity to Modify letter dated 28 December 2023. Updates reflect replacement of Halyard-1 well with Halyard-2
10	August 2024	Santos	Update to address NOPSEMA EP incomplete letter dated 30 July 2024
11	November 2024	Santos	Update to address NOPSEMA EP Request for Further Written Information dated 3 October 2024

Contents

Tables

Figures

Terms

Abbreviation	Description
AEP	Australian Energy Producers (formerly APPEA)
AFMA	Australian Fisheries Management Authority
ALARP	as low as reasonably practicable
AMOSC	Australian Marine Oil Spill Centre Pty Ltd
AMSA	Australian Marine Safety Authority
APASA	Asia-Pacific Applied Sciences Associates
APPEA	Australian Petroleum Production & Exploration Association
AUV	autonomous underwater vehicle
BIA	biologically important area
BTEX	benzene, toluene, ethylbenzene and xylene
CAMBA	China-Australia Migratory Bird Agreement
CHARM	Chemical Hazard Assessment and Risk Management
CH_4	methane
CIU	chemical injection unit
CMMS	Computerised Maintenance Management System
cP	centipoise (millipascal-second (mPa. s))
CO_2	carbon dioxide
CTD	conductivity, temperature and depth
DAWE	Department of Agriculture, Water and the Environment
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEMIRS	Department of Energy, Mines, Industry Regulation and Safety
DoE	(Commonwealth) Department of the Environment
DoEE	Department of the Environment and Energy
DoT	Department of Transport
DPaW	Department of Parks and Wildlife (now DBCA)
DPIRD	Department of Primary Industries and Regional Development
DWER	Department of Water and Environmental Regulation
EHU	electro-hydraulic umbilical
EMBA	environment that may be affected
EOFL	end of field life
EP	Environment Plan
EPA	West Australian (WA) Environmental Protection Authority
EPBC Act	Environmental Protection and Biodiversity Conservation Act 1999
EPO	environmental performance outcome
EPS	environmental performance standard
ES	East Spar
ESD	emergency shutdown
g/m2	gram per square metre
GES	Greater East Spar
GHG	greenhouse gas

Abbreviation	Description
HEV	high environmental value
HSEMS	Health, Safety and Environment Management System
HXT	horizontal subsea tree
IMCRA	Integrated Marine and Coastal Regionalisation of Australia
IMMR	inspection, maintenance, monitoring and repair
IMS	invasive marine species
IMT	Incident Management Team
KEF	key ecological feature
kL	kilolitre
L	litre
LDAR	Leak Detection and Repair
LEMS	Lifting Equipment Management System
LOWC	loss of well control
m3/d	cubic metre per day
Mt	Million tonnes
MEG	monoethylene glycol
MPNMP	Marine Parks Network Management Plan
MoC	management of change
NTA	Native Title Act 1993
NEBA	net environmental benefit analysis
nm	nautical mile
N2O	nitrogen oxide
NGER Act	National Greenhouse and Energy Reporting Act 2007
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOPTA	National Offshore Petroleum Titles Administrator
NOX	nitrous oxides
NWS	North West Shelf
OCNS	Offshore Chemical Notification Scheme
OPEP	oil pollution emergency plan
OPGGS Act	Offshore Petroleum and Greenhouse Gas Storage Act 2006
OPGGS(E)R 2023	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023
OSRL	Oil Spill Response Limited
PLEM	pipeline end manifold
PLET	pipeline end termination
ppb	part per billion
ppm	part per million
PMS	preventative maintenance system
PTS	permanent threshold shift
ROTV	remotely operated towed vehicle
ROV	remotely operated vehicle
SMPEP	shipboard marine pollution emergency plan
SOPEP	shipboard oil pollution emergency plan
SOX	sulphur oxides

Abbreviation	Description
SSS	side-scan sonar
SCSSV	surface controlled subsurface safety valves
ST 1	sidetrack (sidetracked and number reference)
TTS	temporary threshold shift
VI	Varanus Island
VI Hub	Varanus Island oil and gas hub
VOC	volatile organic compound
WA	Western Australia
WA, NA, TL	Western Australia, Northern Australia and Timor Leste
WAFIC	Western Australian Fishing Industry Council
WHP	wellhead platform
WOMP	Well Operations Management Plan
XT	Christmas tree

1. Introduction

1.1 Environment Plan Summary

OPGGS(E)R 2023 Requirements
Regulation 35 (6)
Within 10 days after receiving notice that the Regulator has accepted an Environment Plan (EP) (whether in full, in part or subject to limitations or conditions), the titleholder must submit a summary of the accepted plan to the Regulator for public disclosure.
Regulation 11(4)
The summary: a) must include the following material from the environment plan: i. the location of the activity; ii. a description of the receiving environment; iii. a description of the activity; iv. details of environmental impacts and risks; v. a summary of the control measures for the activity; vi. a summary of the arrangements for ongoing monitoring of the titleholder's environmental performance; vii. a summary of the response arrangements in the oil pollution emergency plan; viii. details of consultation already undertaken, and plans for ongoing consultation; and ix. details of the titleholder's nominated liaison person for the activity. b) must be to the satisfaction of the Regulator.

This Varanus Island Hub Operations Environment Plan for Commonwealth Waters EP Summary has been prepared from material provided in this EP. The summary consists of the following as required by Regulation 35(7):

EP Summary Requirement (Regulation 35(7) of the Regulations)	Relevant Section of the EP
The location of the activity	Section 2.1
A description of the receiving environment	Section 3
A description of the activity	Section 2
Details of the environmental impacts and risks	Section 6 and Section 7
Control measures for the activity	Section 6, 7 and 8.4
Arrangements for the ongoing monitoring of the titleholder's environmental performance	Section 8
Response arrangements in the oil pollution emergency plan (OPEP)	Section 6.8 and OPEP
Consultation already undertaken and plans for ongoing consultation	Section 4
Details of the titleholder's nominated liaison person for the activity	Section 1.7.2

In relation to the Oil Pollution Emergency Plan (OPEP) for this activity, under Regulation 56(1), Santos refers to the Varanus Island Hub Operations Oil Pollution Emergency Plan (OPEP) previously submitted and accepted by NOPSEMA on 23 July 2024.

1.2 Activity Overview

The operation of the VI Hub in Commonwealth waters is managed under the Varanus Island Hub Operations Environment Plan for Commonwealth Waters (Cwth) (John Brookes, Greater East Spar and Associated Facilities) (VI Hub Ops EP). The VI Hub Ops EP was first accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) on 11 September 2014.

Since then, the VI Hub Ops EP has been revised and accepted by NOPSEMA as follows:

- In July 2020 in accordance with Regulation 19 of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS(E)R 2009), a five yearly revision was accepted by NOPSEMA.
- In June 2022 in accordance with Regulation 17(5 of the OPGGS(E)R 2009, to incorporate the operations associated with the single well Spartan gas field, that was tied back to the John Brookes wellhead platform

(WHP) via a single flexible flowline and umbilical. At this time, in accordance with regulation 19(1)(c), NOPSEMA notified Santos the five year review period commenced on 30 June 2022.

This revision of the VI Hub Ops EP is being submitted to NOPSEMA as a new stage of an activity in accordance with Regulation 39(1) of the OPGGS(E)R 2009. The new stage is the replacement of the operation of the Halyard-1 well with the Halyard-2 well. As Halyard-2 is replacing Halyard-1 and targeting the same reservoir formation, no increase in production is anticipated, nor any new or increased environmental impacts or risks.

Minor updates have also been made to this VI Hub Ops EP revision to reflect:

- Forecast greenhouse gas (GHG) emissions for the next five years these have not increased by replacing Halyard-2 with Halyard-1
- Legislative updates to reflect amendments to the Offshore Petroleum Greenhouse Gas Storage (Environment) Regulations 2023 (OPGGS(E)R)
- Current environmental literature available on the existing environment (Section 3 and Appendix D)
- Stakeholder consultation undertaken for the new stage in May 2023 (Section 4 and Appendix F).

As described in previous revisions of this VI Hub Ops EP, Santos WA Energy Ltd (Santos) is the operator of the John Brookes, Spartan and Greater East Spar (GES) gas fields in offshore Commonwealth waters on the Northwest Shelf of Western Australia. Production fluids from these fields are transported by subsea pipelines to the Varanus Island (VI) oil and gas hub (VI Hub) located in State waters (as shown in Figure 1-1).

1.3 Out of Scope

The activities out of scope for this EP are:

- operation and maintenance of all VI Hub Operations infrastructure located within Western Australian State Waters and onshore at VI is managed under the VI Hub Operations EP (State Waters
- Halyard-2 Drilling & Completion activities addressed in the Halyard-2 Drilling & Completion EP.

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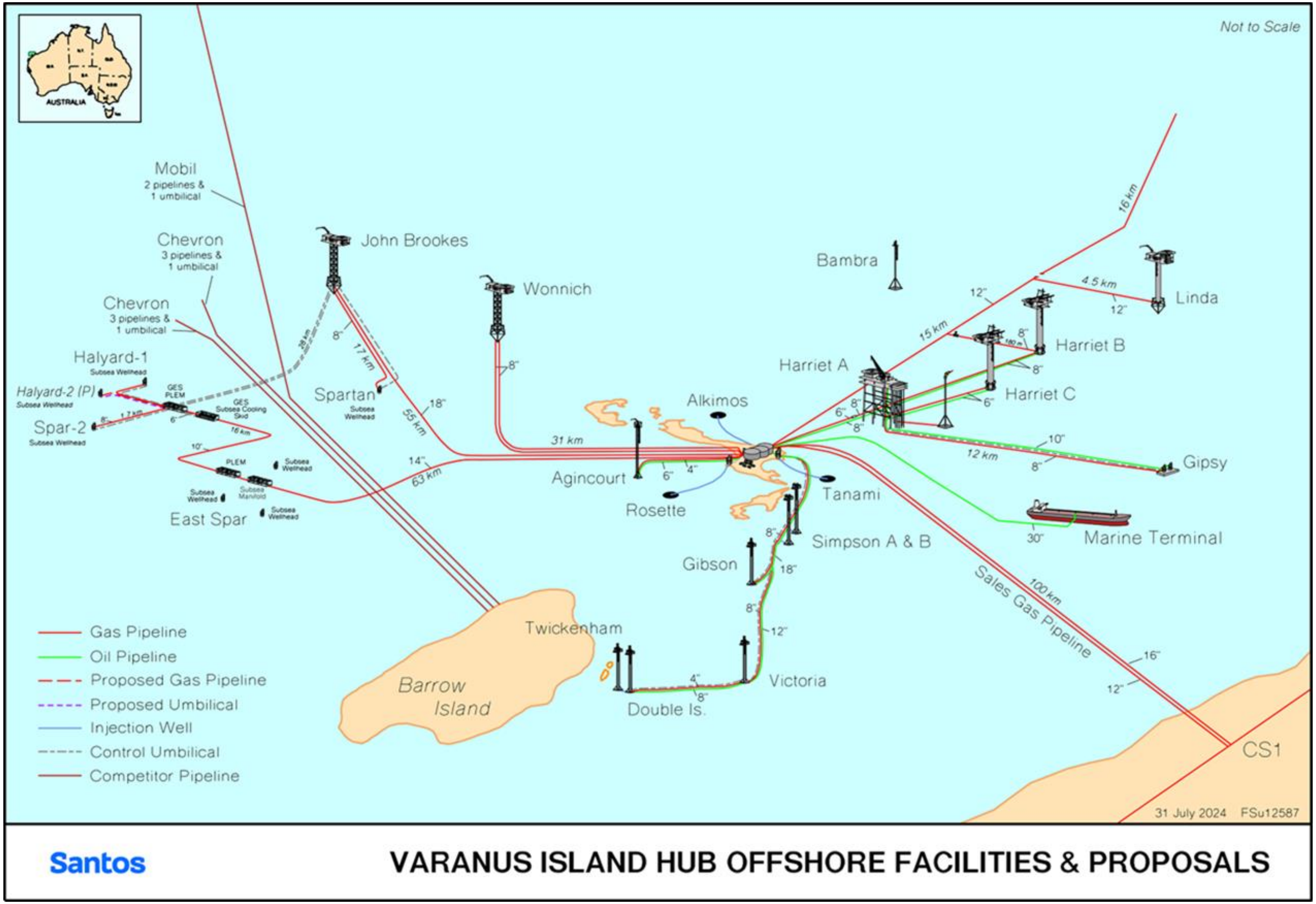

Figure 1-1: Schematic of the Varanus Island Hub facilities

1.4 Activity Primary Approvals for New Stage (Section 39(1))

The tieback of the Halyard-1 production well to the East Spar production system, the connection of control umbilical to the existing John Brookes WHP and production from the Halyard reservoir was referred and determined to be a not controlled action under the EPBC Act Referral Decision 2010/5611. Halyard-2 is a replacement well to Halyard-1, located approximately 10 m from Halyard-1. Santos considers that the operation of the Halyard-2 well is included in the Not-Controlled Action or equivalent to the activities included because the referral included:

- an expected production life of the Halyard field of around 15 years;
- a proposed development design that allows for additional production wells;
- well control from the John Brookes WHP;
- export from the Halyard-1 well through a tie-in spool and flexible flowline to the Halyard PLEM;
- transport of production gases and associated condensate to existing production facilities on Varanus Island from the East Spar Manifold, via the existing East Spar pipeline.

1.5 Purpose of this Environment Plan

OPGGS(E)R 2023 Requirements
Regulation 39(1)
A titleholder must submit to the Regulator a proposed revision of the environment plan for an activity before the commencement of any significant modification or new stage of the activity that is not provided for in the environment plan as currently in force.

The purpose of this EP is to detail the environmental impacts and risks associated with the operation of the VI Hub (Commonwealth waters) (refer to Section 2) and to demonstrate how these will be reduced to as low as reasonably practicable (ALARP) and to an acceptable level. 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 activities described in the EP complies with the Santos Environmental Management Policy and with all relevant legislation.

This EP documents and considers all relevant stakeholder consultation performed during the planning of the activity.

1.6 Environment Plan Validity

In accordance with Regulation 42 of the OPGGS(E)R 2023, this EP remains valid from NOPSEMA acceptance until Santos revises this EP, after the end of each period of five years under Regulation 41 of the OPGGS(E)R 2023, or until it is revised due to a significant change to the activity or level of impact or risk increase as required under Regulation 39(2) or until NOPSEMA accepts an end-of-activity notification under Regulation 46.

Santos may revise the EP, using the MOC Process described in Section 8. Any changes made under this process will not affect the validity of this EP.

1.7 Titleholder

OPGGS(E)R 2023 Requirements
Regulation 15. Details of titleholder and liaison person
23(1) The environment plan must include the following details for the titleholder: a) name b) business address c) telephone number (if any) d) fax number (if any) e) email address (if any) f) if the titleholder is a body corporate that has an ACN (within the meaning of the Corporations Act 2001)—ACN. 23(2) The environment plan must also include the following details for the titleholder's nominated liaison person:

OPGGS(E)R 2023 Requirements
a) name b) business address c) telephone number (if any) d) fax number (if any) e) email address (if any).

1.7.1 Details of Titleholder

Table 1-1 provides the titleholders and their contact details.

Table 1-1: Titleholder details for all titles under this Environment Plan

Title	Pipeline Licence	Titleholder	ACN	Interest (%)	Address
WA-29-L	WA-11-PL	Santos WA Northwest Pty Ltd	009 140 854	55	Business Address: Level 7, 100 St Georges Terrace, Perth, Western Australia, 6000 Telephone number: (08) 6218 7100 Fax number: (08) 6218 7200 Email address: offshore.environment.admin@santos.com
		Santos (BOL) Pty Ltd	000 670 575	45	Business Address: Level 7, 100 St Georges Terrace, Perth, Western Australia, 6000 Telephone number: (08) 6218 7100 Fax number: (08) 6218 7200 Email address: want@santos.com
WA-45-L WA-13-L	WA-21-PL WA-05-PL	Santos WA Southwest Pty Ltd	050 611 688	100	Business Address: Level 7, 100 St Georges Terrace, Perth, Western Australia, 6000 Telephone number: (08) 6218 7100 Fax number: (08) 6218 7200 Email address: offshore.environment.admin@santos.com
WA-63-L	WA-30-PL	Santos WA Southwest Pty Ltd	050 611 688	55	Business Address: Level 7, 100 St Georges Terrace, Perth, Western Australia, 6000 Telephone number: (08) 6218 7100 Fax number: (08) 6218 7200 Email address: offshore.environment.admin@santos.com
		Santos (BOL) Pty Ltd	000 670 575	45	Business Address: Level 7, 100 St Georges Terrace, Perth, Western Australia, 6000 Telephone number: (08) 6218 7100 Fax number: (08) 6218 7200 Email address: want@santos.com
WA-214-P		Santos WA Northwest Pty Ltd	009 140 854	55	Business Address: Level 7, 100 St Georges Terrace, Perth, Western Australia, 6000 Telephone number:

Title	Pipeline Licence	Titleholder	ACN	Interest (%)	Address
					(08) 6218 7100 Fax number: (08) 6218 7200 Email address: offshore.environment.admin@santos.com
		Santos (BOL) Pty Ltd	000 670 575	45	Business Address: Level 7, 100 St Georges Terrace, Perth, Western Australia, 6000 Telephone number: (08) 6218 7100 Fax number: (08) 6218 7200 Email address: want@santos.com

1.7.2 Details for Nominated Liaison Person

Details for Santos' nominated liaison person for the activity are as follows:

Name: Nathan Vitanza (Production Manager – WA, NT & TL Operations VI/DC)

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

Telephone number: (08) 6218 7100

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

1.7.3 Notification Procedure in the Event of Changed Details

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

Additional information regarding Santos' operations can be obtained from the Santos website at: www.santos.com.

1.8 Environmental Management Framework

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

1.8.1 Environmental Management Policy

The activities will be conducted in accordance with the Santos Environment, Health and Safety Policy presented in Appendix A inclusive of the relevant EP sections where the legislation may prescribe or control how an activity is undertaken.

Sections 6,7 and 8 reflect the Santos 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.

1.8.2 International Legislation

Australia is a signatory to numerous international conventions and agreements that obligate the Commonwealth government to prevent pollution and protect specified habitats, flora and fauna. Those that are relevant to the activities are described in Appendix B

1.8.3 Commonwealth Legislation

The petroleum activity described in this EP (Section 2) takes place within the Commonwealth jurisdictional boundary and therefore is subject to Commonwealth legislation.

All activities conducted as part of the EP will comply with legislative requirements established under relevant Commonwealth legislation detailed in Appendix B

1.8.4 State Legislation

In the event of a loss of well control or pipeline loss of integrity or a vessel collision, there is the potential for the spill to impact on State waters and/or shorelines. Relevant State legislation is detailed in Appendix B

2. Activity Description

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

All the facilities described in this Section 2 are part of the VI Hub, a central gathering and processing hub for Santos' oil and gas production facilities. The well fluids (gas and condensate) from the John Brookes, Halyard, Spartan and GES reservoirs are processed in the onshore VI Hub processing plant.

The onshore VI Hub also hosts the accommodation, administration and control centre for the production facilities. All facilities that form part of the hub are operated and maintained from VI. Personnel reside at VI and journey to and from the offshore facilities via helicopter or support vessel. Only VI Hub infrastructure located in Commonwealth waters has been described in Section 2 of this EP.

2.1 Location

The activities will occur in Petroleum Production Licences WA-63-L, WA-29-L, WA-45-L and WA-13-L approximately 127 km northwest of Karratha. The water depth in the operational area ranges between approximately 45 m and 115 m.

The locations of the producing and non-producing infrastructure in the operational area are listed in Table 2-1 and shown in Figure 2-1.

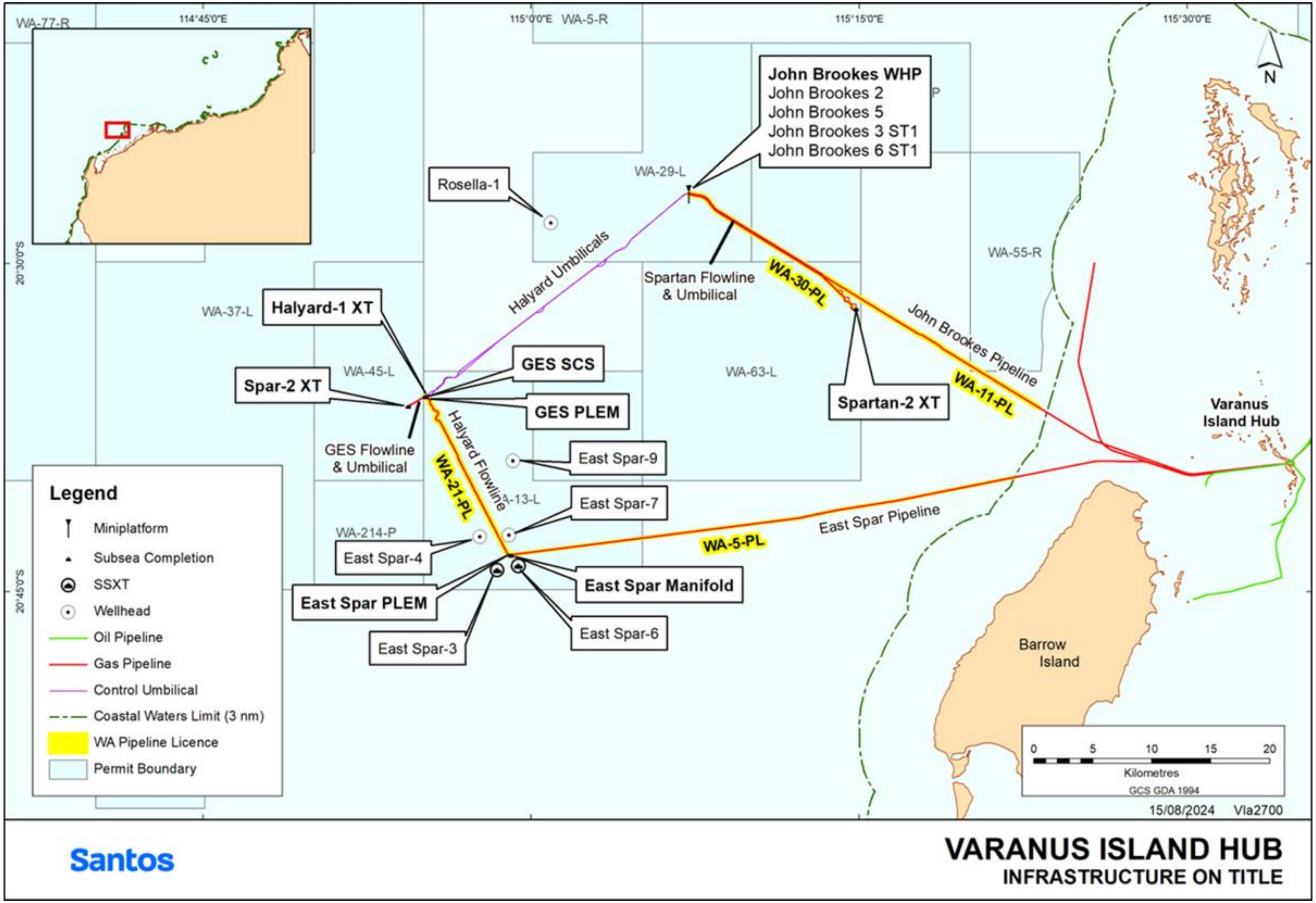

Figure 2-1: Infrastructure locations

Table 2-1: Surface locations for John Brookes, Spartan and Greater East Spar infrastructure

Infrastructure	Approx. Water Depth (m)	Closest Distance to VI (km)	Coordinates (Datum/Projection: GDA 94 Zone 50)			
			Latitude	Longitude	Easting (m E)	Northing (m N)
John Brookes field infrastructure						
John Brookes WHP	48	52 km northwest	20°26’50”S	115°07’13”E	303,892.90	7,737,890.25
John Brookes Pipeline	45.8	Intersects State waters boundary	Approximately 45 km between John Brookes WHP and VI			
John Brookes 2 Well	48	52 km northwest	20°26’50.44” S	115°07’12.47” E	303,890.7	7,737,890.2
John Brookes 3 (ST 1) Well	48	52 km northwest	20°26’50.51” S	115°07’12.47” E	303,890.6	7,737,887.8
John Brookes 5 Well	48	52 km northwest	20°26’50.44” S	115°07’12.56” E	303,893.1	7,737,890.2
John Brookes 6 (ST 1) Well	48	52 km northwest	20°26’50.52” S	115°07’12.64” E	303,895.5	7,737,887.8
Halyard Umbilical	Variable (approx. 48 105 m)	52 km northwest	Approximately 28 km between GES manifold and John Brookes WHP			
Spar-Halyard Replacement Umbilical (electrical only)	Variable (approx. 48 105 m)	52 km northwest	Approximately 28 km between GES manifold and John Brookes WHP			
Rosella-1 (ST 2) Well*	95	60 km northwest	20°28’08.90” S	115°00’54.10” E	292,952.0	7,735,347.7
Spartan field infrastructure						
Spartan-2 Well	58	35 km northwest	20° 32' 4.47" S	115° 14' 52.90" E	317,288.4	7,728,372.4
Spartan Flexible Flowline	48-60	35 km northwest	Approximately 17 km between Spartan-2 well and John Brookes WHP			
Spartan Umbilical	48-60	35 km northwest	Approximately 17 km between Spartan-2 well and John Brookes WHP			
GES field infrastructure						
Spar-2 Well	112.9	70 km west	20°36’31.981”S	114°54’2.09”E	281,788.82	7,719,733.4
Spar-2 Flowline	Variable (approx. 112 m)	69 km west	Approximately 1.9km long, from Spar-2 well to GES PLEM			
GES Umbilical	Variable (approx. 112 m)	69 km west	Approximately 1.9km long, from Spar-2 well to GES PLEM			
GES PLEM	110	69 km west	20°36'04.88	114°55'09.71	283,156.82	7,720,584.72

Infrastructure	Approx. Water Depth (m)	Closest Distance to VI (km)	Coordinates (Datum/Projection: GDA 94 Zone 50)			
			Latitude	Longitude	Easting (m E)	Northing (m N)
GES Subsea Cooling Skid (and tie-in spool)	110	69 km west	20°36'05.70	114°55'10.18	283,170.76	7,720,559.56
Halyard-1 Well	105	68 km west	20°36'04.06"S	114°55'09.67"E	283,156.50	7 720 611.58
Halyard-2 Well [1]	105	68 km west	20°35'49.62"S	114°54'32.12"E	283,145.55	7,720,606.49
Halyard Production Flowline	Variable (from 105 95 m)	62 km west	Approximately 16 km long, between the GES Subsea cooling skid and the East Spar PLEM			
East Spar PLEM and PLET (and tie-in spool)	96	62 km west	20°43'20.25"S	114°9'03.36"E	290,089.71	7,707,279.49
East Spar Manifold	95	62 km west	20°43'19.91"S	114°59'04.01"E	290,108.26	7,707,290.32
East Spar Pipeline	95	41 km west	Approximately 65 km between East Spar Manifold and intersection with State water boundary.			
Gravity base and clump weight	96	62 km west	20°43'23.216"S	114°59'08.879"E	290,228	7,707,196
East Spar-3 Well*	99	62.5 km west	20°44'01.227" S	114°58'26.15" E	289,028.628	7,706,005.986
East Spar-4 Well* XT	101	60 km west	20°42'35.04" S	114°57'34.95" E	287,513.1	7,708,630.2
East Spar-6 Well*	96	55 km west	20º43'49.310" S	114º59'23.98"E	290,697.29	7,706,393.4
East Spar-7 Well*#	98.6	60 km west	20°42'25.334" S	114°58'58.998" E	289,942.2	7,708,967.1
East Spar-9 Well*	97.1	60 km west	20°39'02.150" S	114°59'10.01" E	290,183.77	7,715,220.71
East Spar 6	95	55 km west	20°43'49.307" S	114°59'23.982" E	290697.312	7706393.455

* Not active infrastructure

At same location as original East Spar-1 well

[1] Proposed D&C and Installation activities to occur in 2024/2025 (Halyard-2 Drilling & Completion EP)

2.2 Operational Area

The operational area is defined as a:

- a 500 m radius around the John Brookes WHP
- a 250 m buffer either side of all subsea infrastructure
- a 500 m radius buffer surrounding the temporarily plugged and abandoned Rosella-1 wellhead.

This is the boundary within which activities described in this EP will occur, as shown on Figure 2-2. The East Spar-1 Well, East Spar-3 Well and East Spar Manifold are protected from third-party vessels through the application of a gazetted petroleum safety zone and a cautionary zone under Part 6.6: ‘Safety zones and the area to be avoided’ of the Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGS Act). Aside from the East Spar infrastructure, no other infrastructure has a gazetted PSZ in place. The John Brookes WHP has a 500 m safety exclusion zone and 2.5 nm cautionary area marked on nautical charts.

Halyard and GES subsea infrastructure is marked on nautical charts; however, it is not subject to a petroleum safety zone around the subsea infrastructure. This is due to the low level of fishing in the area (including no active trawl fisheries) and the unmanned nature of the facility limiting compliance ability. This is in line with standard industry practice.

2.3 Timing

The VI Hub Operations Commonwealth Facilities operate 24 hours a day, every day of the year; and routine activities may occur at any time during any season.

Individual general IMMR campaigns are expected to take approximately 7 - 30 days. Timing and duration of these activities is subject to change due to project schedule requirements, vessel availability and weather.

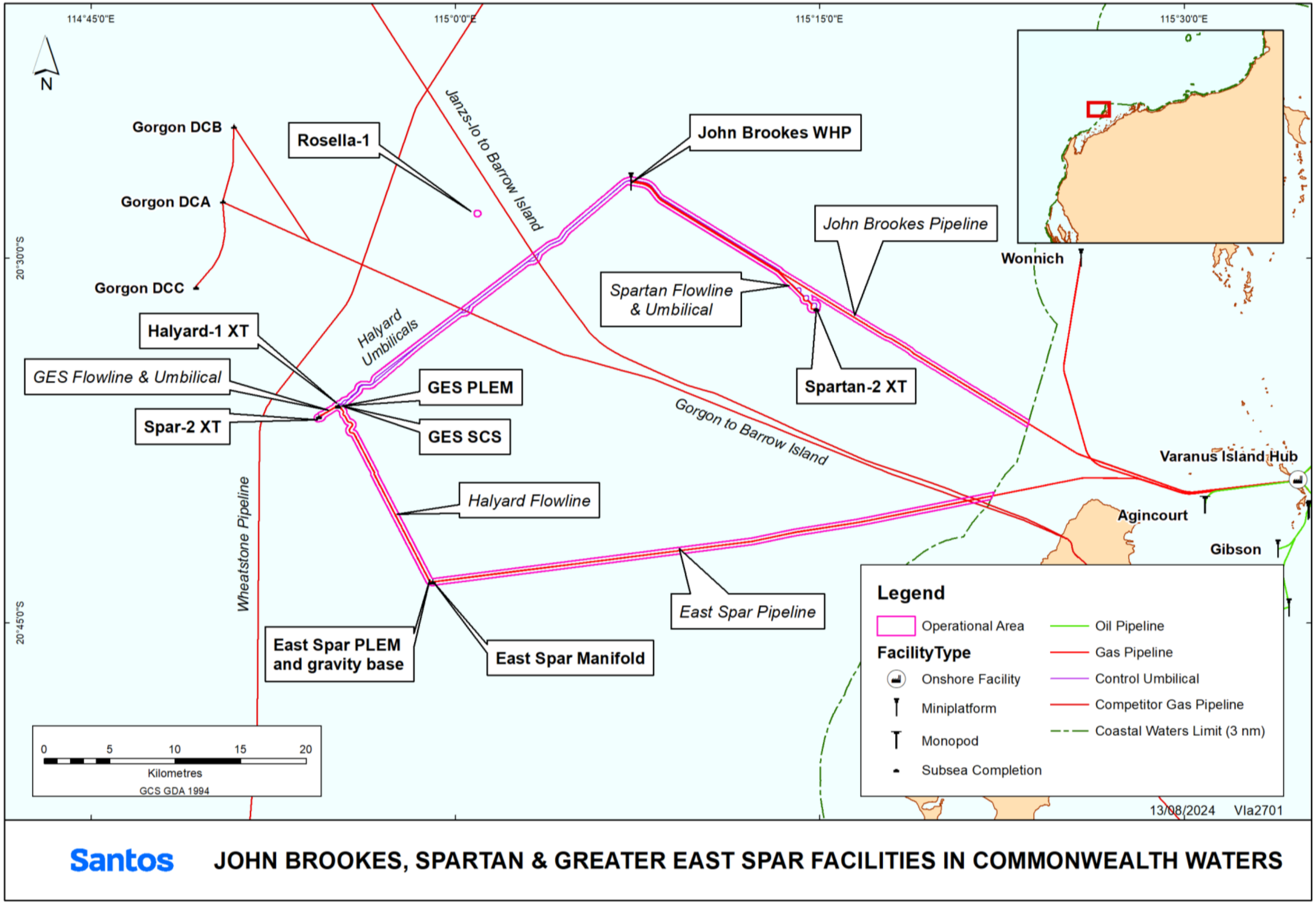

Figure 2-2: John Brookes, Spartan and Greater East Spar facilities in Commonwealth waters

2.4 Facility Overview

Table 2-2 outlines infrastructure status, end of field life estimates, production permit and pipeline licence details for each of the facilities covered under this EP. **Table 2-3** provides the status of wells covered under this EP.

Table 2-2:Details of Varanus Island Commonwealth infrastructure licences and permits included in the Operational EP

<table>
<tr><th>Infrastructure</th><th>Production Permit</th><th>Pipeline License</th><th>Status (As Q3 2024)</th><th>Estimated
End of Field Life</th><th>Design Life</th></tr>
<tr><td colspan="6">John Brookes field infrastructure</td></tr>
<tr><td>John Brookes WHP</td><td rowspan="2">WA-29-L</td><td>N/A</td><td>Active</td><td>2043</td><td>2025 (based on a design life of 20 years from installation in 2005
Platform recertification underway 10 year extension of design life</td></tr>
<tr><td>John Brookes Pipeline</td><td>WA-11-PL</td><td>Active</td><td>2043</td><td>2025 (based on a design life of 20 years from installation in 2005
Design life extension of 15 years in progress</td></tr>
<tr><td colspan="6">Spartan Infrastructure</td></tr>
<tr><td>Spartan Umbilical</td><td>WA-63-L, WA 214-P and WA-29-L</td><td>N/A</td><td>Active</td><td>2029</td><td>20 year design life from installation in 2023-</td></tr>
<tr><td>Spartan Flexible Flowline</td><td>WA-63-L</td><td>WA-30-PL</td><td>Active</td><td>2029</td><td>20 year design life from installation in 2022/2023</td></tr>
<tr><td colspan="6">Greater East Spar field infrastructure</td></tr>
<tr><td>Spar-2 Flowline</td><td rowspan="6">WA-13-L</td><td>WA-21-PL</td><td>Active</td><td>2027</td><td>2037 (20 year design life based on installation in 2017)</td></tr>
<tr><td>GES Umbilical (and flying leads)</td><td>N/A</td><td>Active</td><td>2027</td><td>2037 (20 year design life based on installation in 2017)</td></tr>
<tr><td>GES PLEM (and flying leads)</td><td>WA-21-PL</td><td>Active</td><td>2027</td><td>2037 (20 year design life based on installation in 2017)</td></tr>
<tr><td>GES Subsea Cooling Skid (and tie-in spool)</td><td>WA-21-PL</td><td>Active</td><td>2027</td><td>2037 (20 year design life based on installation in 2017)</td></tr>
<tr><td>Halyard-2 tie in spool</td><td>WA-21-PL</td><td>Yet to be installed</td><td>2027</td><td rowspan="2">To be installed early 2025</td></tr>
<tr><td>Halyard-2 SCM Skid</td><td>N/A</td><td></td><td>2027</td></tr>
</table>

Infrastructure	Production Permit	Pipeline License	Status (As Q3 2024)	Estimated End of Field Life	Design Life
Halyard Production Flowline		WA-21-PL	Active	2027	2031 (based on a 20 year design life from installation in 2011)
Halyard Umbilical	WA-29-L	N/A	Active (hydraulic and chemical systems only, electrical and communications inactive).	2027	2031 (based on a 20 year design life from installation in 2011)
Halyard Replacement Umbilical (Electrical and Communications)	WA-29-L	N/A	Active	2027	2042 (based on a 20 year design life from installation in 2022)
East Spar PLEM	WA-13-L	WA-21-PL	Active	2027	2031 (based on a 20 year design life from installation in 2011)
East Spar Pipeline		WA-5-PL	Active	2027	Approaching the end of design life in 2026, Santos is currently progressing activities required for pipeline life extension. Any assessments completed for life extension for the pipeline system will be addressed in the Operation Pipeline Safety Case
East Spar Manifold		WA-5-PL	Active	2027	
East Spar Tie-in Spool		WA-5-PL	Active	2027	
Gravity base and Clump Weight		WA-21-PL	Inactive	N/A	N/A

Table 2-3Status of Wells included in the Operational EP

Infrastructure	Production Permit	Status (As Q3 2024	Estimated End of Production Life	Installation
John Brookes field wells				
John Brookes 2 Well	WA-29-L	Active production well	2043	Installed in 2005
John Brookes 3 (ST 1) Well		Active production well	2043	Installed in 2005
John Brookes 4 Well		Permanently plugged and abandoned in 2005	Permanently plugged and abandoned in 2005	N/A

Infrastructure	Production Permit	Status (As Q3 2024	Estimated End of Production Life	Installation
John Brookes 5 Well		Active production well, shares the same slot on the WHP as the John Brookes 4 well (abandoned).	2043	Installed in 2005
John Brookes 6 (ST 1) Well		Active production well	2043	Installed in 2009
Rosella-1 (ST 2) Well		Permanently plugged and abandoned in 2007, Accepted as such by NOPSEMA in 2022, only wellhead, debris cap and guide base remain. Will be removed if technically feasible.	Permanently plugged and abandoned in 2007	N/A
Spartan wells				
Spartan-2 ST1 Well	WA-63-L	Active production well	2029	Installed and commenced production in 2023
Spartan-2 ST1 XT (Xmas Tree)		Active		
Greater East Spar wells				
Spar-2 well	WA-45-L	Active production well	2027	Installed in 2010, commenced production in 2017
Spar-2 XT		Active		
Halyard-1 well	WA-13-L	Active production well (well will move to inactive with monitoring status once Halyard-2 is tied in, XT will be isolated from GES production system).	2025	Installed in 2008, commenced production in 2011
Halyard-1 XT		Active (post establishment of Halyard-2, the surface controlled subsurface safety valves (SCSSV) will be closed and inflow tested, XT valves will be closed and inoperable. Pressure and temperature sensors will remain active for monitoring purposes. Well will move to inactive with monitoring status and XT will be isolated from GES production system).		
Halyard-2 Well		Development drilling commenced, expected to be completed in Q4 2024. Expected to be online by Q1 2025	2027	Installed 2024

Infrastructure	Production Permit	Status (As Q3 2024	Estimated End of Production Life	Installation
Halyard-2 XT		Yet to be installed		XT to be installed Q4 2024
East Spar-3 well		Well permanently plugged and abandoned in 2018. Remaining infrastructure to be removed if technically feasible includes subsea tree, wellhead and debris cap.	Permanently plugged and abandoned in 2018	N/A
East Spar-4A (ST 1) well		Well permanently plugged and abandoned in 2004, accepted as such by NOPSEMA in 2022. Remaining infrastructure to be removed includes guide-base structure, wellhead and debris cap.	Well permanently plugged and abandoned in 2004, only wellhead, trash cap and guide base remain to be removed. Will be removed if technically feasible.	N/A
East Spar 6 Well		Well permanently plugged and abandoned in 2018. Remaining infrastructure to be removed if technically feasible includes subsea tree, wellhead and debris cap.	Permanently plugged and abandoned in 2018	N/A
East Spar-7 Well		At same location as original East Spar-1 well. Well permanently plugged and abandoned in 2004, accepted as such by NOPSEMA in 2022. Remaining infrastructure to be removed if technically feasible includes subsea tree and wellheads.	Well permanently plugged and abandoned in 2004, only subsea tree and wellheads remain to be removed if technically feasible.	N/A
East Spar-9 Well		Well permanently plugged and abandoned in 2004, accepted as such by NOPSEMA in 2022. Remaining infrastructure to be removed if technically feasible includes guide-base structure, wellhead and debris cap.	Well permanently plugged and abandoned in 2004, only wellhead, debris cap and guide base remain to be removed if technically feasible.	N/A

2.5 John Brookes Field Infrastructure

The John Brookes facility is located in approximately 45 m of water. Production commenced in 2005, and the facility consists of:

- John Brookes WHP – a normally unmanned wellhead platform designed to accommodate a maximum of six production wells
- John Brookes pipeline – a 55-km-long, 450-mm nominal bore (18”) subsea gas pipeline, routed to the VI onshore processing facilities

- John Brookes wells – four producing wells at the John Brookes WHP.

The John Brookes facility also provides infrastructure for the control of the Spartan-2, Halyard-1, Halyard-2 and Spar-2 wellheads; this control infrastructure consists of:

- Halyard electro-hydraulic umbilical (Section 2.5.2.6) – a 28 km long umbilical supplying hydraulic control fluid and chemicals from the John Brookes WHP to control the Halyard-1 (until Halyard-2 completed), Halyard-2 (when constructed, replacing Halyard-1) and Spar-2 production wells via the GES PLEM (note that electrical power is supplied via the replacement umbilical below due to faults in the electrical cables)
- Spar-Halyard replacement electrical umbilical – a 28 km long umbilical supplying electrical power and communications from the John Brookes WHP to control and monitor Halyard-1, Halyard-2 (when constructed) and Spar-2 wells via the GES PLEM
- Spartan electro-hydraulic umbilical (Section 2.5.2.5) – a 17 km long umbilical supplying electrical power, hydraulic control fluid and chemicals from the John Brookes WHP to control and monitor the Spartan-2 production well
- a three-level cantilever deck comprising the mezzanine and main decks and the upper valve access platform of the John Brookes WHP, which extends 6 m to the north, beneath the crane pedestal. This houses a power generation package and topsides control unit for the Spartan, Halyard and Spar subsea infrastructure, including a hydraulic power unit, master control systems and a chemical injection skid and chemical tank. Minor modifications were made to the integrated control system and chemical injection skid to accommodate the Spartan infrastructure.

Production from the Halyard and Spar wells are independent of the John Brookes facility, as these well fluids are exported to VI via the East Spar pipeline. Production from the Spartan-2 well is via the John Brookes WHP and John Brookes pipeline to the VI onshore facilities.

2.5.1 John Brookes Topsides Infrastructure

The John Brookes WHP has been designed with minimum facilities so as to:

- minimise hydrocarbon inventory and hazardous areas
- minimise equipment maintenance
- maximise the reliability of the WHP, with the use of redundancy for the wellhead control panel, telemetry, and instrument gas and power systems
- minimise the requirement for operating and maintenance personnel to attend the WHP.

The platform topsides are illustrated in Figure 2-3. The topsides modules have four levels (specifically, highest to lowest):

- upper deck
- mezzanine deck
- main deck
- lower deck.

The topsides modules are supported by a four-legged jacket secured to the seabed with grouted piles through pile sleeves at each leg. The main and upper decks are plated, while the mezzanine deck is grated. A list of the equipment available on each deck is presented in Table 2-4. Attached to the substructure of the WHP are:

- one John Brookes export riser located in the jacket bracing
- one Spartan Production J-tube
- twin J-tube to host the Spartan umbilical and Spar-Halyard replacement umbilical
- one Halyard umbilical J-tube
- one boat landing with bumpers, ladders and intermediate landings on the northwest corner.

Figure 2-3: John Brookes wellhead platform – Halyard wing deck

Table 2-4: Equipment layout on the John Brookes wellhead platform

Deck	Equipment
Upper deck (helideck)	• Helideck crane (northwest corner) to lift equipment, materials and products to or from vessels or around the WHP • Laydown area for temporary chemical storage (e.g., monoethylene glycol (MEG) storage (for well start-up)) and corrosion inhibitor
Mezzanine deck	• John Brookes chemical injection tanks (three compartmented tanks with approximately 1,600 L each) • Crane hydraulic power pack with bulk chemical containers • Diesel tank (electrical backup generator skid) and diesel storage • Instrument gas knock-out drum • Wellhead control panel • Regulating panels • Pig launcher • Instrument gas shutdown valve • Navigation lights • Two microturbine power generators with associated fuel gas skid and fuel gas preheater for the GES &Spartan subsea wells.
Main deck	• Four installed wellheads, flowlines and flow meters, with the capacity for six wellheads (one wellhead slot utilised by Spartan production J-tube and flowline) • Process piping, valves and instrumentation • Instrument gas knock-out drum • Spartan pressure protection shutdown valves, flowline and flowmeter • Equipment shelter • Telemetry facilities to enable remote collection of process data and allow process shutdown and emergency shutdown control from VI • Instrument gas system

Deck	Equipment
	• Vent and drain systems and associated pumps • Fully automatic navigation system • Safety equipment • Hydraulic power unit for the Spartan, Halyard and Spar wells subsea control system with associated hydraulic fluids storage vessel • Chemical injection equipment (i.e., MEG skid, Spartan, Halyard and Spar chemical injection system)
Lower deck	• Access to the production emergency shutdown valve • Access to the Spartan Riser Emergency Shutdown Valve • Halyard umbilical termination unit • Spartan umbilical termination unit • Toilet • Atmospheric sump and pumps • Closed-drains sump and pumps

MEG is typically permanently stored in a tank on the WHP and is used via a chemical injection unit (CIU) for initial field start-up and infrequent well start-ups, with variable injection rates depending on the mode of operation (e.g., predose, injection post-start-up). MEG may also be brought onto the WHP for start-up of the wells as required.

Corrosion Inhibitor is also stored in a tank on the WHP and is used via a CIU in the John Brookes, GES and Spartan (topsides) pipework to minimise corrosion risks to the production system.

The main deck is completely bunded, and the bunding feeds into the closed drainage system. A drainage system collects any spillage from installed splash and drip trays.

The atmospheric sump tank is equipped with an oil interface switch and is baffled to intercept and hold any oil in it. The design of the sump allows uncontaminated rainwater to drain overboard from the sump, even during heavy periods of rain associated with cyclonic conditions. The interface level controls effectively mean that only rainwater flows overboard while hydrocarbon fluids are pumped into the export pipeline. The sump design prevents rainwater being pumped into the export pipeline, precluding bacterial growth.

The closed-drains sump vessel collects hydrocarbon fluids from:

- liquid knock out from the instrument gas drying system and gas-powered pump exhausts
- fuel gas knock-out pot
- drainage of production lines during maintenance
- drainage of pig launchers.

Fluid collected in the sump is pumped to the production manifold by a gas-driven sump pump controlled by a high/low level controller.

For the riser section of the Spartan flexible, any Spartan gas that diffuses through the flexible pressure sheath into the annulus will be vented via the John Brookes closed drain atmospheric vent. This system also allows for periodic riser annulus testing.

A toilet and small hand washing basin are installed on the John Brookes WHP. The WHP is unmanned, so the toilet and basin are only used intermittently by the maintenance crew, if required, and discharge to the ocean.

Transport of personnel to the WHP is primarily by helicopter and support vessel (during daylight hours under normal operations). John Brookes Wells

Four John Brookes production wells were drilled to produce from the gas-bearing Upper Barrow formation. Three of these wells were completed in 2005, and one was completed in 2009. One slot on the WHP is spare for production from any future wells. Production fluids from the wellheads flow into a manifold and then directly into the John Brookes pipeline.

2.5.2 Subsea Infrastructure

The John Brookes subsea infrastructure and status is presented in **Table 2-2**. The maintenance for subsea infrastructure is further described in Section 2.10. The well integrity risk assessment and ongoing management of the subsea wells is further detailed in the relevant risk assessment Sections 7.6 and 7.8

2.5.2.1 John Brookes Wells

Four John Brookes production wells were drilled to produce from the gas-bearing Upper Barrow formation.. One slot on the WHP is spare for production from any future wells. Production fluids from the wellheads flow into a manifold and then directly into the John Brookes pipeline.

2.5.2.2 John Brookes Pipeline

The John Brookes pipeline is a single 450 mm-diameter carbon steel wet-gas pipeline that runs approximately 55 km from the WHP to the East Spar Joint Venture Plant on VI.. The first 500 m of the pipeline was replaced in 2015 with an upgraded section. The pipeline is pigged for inspection and/or operational requirements.

A hydraulically operated subsea isolation valve is located approximately 100 m from the WHP. The subsea isolation valve is set to fail last position for normal operations. During well intervention operations, the subsea isolation valve is configured to close on emergency shutdown.

The pipeline stabilisation system was designed to DNV-RP-E305, On-bottom Stability Design of Submarine Pipelines. It comprises concrete weight coating and rockbolts for secondary stabilisation. Concrete gravity anchors provide stabilisation of the spool and pipeline at the WHP end.

The pipeline approach to the WHP is optimised to allow for:

- constraints of the undulating seabed near the WHP
- mobile offshore drilling unit (MODU) approaches for future drilling
- lifting operations from the WHP crane or MODU crane.

A passive cathodic protection system is used to protect the riser, tie-in spools, pipeline, protection frames and anchor assemblies. Pipeline cathodic protection is provided by half-shell bracelet anodes bolted to the pipeline. The anodes are designed for a life of 20 years to match the pipeline design life. The current field life is expected to be until at least 2033, therefore infrastructure may be upgraded or replaced as required to meet this.

A pig launcher is provided on the John Brookes WHP that is capable of launching cleaning pigs and can accommodate intelligent pigs. On the upper deck above the pig launcher trapdoor is an access hatch to allow pig loading from the upper deck. A kicker line and pig signaller are also provided.

2.5.2.3 Spartan-2 Well

The Spartan-2 well was brought online in Q2 2023 and produces gas and condensate from the Flag Sandstone reservoir. The Spartan-2 well is connected to the John Brookes WHP via a 17 km flexible flowline. Production fluids form Spartan-2 then enter the John Brookes pipeline for transportation to the VI onshore facility for processing.

2.5.2.4 Spartan Flexible Flowline

A 17 km, 8-inch diameter flexible flowline connects the Spartan-2 well to the John Brookes WHP, via a pre-installed production J-tube. The design life of the flowline is 20 years. Post lay stabilisation and protection of the flowline (on approach to the John Brookes WHP) is provided by concrete mattresses.

There are 7 sections of flexible pipe to make up the full 17 km Spartan flowline. Each section of flexible pipe's end fittings contain three gas release valves which release hydrocarbon gas that has permeated through the pressure sheath into the annulus. The valves release the annulus gas to protect the outer sheath from bursting by having a release setting below the burst pressure of the flexible outer sheath. For the riser flexible section, the annulus port is connected to the platform open drain to vent the annulus via John Brookes.

2.5.2.5 Spartan Umbilical

A 17 km electro-hydraulic umbilical connects the Spartan-2 XT to the John Brookes WHP, via a J-tube. The umbilical provides hydraulic control fluid, low-voltage power and chemical injection services (MEG) to the Spartan-2 production well via a cobra-head with multi-quick connection system and electrical flying leads (EFLs). Control of the well and distribution of the chemicals is via the distributed control system on Varanus Island. The Spartan umbilical makes one crossing of the John Brookes pipeline. Protection and stabilisation at the John Brookes pipeline crossing, and pre-lay and post lay stabilisation of the umbilical is provided by concrete mattresses and grout bags.

2.5.2.6 Halyard Umbilical

A 28 km bundled electro-hydraulic umbilical from the John Brookes WHP was originally routed to the Halyard-1 XT to supply hydraulic control fluid, low-voltage power and chemical injection services to the Halyard-1 production well via the umbilical's end termination subsea distribution unit and electro-hydraulic flying lead. Control of the well and distribution of the chemicals is via the distributed control system on the John Brookes WHP. As part of the GES project works (2.6), the Halyard umbilical was disconnected from the Halyard 1 XT and connected to the GES PLEM so it could be distributed to both the Halyard-1 XT and Spar-2 XT (and will also connect to the Halyard-2 XT when installed).

Due to communication faults the electrical component of the existing Halyard bundled electro-hydraulic umbilical was replaced in 2022 (Halyard replacement umbilical). The hydraulic and chemical injection lines in the original Halyard bundled electro-hydraulic umbilical are still in working order and continue to be used. A separate 28 km electrical umbilical was installed adjacent to the Halyard umbilical to provide power and communications to the GES infrastructure.

2.6 Greater East Spar Subsea Infrastructure

GES is the name given to facilities consisting of the Halyard, Spar and East Spar fields. There is no topside infrastructure associated with this field. It includes the producing wells (Halyard-1 and Spar-2) and temporarily abandoned wells. Halyard-1 will be replaced by the Halyard-2 well once it is constructed (as described in Table 2-4; Figure 1.1).

The East Spar field was discovered in 1993. Gas and condensate production commenced in 1996 from the East Spar field via VI and was suspended in 2006 upon exhaustion of the field reserves, and the East Spar wells are temporarily abandoned with permanent barriers. However, the infrastructure remains in place to support production from the Halyard and Spar fields. Production from Halyard-1 commenced in 2011 and from Spar-2 in 2017. Production from Halyard-2 is planned to commence in Q1 2025.

The East Spar pipeline was installed in January 1996. Halyard-1 (which will be replaced by Halyard-2 when constructed) and Spar-2 production fluids are transported from the East Spar manifold to VI via the 350 mm (14"), 62.5-km-long East Spar pipeline. The pipeline has a total volume of approximately 6,000 kL. The East Spar pipeline is crossed by four pipelines, two flowlines and two umbilicals owned by Chevron. These pipeline and umbilical crossings and their locations (Figure 2-) given in eastings and northings) are:

- Jansz export flowline crossing – 328 755 E, 7 714 025 N
- Jansz utility pipeline crossing – 328 352 N, 7 713 935 N
- Jansz MEG pipeline crossing – 328 355 N, 7 713 936 N
- Gorgon MEG pipeline crossing – 328 345 E, 7 713 934 N
- Gorgon utility pipeline crossing – 328 348 E, 7 713 934 N
- Gorgon production flowline crossing – 328 254 E, 7 713 914 N
- Gorgon umbilical crossing East Spar – 328 049 E, 7 713 869 N
- Jansz umbilical crossing East Spar – 328 053 E, 7 713 870 N.

During the East Spar Intelligent Pigging and Removal Project in the first quarter of 2019, the East Spar pipeline end termination was installed and connected to the East Spar PLEM to allow diverless intelligent pigging of the East Spar pipeline and associated infrastructure. The East Spar pipeline end termination consisted of a diver to diverless connection to allow a diverless pig launcher to be installed and connected. This enabled future pigging campaigns to be performed without the requirement for divers. As part of this project all subsea infrastructure between the East Spar manifold and the XT (East Spar-1, East Spar-3 and East Spar-6) was removed but the East Spar manifold remains in place. The removed infrastructure included the flexible flowlines, control umbilicals, rigid spools and subsea heat exchangers.

A pipeline life extension process was completed and has concluded that the East Spar pipeline is currently fit for service and can continue to operate until at least 2026. Maintenance of the remaining East Spar infrastructure is covered under this EP, and therefore Santos remains compliant with the OPGGS Act obligations for the titleholder to maintain, remove or have alternative arrangements accepted for infrastructure.

The Halyard-1 well was drilled and completed in March 2008. The Halyard-1 well produces fluids containing gas, condensate and water. The Halyard flexible 10" flowline is connected from the GES PLEM to the East Spar PLEM and East Spar manifold from which the well fluids are transported 65 km via the East Spar pipeline to VI. The Halyard-1 well will be disconnected and shut in to allow production from the Halyard-2 (replacement well), with timing of this activity estimated to be Q1 2025. The drilling, installation and pre-commissioning of the Halyard-2 well, along with the disconnection and shut in of the Halyard-1 well and the removal of the production spool are covered in the Halyard-2 Drilling & Completion EP. Santos intends to plug and abandon (P&A) the Halyard-1 well at the same time as other producing GES assets (Halyard-2 and Spar-2). Plug and abandoning Halyard-1 earlier does not represent an increase in risk, as well integrity monitoring is preserved (as described in the approved

WOMP), with the existing communications (monitoring) from the John Brookes WHP/ Varanus Island control room remaining in place.

To allow commissioning of the Halyard-2 well, the Spar-2 well shall be temporarily shut in (if production has not already ceased due to turn down levels being met). Once production from Halyard-2 has reached steady state, Spar 2 will be restarted.

The East Spar PLEM is connected to the East Spar manifold via a rigid tie-in spool. To match the East Spar manifold production header and facilitate pigging, the PLEM has a 14” production header.

The Spar-2 well, located 1.7 km west-southwest of the Halyard-1 well, was drilled and completed in 2010 as a gas production well in approximately 115 m water depth. Production from the Halyard and Spar wells is independent of the John Brookes facility, as the well fluids are exported to VI via the East Spar Pipeline. The Spar-2 well produces through the same 10” Halyard flowline and 14” East Spar pipeline as the Halyard gas field. To enable production from the Spar-2 well, minor modification to the existing Halyard subsea infrastructure took place in 2018, and the modification included installation of:

- the GES PLEM
- a subsea cooling skid
- a 1.7-km 8” flowline (connecting the GES PLEM to the Spar-2 XT)
- two 6” tie-in spools
- two electric flying leads
- a 1.9-km subsea control umbilical.

The Halyard umbilical and flowline were also re-routed.

The GES PLEM and subsea cooling skid are connected via a rigid tie-in spool. The Spar-2 XT operates with direct flowline and umbilical connections to the GES PLEM, and a second rigid tie-in spool completes the connection of the Halyard-1 XT into the GES PLEM.

The Halyard-1 and Spar-2 wells have been completed with a second-generation subsea control module for hydraulic control of the fail-safe XT valves and production and annulus monitoring. The Halyard-2 well will be completed using a similar subsea control module.

Reservoir fluids flow from one or more subsea wellheads is comingled in the GES PLEM then routed directly into the flowlines and pipeline to VI.

The GES subsea infrastructure and status is presented in **Table 2-2**. The maintenance for subsea infrastructure is further described in Section 2.10. The well integrity risk assessment and ongoing management of the subsea wells is further detailed in the relevant risk assessment Sections 7.6 and 7.8.

Due to communication faults in the existing umbilical, an additional 28 km electrical umbilical was installed next to the Halyard umbilical and terminated in the UTA. The UTA is connected to the GES PLEM via 2 EFLs and the existing umbilical EFLs disconnected.

The Halyard 10” flexible and Spar-2 8” flexible pipe’s end fittings contain gas release valves which release hydrocarbon gas that has permeated through the pressure sheath into the annulus. The valves release the annulus gas to protect the outer sheath from bursting by having a release setting below the burst pressure of the flexible outer sheath.

2.6.1 Gravity Base and Clump Weight

The gravity base and clump weight was originally used to moor the NCC buoy, which was removed from the field in 2015. The gravity base consists of a steel wall frame structure measuring 2.75m x 18.9m x 18.9m (h x l x w), weighing ~ 57 tonnes. This is surrounded by iron ore ballast consisting of ~3,580 tonnes of internal ballast and 2,500 tonnes of perimeter ballast.

The cylindrical clump weight is located in the centre of the gravity base and was used as a Buoy installation aid. The clump weight is 16m high with a 7.5m diameter and weighs 490 tonnes with ore ballast.

2.7 Halyard-2 Well Commissioning and Start Up

Commissioning and startup of the Halyard-2 well will take place over approximately three days. Commissioning and start up activities are managed entirely from Varanus Island, as such there are no infield vessel-based activities. There are no emissions or discharges associated with Halyard-2 well commissioning and start up over and above normal operations conditions. No additional construction or modifications are required at the John

Brookes WHP for the start-up, commissioning and operations of the Halyard-2 well. The Halyard-2 well commissioning start-up and operation activities are described in Table 2-5 and described below.

Table 2-5: Halyard-2 Well Commissioning and Start-up Activities

Activity	Typical emissions and discharges
Pressurise GES system, including East Spar Pipeline	Pressurisation is via John Brookes gas from VI and will take place over approximately three days. No discharges.
Subsea valve operation	Discharge from valves (water based hydraulic fluids) approximately 2 L to 5 L per vale actuation, resulting in a total of approximately 25 L during commissioning (as described in Section 6.7).
Priming activities on subsea infrastructure	MEG is injected via the control system from the John Brookes WHP and remains in a closed tested system and is not discharged. This is also required for normal cold well start up activities already described in Section 2.8.2
Treated seawater displacement (from Halyard-2 tie in spool)	Treated seawater (approximately 0.7 m^3) will be displaced to East Spar slug catcher on VI using Halyard-2 production gas as a one-off activity. There will be no emissions or discharges relevant to this EP. Discharges to the VI Hub are managed under the VI Hub Operations (State Waters) EP (EA-60-RI-00186)
Ongoing operation of the Halyard -2 well	The Halyard-2 well is expected to operate for a short duration and cease production in 2026. Emissions and discharges relating to the ongoing operation of the well are limited to subsea valve operation, as described above, noise emissions generated by the operation of the subsea well and greenhouse gas emissions from the producing well.

2.8 Operational Activities

The John Brookes, Spartan and GES facilities have been designed to export well fluids from the production wells to the processing facilities on VI. Side streams of gas are taken from the main production manifold and dried for use as utility gas and as fuel gas for the Halyard microturbines.

VI operators provide 24-hour control of the WHP via telemetry and a distributed control system from a central control building on VI. WHP visits are only required for maintenance, with crews travelling via helicopter or support vessel to the WHP to carry out inspection, maintenance, monitoring and repair; to replenish fuel or chemicals; and to carry out operational requirements, such as a restart after a trip.

2.8.1 John Brookes Wellhead Platform Visits

The John Brookes WHP is a normally unmanned facility; therefore, inspections and maintenance activities are conducted on a scheduled or as-needed basis. Inspections and maintenance of the WHP and the John Brookes and East Spar pipelines and Spartan flowline are managed using the Santos Computerised Maintenance Management System (CMMS).

Site safety and general maintenance inspections of the WHP are conducted routinely. These routine inspections are undertaken to maintain the integrity of structures and production systems. Visits to the WHP are generally conducted via helicopter utilising the helideck but may also be conducted via vessels. Replenishment of chemicals, diesel fuel and potable water will be performed during visits conducted using an offshore support vessel.

Maintenance activities that may be undertaken during these visits are described in relation to their potential impacts in Sections 6 and 7.

2.8.2 Chemicals Use and Storage

Storage of chemicals and hydrocarbons is limited to the small amounts of diesel, hydraulic oil, MEG and corrosion inhibitor required to operate the facility. Chemical injection for Halyard-1, Spar-1 and Spartan-2 takes place from the John Brookes WHP. This will also be the case for the Halyard-2 well.

Batch injection of MEG is conducted during start-up and restart of the Spartan-2, Halyard wells and Spar-2 wells. Corrosion Inhibitor is injected continuously to support normal operations from John Brookes, Spartan-2 (topsides), Halyard-1 (until disconnection), Halyard-2 and Spar-2 wells.

MEG and corrosion inhibitor are delivered to the WHP in transportable certified tote tanks by support vessels. The transportable tanks are typically lifted onto the upper deck by the WHP crane from where the chemicals are transferred to the fixed storage tanks by hoses fitted with quick connect/disconnect couplings.

2.8.2.1 Chemical Selection

A risk-based approach to select chemical products ranked under the Offshore Chemical Notification Scheme (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 (HQ) by the CHARM (Chemical Hazard Assessment and Risk Management) mathematical model, which uses aquatic toxicity, biodegradation and bioaccumulation data. The HQ 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 and Santos Drilling Fluid and Chemical Selection in Drilling Activities Procedure accept 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 that their use and associated risk is acceptable and ALARP.

As described above, investigation of potential alternative chemicals is completed 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 or 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.

2.8.2.1.1 Ecotoxicity Assessment

Table 2-6Table 2-6 and Table 2-7Table 2-7 act as guidance in assessing the ecotoxicity of chemicals during the investigation of potential alternatives. Table 2-7Table 2-6 is used by Cefas to group a chemical based on ecotoxicity results, ‘A’ representing highest toxicity/risk to environment and ‘E’ lowest. Table 2-7 shows classifications/categories of toxicity against aquatic toxicity results.

Table 2-6: Initial Offshore Chemical Notification Scheme grouping

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

Note: Aquatic toxicity refers to the Skeletonema costatum 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 2-7: Aquatic species toxicity grouping

Category	Species	LC50 and EC50 criteria
Category Acute 1 Hazard statement - Very toxic to aquatic life	Fish	LC50 (96 hr) of ≤1 mg/L
	Crustacea	EC50 (48 hr) of ≤1 mg/L
	Algae/other aquatic plant species	ErC50 (72 or 96 hr) of ≤1 mg/L
Category Acute 2 Hazard statement – Toxic to aquatic life	Fish	LC50 (96 hr) of >1 mg/L to ≤10 mg/L
	Crustacea	EC50 (48 hr) of >1 mg/L to ≤10 mg/L
	Algae/other aquatic plant species	ErC50 (72 or 96 hr) of >1 mg/L to ≤10 mg/L
Category Acute 3	Fish	LC50 (96 hr) of >10 mg/L to ≤100 mg/L

Category	Species	LC50 and EC50 criteria
Hazard statement – Harmful to aquatic life	Crustacea	EC50 (48 hr) of >10 mg/L to ≤100 mg/L
	Algae/other aquatic plant species	ErC50 (72 or 96 hr) of >10 mg/L to ≤100 mg/L

2.8.2.1.2 Bio-degradation 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:

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

Where X is equal to:

- 60% in 28 days 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).

2.8.2.1.3 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 bioaccumulative chemicals.

The following guidance is used by Cefas:

- Non-bioaccumulative/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.
- Bioaccumulative/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 and Santos Drilling Fluid and Chemical Selection in Drilling Activities Procedure as applicable.

2.8.3 Aircraft Safety – Bird Management

Santos is committed to ensuring the safety of aircraft and passengers visiting the Santos normally unmanned offshore platforms including John Brookes WHP. One of the hazards to helicopters and personnel is the presence of birds at the WHP.

The primary hazard is birds taking flight as helicopters approach, which may cause pilot distraction and introduce the potential for bird strike, which could lead to helicopter damage / crash, potentially a multiple fatality event and major accident event (MAE).

An additional hazard caused by birds is the build-up of guano on the helideck and other decks of the WHP. The associated hazards from guano include:

- Helideck markings and lights become obscured.
- Solar panels that power electrical equipment impacted.
- Safety critical equipment on the platform becomes obscured and may deteriorate at a quicker rate when covered in guano.
- Surfaces become slippery, particularly after rainfall.

- Cleaning the guano also introduces a cost and additional safety risk as personnel must travel to the platform in the days before maintenance campaigns commence, to pressure spray the helideck and other safety critical items.

2.8.3.1 Aviation safety and bird management assessments

Between 2017 and 2020, Santos and bird management consultants conducted assessments regarding the risks of birds to helicopters and personnel at Santos offshore platforms. The investigations included the evaluation of appropriate techniques for deterring birds from the platforms. Information was gathered for the following reports:

- Santos Offshore – Impact Assessment of Bird Deterrent Systems at Offshore WHP on Seabirds.
- Bird Management Plan for Offshore Platforms.

The function of Bird Management Plan for Offshore Platforms is to define the risk that birds pose to helicopter traffic at Santos' offshore platforms including the WHP, and to establish a strategy to manage the risk. The document:

- Incorporates the themes of Civil Aviation Safety Authority (CASA) Advisory Circular 139-26 Wildlife Hazard Management at Aerodromes.
- Addresses the requirements of Civil Aviation Safety Regulations (CASR) Part 133 - Air transport and aerial work operations – rotorcraft1.
- Seeks to maintain the helideck 'fit for function' to prevent a helicopter crash 'major accident event' as described in the John Brookes Safety Case Part IV—Formal Safety Assessment (JB-91-RF-00003.04).
- Provides supporting evidence for the Environmental Management of Change (MOC) process.
- Supports the General Permit Application for Regulation 258: impact to listed marine species and Regulation 216: impact to migratory species submitted to the Department of Environment and Energy (DotEE) as required by the Environmental Protection and Biodiversity Conservation (EPBC) Act 1999.
- Supports Santos Health and Safety policies and procedures.

The objectives of the Bird Management Plan for Offshore Platforms include:

- The primary objective is to reduce the risk to helicopters from bird strikes, which is identified as a hazard which could result in a major accident event (MAE).
- Other benefits of actively reducing bird activity at the WHP include the reduction of guano loading which obscures critical helipad markings, reduces friction on the helipad, causes equipment downtime and poses health and safety risks to personnel.
- Define the methods by which birds will be deterred from the platform (as described in the potential bird management strategies section below).
- Provide a tool to support compliance with relevant environmental legislation.
- Define roles and responsibilities.
- Define the approach for recording, maintaining and reviewing data.

2.8.3.2 Bird management strategies

Safety of aircraft and passengers visiting the WHP is critical and requires management of birds to ensure the safe landing and take-off of helicopters. The objective of bird management is to remove or significantly reduce bird presence and guano build up on the platform. A combination of passive and active measures may be implemented.

2.8.3.2.1 Passive Management Strategies

Passive management describes the process of modifying habitats to reduce the number of birds in the area. Examples of strategies currently used at the WHP include:

- Bird spikes on equipment such as but not limited to micro-turbines, solar panels, exhaust ducting.
- Parallel lengths of wire installed above equipment such as but not limited to solar panels, to reduce bird ingress to this level and to prevent concealed birds taking off as helicopters near the platform.

Examples of strategies not currently used at the time of writing this EP revision, however may be considered in the future:

- Netting between levels of the platform to prevent bird access.
- Birds of prey decoys and inflatable decoys.

2.8.3.2.2 *Active Management Strategies*

Active management describes the process of directly removing or reducing the numbers of birds in high-risk areas. Examples of strategies that may be implemented include acoustic devices, as described below.

In accordance with the EPBC Act Part 13 Permit (Permit E2020-0173, ‘the permit’), an acoustic bird-deterrent system has been installed on the WHP.

- The bird deterrent system uses a (HS-14 RAHD) non-lethal acoustic hailing system to deter and disperse birds using short, intermittent noise events.
- The noise emitting device is on the perimeter of the helideck.
- The system is also fitted with lighting to provide safe helicopter landing on the WHP during hours of darkness.
- The system is fully automated (operates independently of VI control room operators) and captures and stores CCTV storage for retrieval during WHP visits to aid reporting and analysis of the performance of the system.
- The system can be shut down and isolated remotely during helicopter approach by the pilot via the Pilot Activated Airfield Lighting Control (PAALC) interface. The PAALC is used as a remote means of halting the bird deterrent system via standard pilot operated systems already in use.
- The acoustic system has a 148 dB spl peak acoustic output at 1 m, and in accordance with the permit conditions, the acoustic system emits a maximum volume output of no more than 110 dB at 10 metres horizontal distance from the WHP.
- Sound Pressure Level: peak 148 dB @ 1m. Beam Width: ±12° (24° conical @ 2 kHz/-3 dB). Frequency Response: 300 Hz – 8 kHz.

2.8.3.3 EPBC Act Part 13 Permit (E2020-0173)

The bird deterrent system is permitted by an EPBC Act Part 13 Permit (Permit E2020-0173, ‘the permit’) issued by the Department of Agriculture, Water and Environment (DAWE). The permit is to install and operate bird deterrence equipment on unmanned wellhead platforms including ‘John Brookes’ 100 km offshore WA. This decision is made under Sections 216 and 258 of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). Compliance with permit conditions is reported annually to DAWE under the current permit (Table 8-4).

The conditions of Permit E2020-0173 that relate to the bird deterrent system on the WHP are in 2-8.

Table 2-8: Relevant conditions of permit E2020-0173

No.	Condition attached to the permit
2	The permit holder is authorised to install and operate passive deterrent equipment and an acoustic hailing system with a maximum volume output of 110 db at 10 metres (horizontal distance).
3	Within three months after every 12 month anniversary of the date of this permit, the permit holder must provide a compliance report to the Department demonstrating compliance with these permit conditions and provide details and relative outcomes of the deterrent equipment installed over the preceding 12 months.
4	The permit holder must inform the Department in writing within seven days if, whilst the action is being carried out, any Environment Protection and Biodiversity Conservation Act 1999 listed threatened, migratory or marine species in a Commonwealth area is injured or killed by the actions.
5	The permit holder may give to another person written authority to take, for or on behalf of the holder, any activity authorised by the permit. When an authority is given to another person, the condition requirements also apply. The giving of an authority to another person does not prevent the permit holder from undertaking the authorised activity. The permit holder who gives an authority to another person must inform the Department in writing within fourteen days after giving the authority. The permit holder may only give an authority to another person who has sufficient experience and competence in the activities of this permit.
Definitions: • Acoustic hailing system: Non-lethal acoustic equipment designed to deter and disperse seabirds resting on platforms using short, intermittent noise events. • Deterrent equipment: Non-lethal bird deterrent measures including passive measures such as bird spikes on handrails, parallel lengths of wire installed above handrails, bird of prey decoys and netting between levels of the platform.	

2.9 Inspection, Maintenance, Monitoring and Repair Activities

The John Brookes WHP is normally an unmanned facility, and the Spartan and Greater East Spar facilities are subsea developments, which by their very nature are unmanned facilities. As such, inspection, maintenance, monitoring and repair (IMMR) activities are conducted on a scheduled and as-needed basis, while intervention activities (Section 2.9.8) are conducted on an as-needed basis.

Maintenance of the WHP and subsea equipment is managed using the CMMS. This system provides:

- the ability to analyse equipment for better maintenance regimes, design changes or replacement
- timely preventive maintenance schedules
- improved control over maintenance expenditures
- automatic parts ordering and inventory control
- reduction of inventory costs and improved stores accountability
- improved utilisation of labour.
- preventive maintenance is incorporated into the VI CMMS and includes:
- routine inspections of operational and suspended infrastructure
- assurance activities
- maintenance carried out on a usage basis, such as machine running hours.

It is through the implementation of this maintenance regime that Santos will meet its obligations under the OPGGS Act (s.572(2)) to 'maintain in good condition and repair all structures that are, and all equipment and other property that is, in the title area and used in connection with the operations'.

Maintenance activities may include corrective (e.g., repair of equipment) and non-routine maintenance. Generally, IMMR may involve additional personnel and the use of ROVs, divers and work vessels, which may require anchoring at or near the work location.

Ongoing IMMR may include such activities as:

- general inspections
- integrity and corrosion control
- plant and subsea infrastructure cleaning, repair and modifications
- subsea pipeline and seafloor imaging surveys
- subsea equipment and infrastructure installation, cleaning, repair and modification
- marine growth removal
- inline inspections of pipelines (pigging)
- installation of replacement equipment/parts
- installation of additional secondary stabilisation
- pipeline stabilisation
- topsides cleaning of facilities (both maintenance and for suspension)
- flexible riser annulus vacuum testing
- rigless well servicing or intervention.

2.9.1 General Inspections

Topsides and subsea maintenance, inspection or repair activities are expected to be undertaken by Santos using dedicated crew, remotely operated vehicles (ROVs), autonomous underwater vehicles (AUVs) or diving contractors.

ROV inspection activities normally comprise a simple visual survey that does not involve making contact with subsea infrastructure, usually after such events as major storms. Such inspections check for disturbance or damage to the subsea infrastructure that may impact on safe operation.

ROV surveys may include inspection, photography, side-scan sonar survey, cleaning, condition monitoring, anode replacement and general maintenance of structures, riser or pipeline, and intervention activities or valve operations.

All subsea inspections are carried out in accordance with Santos' Underwater Inspection Manual.

2.9.2 Abandoned Subsea Well Inspection

Well integrity monitoring for any temporarily abandoned subsea wells will be undertaken in accordance with requirements defined in the applicable WOMPs. This may include visual inspections of well location sea surface using aircraft or vessel, and ROV visual inspections of the wellhead infrastructure and the seabed around it. These surveys are intended to confirm ongoing containment.

All subsea inspections are carried out in accordance with Santos' Underwater Inspection Manual.

2.9.3 Integrity and Corrosion Control

Integrity and corrosion control is managed based on inspections and maintenance of the subsea infrastructure are scheduled through the CMMS and carried out in accordance with routine work orders.

Offshore external inspection of all Santos subsea assets is based on asset class, as outlined in the Subsea Inspection Procedure. This procedure covers inspection of all subsea infrastructure, including structural, riser, pipelines, conductors, flowlines, XTs, manifold systems, wellheads, hoses.

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

Offshore inspection ancillary work is detailed in Varanus Island Offshore Facilities and Harriet Alpha Performance Standard Assurance Plans: PS-01 Platform Structural Integrity: Jackets, Subsea and Topsides Structures, including Helidecks and PS-03 Hydrocarbon Containment: Risers and Pipelines. Procedures referenced in these assurance plans cover subsea infrastructure to assess their integrity. These activities can involve topsides inspections and ROV or AUV inspections or diver-assisted surveys.

Additional inspections may be performed following physical events (e.g., extreme weather, extreme sea conditions, third-party interactions), integrity assessments or other triggers that indicate further inspection is required. For example, post-cyclone inspection by ROV may be able to provide additional surveillance of anomalies or areas of interest flagged by other inspections or by analysis.

Diving operations may be periodically required at or near the WHP. Diving operations are carried out using detailed planning and execution procedures. All diving operations are carried out in accordance with the Commonwealth OPGGS (Safety) Regulations 2009. Diving work is undertaken from a dedicated dive support vessel. No diving operations are carried out from the WHP.

A program of ongoing fabric maintenance of the WHP is also undertaken as part of the corrosion control program. Prior to painting, the offshore structures may be cleaned with an ultra-high-pressure water or grit blasted with garnet (a naturally occurring (inert/nontoxic) product) or other means.

Following an inspection, it may be necessary to disturb the seabed in the vicinity of subsea infrastructure, such as a pipeline, to correct free spans (e.g., by placing grout bags under the free span) or burial (by jetting or airlifting sediments from the top of the pipeline).

Activities associated with mothballing pipelines and facilities may include subsea infrastructure cleaning or flushing to maintain integrity during extended periods of inactivity.

Such activities may involve marine vessel or diver-based interventions to flush lines with treated seawater or inert gas. This may involve hot tapping (the process of drilling a hole through a pressure barrier using special equipment and procedures so that the pressure and fluids are safely contained when access is made) pipelines to facilitate this outcome.

2.9.4 Subsea Pipeline and Seafloor Imaging Surveys

Subsea pipeline and seafloor imaging surveys may be undertaken using methods and technologies such as single-beam echo sounders (SBESs), multibeam echo sounders (MBESs), SSSs and AUVs to identify:

- free spans
- lateral and upheaval buckling
- severe scour or other seabed disturbance
- gross variation from as-laid positions

- debris.

These surveys will provide input to integrity assessments and will assist in planning of future inspection campaigns, if required.

2.9.4.1 Single-beam Echo Sounders and Multi-beam Echo Sounders

SBESs 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 to allow for correction for the motion. MBESs work in the same way but produce a swath of acoustic fan-shaped pulses of sound made up of many single beams.

2.9.4.2 Side Scan Sonar Surveys

SSS is a marine geophysical technique that is used to produce an image of the seafloor. SSS transducers may be mounted on AUVs or vessel hulls or more commonly operated using an ROTV. The ROTV is towed behind the vessel using a tether at approximately four knots.

2.9.4.3 Autonomous Underwater Vehicles

Autonomous underwater vehicles (AUVs) may be used to conduct geophysical and inspection

activities, including sub-bottom profiles, MBESs, SBESs, SSS, cameras and conductivity, temperature and depth (CTD) profilers. The survey speed is often determined by the payload and survey objective but is generally around four knots. AUVs are battery powered.

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. The AUV is typically deployed from a vessel using a crane or an A-frame and is recovered using a winch or net.

2.9.5 Equipment and Infrastructure Installation, Cleaning, Repair and Modification

Installation, modification and cleaning of equipment or infrastructure in the operational area is occasionally required due to changes in recovery rates or other operational modifications and upgrades.

Infrastructure and equipment may also need to be replaced as dictated by the inspection and testing regime (Section 2.9.11). Such activities can include:

- removing pipework and process units
- extending the WHP
- upgrading the various components, control systems and equipment on the WHP
- upgrading the various subsea components, control systems and equipment
- flushing, draining and recovering residual liquids from pipes
- flushing residual liquids from subsea infrastructure to VI
- making piping, process and electrical alterations to accommodate operational changes to the field, such as new wells
- performing topsides cleaning or abrasive blasting, involving the use of cleaning and corrosion-inhibitor chemicals, with high-pressure or steam cleaning of pressure vessels, piping and equipment.

2.9.6 Marine Growth Removal

Marine growth on the substructures of offshore platforms must be maintained at levels that do not compromise the structural integrity of the platform. The John Brookes substructure provides attachment points for a variety of marine organisms that, over time, add significantly to the drag and weight on the substructure. As part of the maintenance of the facility, marine growth on the substructure is typically measured every five years using ROVs and/or divers; and if determined to be beyond the allocated thickness, it is periodically removed. This is carried out on an as-required basis in line with Santos' CMMS requirements.

In addition, as part of ongoing maintenance and to facilitate inspections, marine growth is removed from the WHP substructure, subsea pipelines, wellheads, heat exchangers and manifolds using inspection or working class ROVs and/or divers.

Marine growth is removed using high-pressure water cleaning (water jetting), brushing, vacuuming, grit blasting, or a combination of these:

- 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 pipeline or structure.
- Brushing – typically a coarse brush is applied to the pipeline or structure.
- 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, 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.

2.9.7 Pipeline Span Rectification

Pipeline span rectifications may be required to prevent possible damage to the pipelines and flowlines and to maintain their integrity. Where span rectification is required, there are various methods that may be used for span rectification, as outlined below.

2.9.7.1 Grout or Sand Bags

Spans can be filled in through the use of a grout bag (a bladder or bag) that is positioned under the pipeline and pumped full of grout until the bag supports the pipeline or alternatively using prefilled sand bags. This method, using a support vessel, can address scouring issues around support structures, which are checked to confirm that these are stable under storm conditions.

2.9.7.2 Trenching or Jetting

Trenching or water jetting the pipeline into the seabed removes the span and provides additional stability protection to the pipeline.

2.9.8 Well Intervention

There are no current or ongoing well intervention activities planned on John Brookes WHP. Well intervention activities may be required in response to well servicing requirements for John Brookes Wells, Spartan-2, Spar-2, Halyard-1 or Halyard-2. Well intervention is a collective term for deployment of tools, fluids, and equipment in pressurised or dead completed wells. A range of activities are undertaken through well interventions completed from the John Brookes WHP. These may include but are not limited to:

- Plug and abandon, kill and cement, or suspend wells in preparedness for a MODU to re-enter a well and either undertake a side track or P&A the well (MODU activities are not covered by this EP).
- Isolate subsea valves to the WHP or pipeline before commencing drilling or other topsides activities.
- Remove plugs and perforate wells whether new wells or new intervals of old wells.
- Perform bottom hole pressure surveys (for reservoir modelling and management), run production logging tools to determine flow rates from different zones and identify gas/oil and water contact,
- Instalbridge plugs to isolate water zones and perforate new zones in a well.
- Trouble-shoot surface controlled subsurface safety valves (SCSSV) in wells.
- Pump: bullhead well kill, lubricate bleed, annulus top ups, corrosion treatment, scale treatment, spotting cement or resin products at reservoir to isolate zones.
- Service the well, including xmas tree maintenance and removal (from the John Brookes WHP only) and wireline logging in the well bores.
- Commission new wellheads.

Different well intervention techniques, all of which can be carried out in either pressurised (live) or dead wells, are summaries in Table 2-9.

Table 2-9: Well intervention techniques

Intervention Technique	Description
Coil tubing	A coil tubing operation is a technique that is used to deploy various tools (logging tools, drilling tools, packers, etc.) and to circulate or place fluids in the well.
Wireline operation	A wireline operation is a technique that is used to deploy various electrical or mechanical down hole tools (logging tools, plugs, packers, perforating guns, shifting tools, pulling tools, etc) on electrical cables, braided cables or slickline (non-electrical cable).
Hydraulic work over	A hydraulic work over (snubbing) operation is a technique that is used to deploy tools and equipment via jointed pipe and to provide a conduit to circulate or place fluids in the well.
Pumping operation	A pumping operation can be defined as an injection of fluids into a well through tubing and annuli.

All well intervention activities are carried out under an activity-specific, internally approved well services program as per the John Brookes Well Operations Management Plan (WOMP) the Halyard-1, Halyard-2 and Spar-2 WOMP and the Spartan-2 WOMP.. These work programs (one for each well) outline work sequence, method of isolation and tubing or annulus fluid volumes. The WOMP prescribes the well integrity management of individual wells for a given asset and is the primary document in terms of well integrity management for a given Santos well. Well design and well barriers are assessed against the Well Lifecycle Management System Technical Standards. The WOMP is a stand-alone document and defines the well integrity performance standards for the wells it covers.

During well intervention work, a dedicated crew undertakes the required intervention work, either from the WHP (day shift) or from a support vessel (day and night shift) as required.

Rosella-1 is an open water exploration well which has been accepted as permanently abandoned. East Spar wells 3, 4, 6, 7 and 9 are all subsea wells that have also been accepted as permanently abandoned. There are no intervention activities planned on these open-ocean and subsea wells.

When the Halyard-1 well has been shut-in and disconnected from the production system, Santos will continue to monitor and inspect the Halyard-1 well in accordance with the NOPSEMA accepted WOMP.

2.9.9 Well Abandonment or Suspension

During the field life, the John Brookes wells, Spartan-2, Halyard-1, Halyard-2 and Spar-2 wells may be suspended, temporarily abandoned or permanently plugged and abandoned in accordance with the requirements of the OPGGS Act.

Activities involving the use of a MODU, such as the drilling of new wells or the permanent abandonment of wells, are not covered in this EP.

Equipment used for suspension activities will either be lifted aboard and operated on the WHP or operated from a support vessel. Activities are as described in the respective WOMPs and include:

- installation of deep-set tubing/tubing hanger plugs to isolate tubing leak
- installation of tubing/tubing hanger plug(s) to provide barriers to enable XT/WHD removal, remediation and/or repair.

Depending upon the specific well activity requirements at the time, flushing and/or purging the pipeline and process equipment of any residual hydrocarbons may be required, while leaving the pipeline in situ until a final decommissioning program has been developed. NOPSEMA-accepted WOMPs are in place for all wells within the operational area. The WOMPs describe the well integrity risks and inspection requirements for operational and suspended wells.

2.9.10 Cold Venting

There is no flare on the WHP; therefore, any gas emissions are cold-vented. Fugitive emissions can also occur during cold venting. High-pressure process hydrocarbons contained within the process systems on the platform can be released (cold vented) during maintenance activities or in the event of an incident. The well stream hydrocarbons are mainly methane.

- Cold venting will typically occur:
- under manual depressurisation of the production system for maintenance
- following an emergency shutdown

- under depressurisation and draining of the pig launcher after each use.

2.9.11 Inline Inspections

The John Brookes pipeline has the ability to be pigged while operational. A pig launcher is provided on the WHP that is capable of launching cleaning pigs and can accommodate intelligent pigs. Pigs travel from the WHP to VI.

Pigging of the East Spar pipeline is done infrequently, as the pig launcher is subsea. Intelligent pigging frequency depends on the findings from the previous inspection.

2.9.12 Life Extension Works

To ensure continued safe operations until EOFL, life extension works may be required on infrastructure in the John Brookes, Spartan and GES fields.

The EOFL and design life estimates for John Brookes, Spartan and GES fields are outlined in **Table 2-2**. Santos is not planning to cease operation of or remove this property within the five-year period of this EP.

Engineering studies will be completed, and potentially rectification works, if necessary, to ensure infrastructure integrity and safe operations beyond design life. Any rectification work that may be required will be the types of maintenance and repair activities that have been described in Section 2.9 above. If additional works are required that are not already described, any proposed changes to the EP will be managed in accordance with Santos' Environment Management of Change Procedure, as described in Section 8.11.2.

2.10 Safeguards, Emergency Blowdown and Shutdown Systems

2.10.1 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 as outlined in Sections 2.10.2 and Section 2.10.3.

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 general categories of:
- 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.

The emergency shutdown and emergency blowdown activities for the John Brookes WHP and Halyard, Spar and East Spar pipelines are as described below.

2.10.2 Emergency Shutdown Activities

When the John Brookes WHP shutdown is activated, the pipeline is also shut in. The Spartan, Halyard and Spar subsea wells are shut in along with shutdown of the Spartan, Halyard and Spar equipment on the WHP. All safety systems on the WHP are designed to fail safe, with the wells and WHP isolated. Automatic shutdown is preceded by a pre-alarm relayed to the onshore VI control room. In addition, if an emergency shutdown at the onshore East Spar Joint Venture gas plant occurs, the John Brookes WHP wells, Spartan, Halyard and Spar subsea wells will also automatically shut in.

2.10.3 Emergency Blowdown Activities

There is no automatic depressurisation for the John Brookes WHP or the Spartan, Halyard, Spar and East Spar subsea system. The production system remains pressurised after shutdown.

2.11 Vessel Operations

Support vessels are used for routine visits to the John Brookes WHP for activities such as chemical replenishment chemicals, diesel fuel and potable water. Support vessels will also be used to backload any equipment, waste and materials that require offloading.

Dedicated equipment-specific vessels that may be used include dive support vessels, ROV support vessels, or a support vessel equipped with ROV, AUV or SSS equipment. Maintenance or well intervention activities may require more than one support vessel.

Vessel-to-vessel refuelling is not normally required for routine activities associated with the John Brookes, Spartan or GES facilities as these activities usually have a limited duration and scope. Similarly, equipment transfers are rarely required. However, depending on the nature and scale of a non-routine activity, a 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 impacts 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 impacts and risks associated with sourcing non-local vessels, including appropriate management controls, are included in this EP.

2.12 Planning for Decommissioning

Execution of decommissioning activities associated with the Varanus Island Commonwealth Waters infrastructure (described in this EP) are not proposed within the scope of this EP, however, they are described here to provide context for Santos' planning for future phases.

Santos will ensure through monitoring, and maintenance if required, that property can be removed when required, and the ongoing presence of the property will not result in unacceptable environmental impacts or risks.

Section 2.12.1 provides an overview of the key decommissioning legislation and guidelines driving the planning for decommissioning. Santos' decommissioning planning activities in accordance with NOPSEMA Decommissioning Compliance Strategy 2024–2029 is outlined in Section 2.12.3**.**

2.12.1 Regulatory Context

The NOPSEMA planning for proactive decommissioning document (N-00500-IP2002), states that decommissioning is taken to mean the process of removing or otherwise satisfactorily dealing with offshore petroleum property (including wells) in a safe and environmentally responsible manner when it is neither used nor intended to be used.

Decommissioning in Commonwealth waters is governed by a series of legislation, policies and standards. The OPGGS Act is the primary legislation governing offshore decommissioning in Commonwealth waters. NOPSEMA lists multiple documents it considers relevant to decommissioning, including but not limited to the following:

- NOPSEMA Information paper: Planning for proactive decommissioning (N-00500-IP2002 A816565).
- NOPSEMA Policy: Section 572 Maintenance and removal of property (N-00500-PL1903 A720369).
- NOPSEMA Policy Section 270 Consent to surrender title – NOPSEMA advice (N-00500-PL1959 A800981).
- NOPSEMA Decommissioning Compliance Strategy 2024-2029 (A927433, v0 November 2023).

NOPSEMA Information paper – planning for proactive decommissioning

The NOPSEMA planning for proactive decommissioning document (N-00500-IP2002) states the following key points:

- The safe and environmentally responsible decommissioning of property is a key objective that titleholders shall plan for over all stages of the life cycle of a petroleum project to ensure compliance with the OPGGS Act and OPGGS(E)R.
- Titleholders are required under section 572(2) and (3) of the OPGGS Act to maintain property brought onto the area of a title and to remove that property when it is no longer in use or to be used.

- Consideration of alternative end state outcomes are subject to other provisions of the OPGGS Act and Regulations and provided for under section 572(7). Further, section 270(3)(c) to (f) requires titleholders to meet obligations with respect to property and the environment to the satisfaction of NOPSEMA in support of consent to surrender title.
- Planning for proactive decommissioning should be focused upon the outcomes required to comply with section 572 and then satisfy NOPSEMA for the purpose of 270(3)(c) to (f) of the OPGGS Act. The criteria and obligations required in order to comply should be included in the final permissioning documents and accepted by NOPSEMA prior to the commencement of final decommissioning activities.

NOPSEMA Policy – Section 572 maintenance and removal of property

The NOPSEMA Section 572 Maintenance and removal of property policy (N-00500-PL1903 A720369) sets out the principles that NOPSEMA will apply in the administration of section 572 of the OPGGS Act which requires titleholders to:

- maintain all structures, equipment and other property in a title area in good condition and repair
- remove all structures, equipment and other property that is neither used nor to be used in connection with operations authorised by the title; or
- make arrangements that are satisfactory to NOPSEMA in relation to those structures, equipment and other property.

Santos will ensure through IMMR and integrity management activities (as described in Section 2.9) 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.

A Well Operations Management Plans (WOMP) will also be implemented. The WOMP describes how the wells are managed including inspection, maintenance and repair activities. It also covers emergency situations. These measures are intended to ensure integrity of the wells and ensure that risks to personnel and the environment are ALARP.

Table 2-10: Duties and requirements under section 572

Section of Act	Duties and Requirements
Maintenance of property etc. (section 572(2))	A titleholder must maintain in good condition and repair all structures that are, and all equipment and other property that is: a. in the title area b. used in connection with the operations authorised by the permit, lease, licence or authority.
Removal of property etc. (section 572(3))	A titleholder must remove from the title area all structures that are, and all equipment and other property that is, neither used nor to be used in connection with the operations: a. in which the titleholder is or will be engaged b. that are authorised by the permit, lease, licence or authority.
Exception to the requirement (section 572(6))	Section 572(6) provides that maintenance and removal requirements, “do not apply in relation to any structure, equipment or other property that was not brought into the title area by or with the authority of the titleholder”. Where a title has been sold or transferred (change in control), the requirement to maintain and remove property etc. remains with the titleholder, whether it is operational or not. Where property etc. remains within a title and the title has ceased to be in force (i.e. for a period of time an area has reverted to vacant acreage), the current titleholder may not be responsible for any property etc. in the area of the title resulting from historical activities of the former titleholder if that property etc. is not being used. It should be noted, where a title ceases to be in force, in whole or in part, NOPSEMA may still direct the titleholder, former titleholder or certain other persons, under section 587 of the OPGGS Act to remove or make arrangements with respect to property etc.
Obligations of maintenance and removal of property etc. are subject to other provisions (section 572(7))	Section 572(7) of the OPGGS Act allows for titleholders to make other arrangements that are satisfactory to NOPSEMA with respect to property etc. for the purposes of section 270 of the OPGGS Act via an accepted permissioning document. Other arrangements in the context of this regulatory policy include where a titleholder intends to do something that is different from the requirements of section 572(2) and (3). Maintenance and removal of property etc. requirements are subject to other provisions of the OPGGS Act, the regulations, directions given by NOPSEMA or the responsible Commonwealth Minister, and any other law. The maintenance and removal requirements do not substitute for, or override other provisions of, or arrangements made under, the OPGGS Act or regulations.

Section of Act	Duties and Requirements
	If a titleholder intends to make other arrangements in relation to property etc. under section 572(7), the proposed approach should be included in permissioning documents and accepted by NOPSEMA prior to the property etc. being brought into the title area. Any changes in the titleholders' approach should be addressed in subsequent revisions of permissioning documents.

NOPSEMA Policy – Section 270 consent to surrender title

The NOPSEMA policy Section 270 Consent to surrender title – NOPSEMA advice (Document No: N-00500-PL1959 A800981) states the following key points:

- Section 270 of the OPGGS Act provides that the Joint Authority (JA) may consent to the surrender of petroleum exploration permits, production licences, retention leases, infrastructure licences and pipeline licences, if it is satisfied there are sufficient grounds to warrant giving consent.
- NOPSEMA will be requested to provide advice to the JA in relation to certain criteria to inform the JA's decision-making.
- NOPSEMA's advice will be based upon performance against conditions and obligations set out in permissioning documents.

Santos acknowledges the requirement of Section 270 but notes that Section 270 matters are not addressed within this EP and are therefore not discussed further. Section 270 matters will be the subject of a future decommissioning EP.

NOPSEMA Decommissioning Compliance Strategy 2024–2029

NOPSEMA's vision is that decommissioning of offshore petroleum wells, structures and property is completed in a timely, safe and environmentally responsible manner. Santos proposed schedule for future decommissioning activities is outlined in Section 2.12.3.

2.12.2 Santos Decommissioning Objectives

Santos' is committed to managing the lifecycle of its assets and proactive decommissioning planning through the implementation of Santos' overall decommissioning plan. Santos' decommissioning objectives are to:

- 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 outcomes comply with section 572 and 270 of the OPGGS Act and other relevant legislation.

2.12.3 Decommissioning Strategy

Santos has a progressive approach to decommissioning the VI Hub facility. Santos breaks dowm decommissioning scopes into five phases:

- Cessation of production- suspension of operations
- Preservation
- P&A of wells
- Asset removal
- Surrender of title monitoring

The VI Hub facilities currently produce from several fields and forecast EOFL varies across the fields. Consistent with Santos's progressive approach to decommissioning, activities as per the above decommissioning phases will take place as fields and associated infrastructure are no longer in use. As such the above above-mentioned decommissioning phases will vary across the fields.

The EOFL for each field is outlined in Table 2-2 and Table 2-3. The current expected EOFL for John Brookes is estimated at 2043 and no EOFL decommissioning activities for the infrastructure within this field are scheduled to occur within the next 5 years.

Spartan and some GES infrastructure are nearing EOFL i.e. cessation of production is likely to occur within the next five years as such these fields are currently considered to be in late life operations. During this stage, Santos has and will continue to develop decommissioning materials to facilitate the future acceptance of the final permissioning documents. Some of the activities performed in the current stage are summarised in Table 2-11 (derived from Table 1 of the Planning for Proactive Decommissioning Information Paper, N-00500-IP2002 A816565).

Consistent with Santos' progressive approach to decommissioning and in order to minimise risk, the following decommissioning activites at the VI Hub facility have been undertaken:

- Permanent abandonment of all inactive wells John Brookes 4 Well, Rosella-1 (ST 2) Well East Spar-3 well, East Spar-4A (ST 1) well, East Spar 6 Well, East Spar-7 Well, East Spar-9 Well
- Removal of East Spar 1/3/6 flexible flowlines along with umbilical's, spools, heat exchangers/cooling skids
- Removal of NCC buoy

Santos has been preparing for decommissioning across numerous assets including Mutineer-Exeter, Fletcher and Finucane (MEFF), Bayu Undan, Harriet Joint Venture (State waters), Ningaloo Vision and Reindeer. Santos plans to undertake site specific studies to support VI Hub decommissioning (**Table 2-12**).

Santos's decommissioning plan takes the following factors into account when developing decommissioning timelines:

- Ability to obtain all regulatory acceptances before taking financial commitments to major contractors to execute the works
- Safe execution of decommissioning programs (VI hub specifically takes into account live infrastructure in the vicinity of decommissioning activities)
- Rig/vessel availability
- Ability to combine decommissioning operations with other projects and/or operators to undertake works efficiently, and in a cost-effective manner
- Production duration from producing assets.
- Decommissioning timing targets outlined in NOPSEMA's decommissioning compliance strategy.

Table 2-11 Decommissioning activities proposed for infrastructure nearing EOFL (late life operations)

Stage	***Description of decommissioning activity***	**Santos Activities**
Late life operations	*Continuation of permanently abandoning wells and ongoing decommissioning of property with no further use.*	Inactive wellheads have been permanently abandoned.
	Additional technical and environmental studies to inform decommissioning.	Studies are proposed to support decommissioning (Table 2-12).
	Ongoing and potentially additional maintenance of property to enable decommissioning.	Infrastructure is inspected and maintained during all stages of the project as described in Section 2.9.1.
	Function testing of unused or preserved equipment installed to support decommissioning.	Not relevant. Decommissioning equipment has not been installed.

2.12.4 Santos Decommissioning Plan

Santos has prepared a long term decommissioning plan across all of it's Commonwealth and State waters facilities. The decommissioning plan ensures Santos is 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 execution of all campaigns.

Santos acknowledges NOPSEMA's Decommissioning Compliance Plan and Strategy which aims to ensure titleholders have appropriate plans for decommissioning and are completing activities in a timely manner. Santos will ensure that VI Hub facilities are maintained in safe condition and do not pose a threat to people, the environment or property.

EOFL estimates for VI Hub infrastructure are outlined in **Table 2-2** and **Table 2-3**. Santos' progessive decommissioning plan for VI Hub Commonwealth facilities is based on EOFL dates. Santos will submit its Decommissioning Plan for VI Hub Commonwealth infrastructure reaching EOFL between 2027 and 2030 to NOPSEMA by Q2 2025. A summary of proposed timelines, tasks and milestones for planning for decommissioning is provided in **Table 2-12**.

The Decommissioning Plan will outline Santos' progressive decommissioning planfor the VI Hub Commonwealth facilities. The Decommissioning Plan will group the infrastructure based on EOFL dates, and the following information will be provided for each infrastructure group:

- Decommissioning execution strategy
- Proposed decommissioning solution to meet the requirements of the OPGGS Act
- A proposed decommissioning schedule including regulatory approval timelines
- Project management including proposed resourcing

The Decommissioning Plan will include timeframes for the following activities and planned submission dates for associated regulatory approvals:

- Cessation of production activities
- Plug and abandonment of wells and
- End state decommissioning

A Cessation of Production EP will be submitted to NOPSEMA one year prior to EOFL for the relevant infrastructure group and will address the following:

- Description of all property brought onto title including its current status and condition
- Cessation of production and maintenance activities such as flushing flowlines
- Decommissioning timelines

A plug and abandonment EP will be submitted to NOPSEMA within two years of EOFL which addresses the following:

- Description of all property brought onto title including its current status and condition
- A description of all activities associated with plugging and abandonment of all wells on title
- Details plans of P&A activities and execution timings

A decommissioning EP will be submitted to NOPSEMA within four years of EOFL 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
- 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, to enable NOPSEMA to have regard to the Australian Government Decommissioning Guideline policy principle that deviations will provide an ALARP and acceptable environmental outcome when compared to 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
- 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 an ALARP and acceptable environmental outcome compared to complete property removal
- Where deviation/s to removal of property or relocation of property is proposed, Santos will address arrangements for monitoring and management

Table 2-12: Planning for decommissioning

Timeframes	Tasks and Milestones
Complete	+ Permanent abandonment of inactive wells John Brookes 4 Well, Rosella-1 (ST 2) Well East Spar-3 well, East Spar-4A (ST 1) well, East Spar 6 Well, East Spar-7 Well, East Spar-9 Well
Complete	+ Removal of East Spar 1/3/6 flexible flowlines along with umbilical's, spools, heat exchangers/cooling skids + Removal of NCC buoy
2026-2030	+ Engineering and scientific studies for decommissioning (Table 2-13).
Q2 2025	+ Submission of decommissioning plan for infrastructure reaching EOFL by 2030
2026 (one year prior to EOFL)	+ Submission of Cessation of Production EP for infrastructure reaching EOFL by 2027 (for example Halyard wells).
2028 (one year prior to EOFL)	+ Submission of Cessation of Production EP for infrastructure reaching EOFL by 2029 (for example Spartan wells)
2029 (within 2 years of earliest EOFL)	+ Submission of P&A EP for infrastructure reaching EOFL by 2027-2029 (for example Halyard and Spartan wells, or if required a separate Spartan P&A EP will be submitted within 2 years).
2031 (within 4 years of earliest EOFL)	+ Submission of decommissioning EP for infrastructure reaching EOFL by 2027-2029, including infrastructure listed as inactive in Table 2-2 and wells listed as permanently abandoned in Table 2-3.
2027-onwards	In accordance with Section 572 of the OPGGS Act and the NOPSEMA Policy 'Section 572 Maintenance and removal of property: Santos will continue planning for decommissioning of all property to ensure property no longer in use is removed to meet Section 572(3), until such time an alternative arrangement has been accepted by NOPSEMA under Section 572(7). Removal of all property remains the base case until an alternative arrangement has been accepted by NOPSEMA. Section 572(3) of the OPGGS Act states: + Removal of property etc. (3) A titleholder must remove from the title area all structures that are, and all equipment and other property that is, neither used nor to be used in connection with the operations: (a) in which the titleholder is or will be engaged; and (b) that are authorised by the permit, lease, licence or authority. The NOPSEMA Policy 'Section 572 Maintenance and removal of property' states: + Section 572(7) of the OPGGS Act allows for titleholders to make other arrangements that are satisfactory to NOPSEMA with respect to property etc. for the purposes of section 270 of the OPGGS Act via an accepted permissioning document.
Notes: Dates in this table are estimates only.	

2.12.5 Studies

Santos proposes to remove VI Hub infrastructure in line with section 572 of the OPGGS act subject to a technical feasibility assessment. Santos proposes the studies in Table 2-13 to support decommissioning.

Table 2-13 Studies proposed to support decommissioning

Decommissioning option	Study	Year	Scope / Purpose
Cessation of production	Modelling study	2026	Modelling to support flushing activities at cessation of production
Removal and leave in situ	Technical feasibility assessment	2026-2030	Assessment of technical feasibility of infrastructure removal
	Comparative assessment of decommissioning options	2026-2030	Comparison of technically feasible decommissioning options against environmental and social assessment criteria
	Waste management study	2026-2030	Identify options for repurposing, recycling and disposal of materials
	Environmental Sampling if required	2026-2030	Environmental sampling to inform impact and risk evaluation for future activities
Leave situ only	Degradation assessment	2026-2030	Material degradation assessment (concrete, plastic, steel etc.) for leave in situ option
	Snag risk assessment	2026-2030	Assessment of snag risk associated with leaving infrastructure in situ
	Biodiversity & habitats assessment	2026-2030	Assessment of biodiversity associated with infrastructure

3. Description of the Environment

OPGGS(E)R 2023 Requirements
Regulation 21. Environmental assessment.
Description of the environment 21(2) The environment plan must: a) describe the existing environment that may be affected by the activity; and b) include details of the particular relevant values and sensitivities (if any) of that environment. Note: The definition of environment in regulation 4 includes its social, economic and cultural features. 21(3) Without limiting paragraph (2)(b), particular relevant values and sensitivities may include any of the following: a) the world heritage values of a declared World Heritage property within the meaning of the EPBC Act; b) the national heritage values of a National Heritage place within the meaning of that Act; c) the ecological character of a declared Ramsar wetland within the meaning of that Act; d) the presence of a listed threatened species or listed threatened ecological community within the meaning of that Act; e) the presence of a listed migratory species within the meaning of that Act; f) any values and sensitivities that exist in, or in relation to, part or all of: i) a Commonwealth marine area within the meaning of that Act; or ii) Commonwealth land within the meaning of that Act.

3.1 Environment that May be Affected

This section summarises the key physical, biological, socio-economic and cultural characteristics of the existing environment that may be affected (EMBA), both from planned activities and unplanned events associated with the activity. The description of the environment applies to two areas:

- the operational area, which includes all infrastructure and activities associated with the John Brookes, Spartan and Greater East Spar facilities in Commonwealth waters
- the environment that may be affected (EMBA), shown in Figure 3-2

A detailed and comprehensive description of the environment (required by OPGGS(E)R 2023, Section 21(3)) in the operational area and broader EMBA is provided in Appendix C.

Copies of the Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool outputs for the operational area and the EMBA are also available in Appendix D. The searches are completed using the same EMBA shapefiles used to produce the figures throughout Section 3 of the EP, 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.

The EMBA encompasses the full range of environmental receptors that might be contacted by surface and subsurface hydrocarbons in the highly unlikely event of a worst case oil spill. Most planned and unplanned events associated with the activity may affect the environment up to a few hundred metres from the facilities. A large unplanned hydrocarbon spill would extend substantially beyond a few hundred metres. Section 3.1.1 describes how the EMBA is determined.

3.1.1 Determining the Environment that May be Affected

Stochastic hydrocarbon dispersion and fate modelling, applied to all credible spill scenarios identified as relevant to the activity (Section 7.5.1) was undertaken to inform the EMBA (RPS, 2019).

Replacement of Halyard-1 well with Halyard-2 did not increase the credible spill scenario volumes. As such no additional modelling was required for this new stage of the activity.

Stochastic modelling is created by overlaying hundreds of 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.

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, as relevant, to identifying an area that might be contacted by hydrocarbons, environment risk assessment and oil spill response planning, for the various hydrocarbon phases. Refer to Table 3-1 for the exposure values used and to Section 7.5 for further information on the reasons why these exposure values have been selected and how they relate to the risk assessment in Section 7.6 to Section 7.9

The EMBA is based on stochastic modelling, using the low exposure values (Figure 3-2). The EMBA encompasses the outer most boundary of the overlaid worst-case spatial extent of the four hydrocarbon phases listed above for all the credible spill scenarios. The EMBA is illustrated in Figure 3-1

The low exposure values are used as a predictive tool to set the outer boundaries of an EMBA and may not necessarily result in ecologically significant impacts. To inform the evaluation of potential environmental consequences of a hydrocarbon release (impact assessment), modelling includes higher exposure values (i.e., the concentrations at which environmental consequences may result). The higher exposure values are known as 'moderate' and 'high' are described within Table 3-1and further explained Section 7.5.5. Applying the same method used to determine the EMBA, spatial areas were derived for moderate and high exposure value areas (MEVA and HEVA) as illustrated in Figure 3-2

While the EMBA represents the largest possible spatial extent that could be contacted by any of the worst-case spill events modelled, an actual spill event is more accurately represented by only one of the simulations from the stochastic modelling, resulting in a much smaller spatial footprint from an actual spill event. Modelling of a single simulation, representative of a single spill event is termed deterministic modelling. An example of a deterministic run is illustrated in Figure 3-1 to demonstrate a more realistic spatial extent for the worst-case spill event (i.e., a deterministic EMBA – using low exposure values). The deterministic EMBA for this EP is a single simulation from the worst case scenario described in Table 7-10 which is a surface hydrocarbon release from the John Brookes WHP (Section 7.6).

Table 3-1: Hydrocarbon exposure values in the environment that may be affected

Hydrocarbon Phase	Exposure Value		
	Low	Moderate	High
Floating (g/m^2)	1	10	25
Shoreline accumulation (g/m^2)	10	100	1,000
Dissolved aromatics (ppb)	6	50	400
Entrained (ppb)	10	100	-

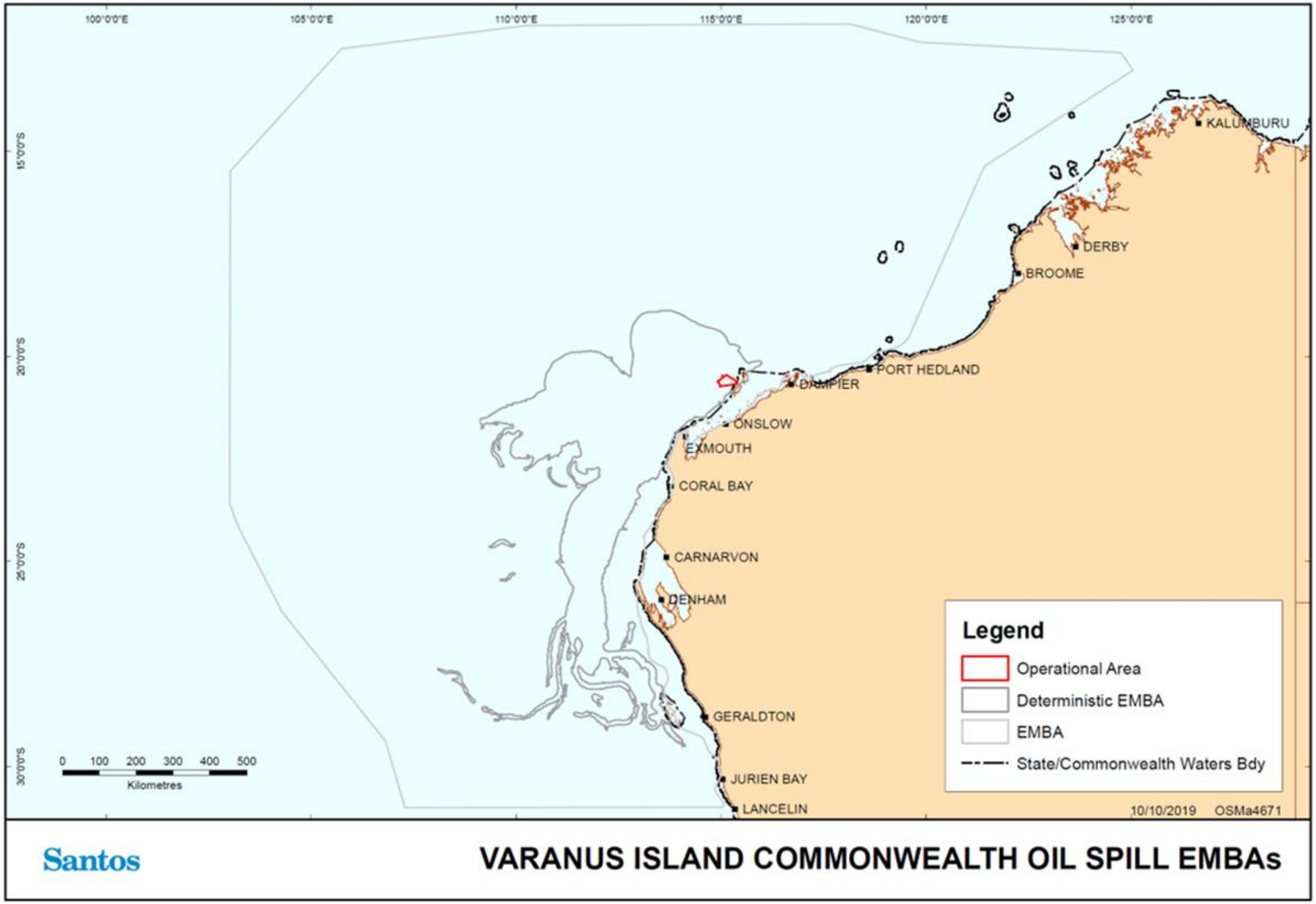

Figure 3-1: Varanus Island Commonwealth oil spill environments that may be affected

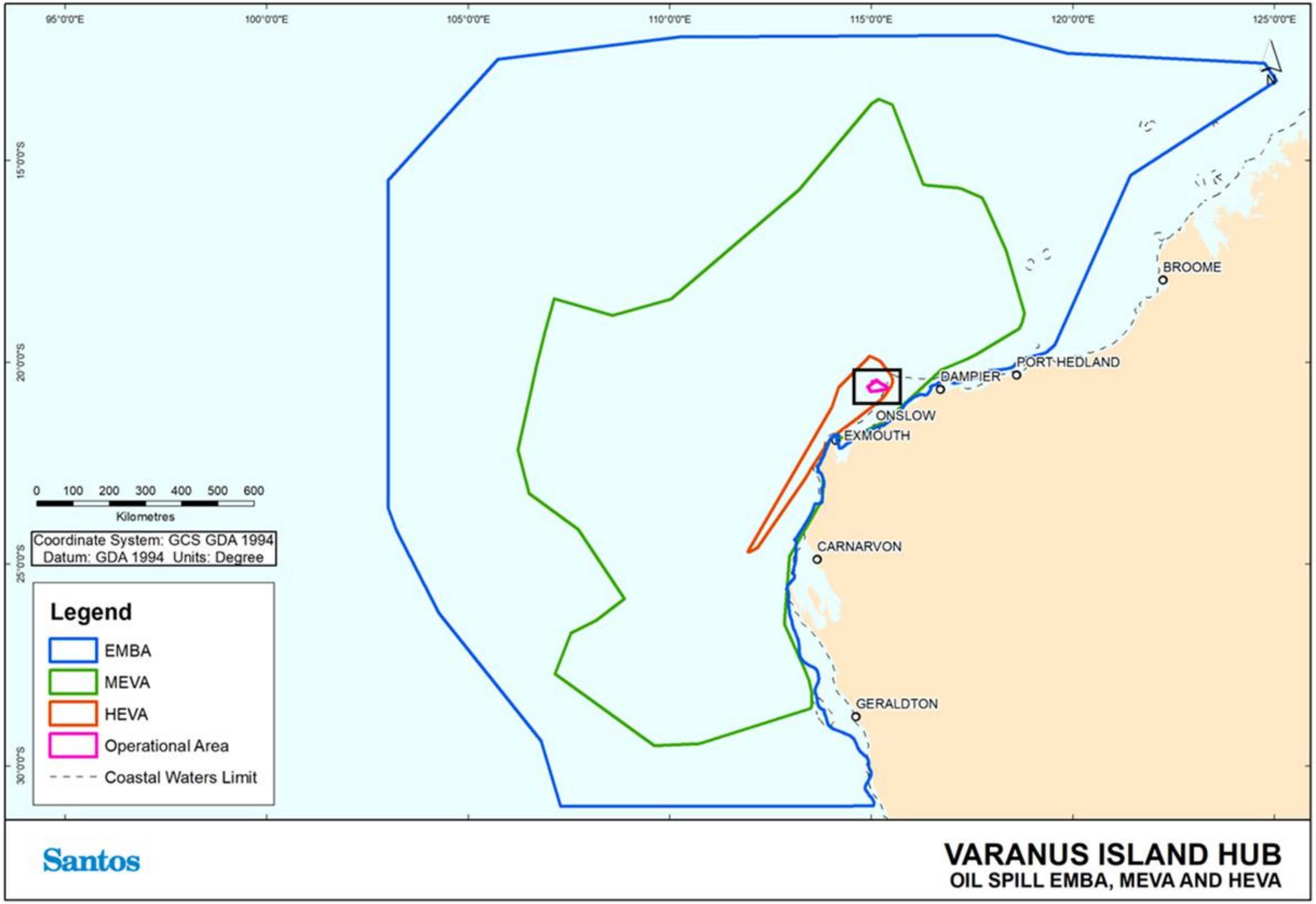

Figure 3-2: Overall environment that may be affected, moderate and high exposure value areas for the Varanus Island Hub Operations

3.2 Environmental Values and Sensitivities

Desktop searches of the operational area and the EMBA were undertaken using the DCCEEW Protected Matters Search Tool (PMST) to identify matters of national environmental significance listed under the EPBC Act. The results of these searches, undertaken on 8 November 2024, are provided in Appendix D.

To identify sites associated with cultural heritage in the EMBA a search was undertaken using the Department of Planning, Lands and Heritage (DPLH) Aboriginal Cultural Heritage Inquiry System Tool. Results of these searches, undertaken on 21 May 2024, are provided in Appendix E.

A comprehensive description of the environmental values and sensitivities of the existing environment in the EMBA (required by OPGGS(E)R 2023, Section 21(3)) is provided in Appendix C. The information derived from the PMST, bioregional plans and fauna recovery plans relevant to the operational area and the EMBA is summarised in this section.

3.2.1 Bioregions

Based on the Integrated Marine and Coastal Regionalisation of Australia (IMCRA), Version 4.0 (DEH, 2006), the operational area overlaps the Northwest Shelf Province and the EMBA overlaps the (refer Figure 3-3):

- Northwest Shelf Province
- Northwest Province
- Northwest Transition
- Timor Province
- Central Western Transition
- Central Western Shelf Transition
- Central Western Shelf Province
- Northwest Shelf Transition
- Christmas Island Province
- Southwest Shelf Transition
- Central Western Province.

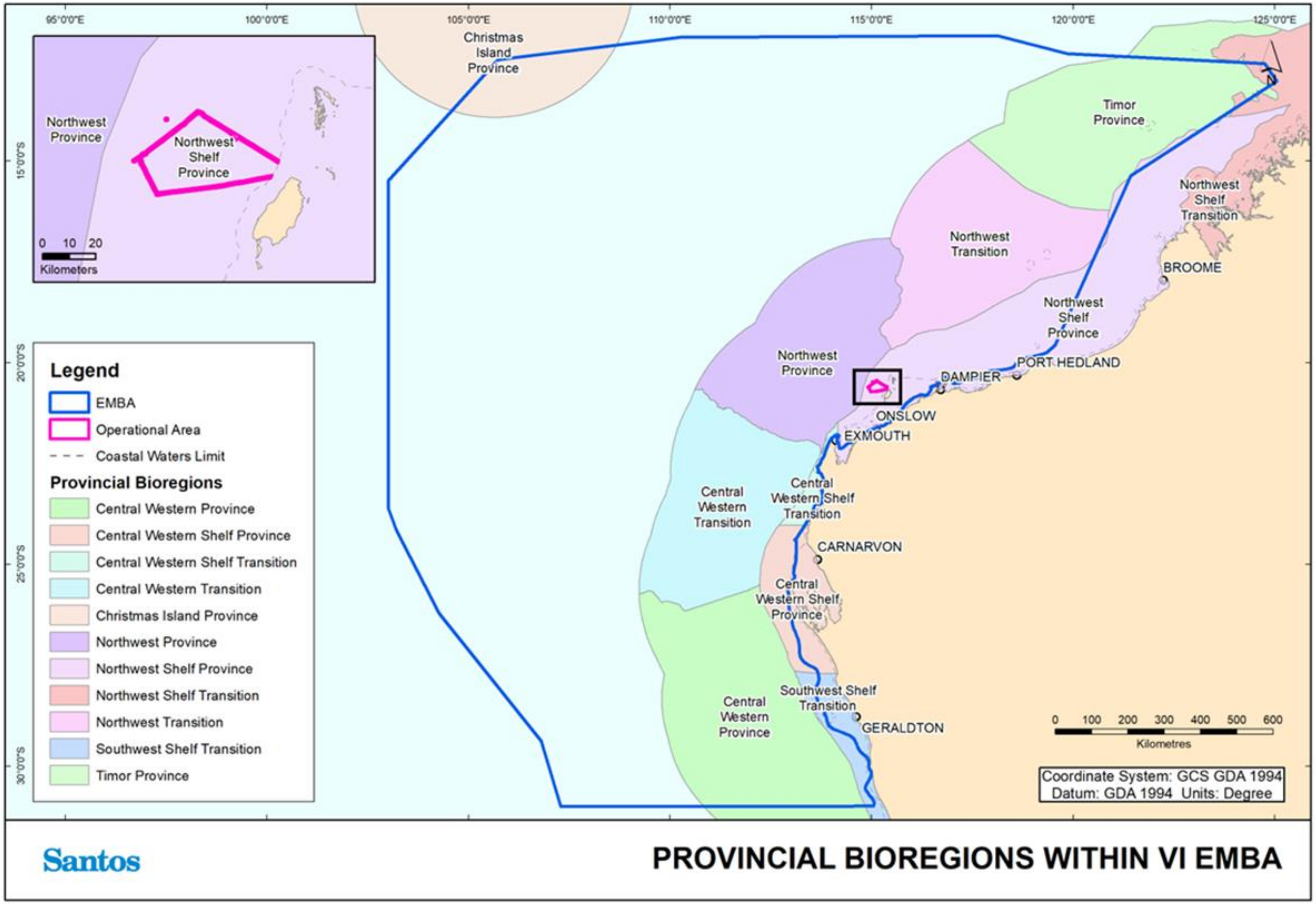

Figure 3-3: Provincial bioregions within the operational area and environment that may be affected, as shown in Integrated Marine and Coastal Regionalisation of Australia 4.0

3.2.2 Benthic Habitats

The presence of marine and coastal habitats in the operational area and the EMBA are summarised in Table 3-2.

A detailed description of these habitats with reference to the IMCRA provincial bioregions is provided in Appendix C. A summary of key benthic habitats, offshore reefs and islands, and shoals and banks is provided below.

The benthic (at or just below the seabed) habitats in waters in the operational area lie at depths ranging from approximately 45 m to 110 m. The operational area is likely to consist of soft sediment seabeds and sandy and muddy substrates, occasionally interspersed with hard substrates covered with sand veneers (DEWHA, 2008). Non-coral benthic invertebrates are likely to be the dominant community, albeit in low densities. Non-coral benthic invertebrates that occur in the operational area are likely to include sea cucumbers, urchins, crabs and polychaetes on soft substrate. Hard substrates are likely to contain sessile (fixed in one place) invertebrates, such as sponges and gorgonians (DEWHA, 2008).

There are no known offshore reefs or islands in or in close proximity (less than 5 km) to the operational area. However, there are emergent oceanic reefs and islands in the EMBA, including Barrow Island, Montebello Islands, Lowendal Islands, Dampier Archipelago, Thevenard Islands, Muiron Islands and the Abrolhos Islands. A description of the values and sensitivities associated with these reefs and islands is provided in Appendix C.

A number of shoals and banks in the open offshore waters of the region have recognised environmental value. The key shoals and banks in the EMBA include the Rowley Shoals, Glomar Shoals, Rankin Bank and the Abrolhos Shoals. The closest bank feature to the operational area is Penguin Bank, located approximately 70 km south of the operational area. Approximately 40 bank features were identified in the wider EMBA (Geoscience Australia, 2019). The nearest key shoals to the operational area are the Glomar Shoals, located approximately 160 km northeast of the operational area. An understanding of these features has been gained from the Big Bank Shoals study (Heyward et al., 1997) and the PTTEP Australasia surveys initiated in response to the Montara incident (Heyward et al., 2010; Heyward et al., 2012).

The shoals and banks in the EMBA contain benthic habitats and associated fauna assemblages that are highly diverse compared to the surrounding relatively deep and bare seabed that constitutes the majority of the outer continental shelf in the region. These shoals and banks may act as important sources of larvae of important taxa such as fish and corals, which may be advected considerable distances (Shell, 2019). The shoals and banks support many of the same species found on emergent reef systems of the Indo-West Pacific region (Heyward et al., 2017a). This indicates a high level of ecological connectivity among the reef systems and between the shoals and banks. This is further supported by an analysis undertaken by the Australian Institute of Marine Science that compared benthic habitat community data from a number of shoals and banks in the Timor Sea and Bonaparte Gulf region. The analysis showed that neighbouring shoals and banks frequently share many attributes in terms of benthic community composition and species (Heyward et al., 2017b).

While the benthic communities on each shoal or bank reveal a degree of connectivity, it is acknowledged that they may vary in the abundance and diversity of dominant benthic species, with subsets of species featuring more prominently on some than others (Heyward et al., 2017b). This variability may reflect different disturbance events (e.g., cyclones, storm damage and coral bleaching) and recruitment histories, as well as potentially different ecosystem trajectories (Heyward et al., 2017b)

Table 3-2: Habitats in the environment that may be affected, listed according to presence in the operational area and provincial bioregions of Australia

Category	Receptor	EMBA Presence											Relevant Events That May Impact on the Receptors
		OA Presence	Northwest Province	Northwest Shelf Province	Northwest Transition	Central Western Transition	Central Western Shelf Transition	Central Western Province	Northwest Shelf Transition	Christmas Island Province	Northwest Province	Northwest Shelf Province	
Benthic Habitats	Coral reefs			✓	✓		✓	✓					Unplanned Condensate release due to subsea or surface well release. Diesel release from vessel collision.
	Seagrass			✓	✓		✓	✓					
	Macroalgae			✓	✓		✓	✓					
	Non-coral benthic invertebrates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Planned Seabed disturbance. Planned operational discharges. Unplanned Condensate release due to subsea or surface well release. Diesel release from vessel collision. Unplanned release of solids.
Shoreline Habitats	Mangroves			✓			✓	✓					
	Intertidal platforms			✓			✓	✓				✓	
	Sandy beaches			✓			✓	✓				✓	
	Rocky shorelines			✓			✓	✓				✓	

3.2.3 Protected and Significant Areas

Protected and significant areas identified in the operational area and the EMBA are detailed in Table 3-3, Figure 3-4 and Figure 3-6. These areas are further discussed in Appendix C

The management zones associated with the Australian marine parks identified in the EMBA and the relevant objectives are detailed in Table 3-4.

Table 3-3: Distance from operational area boundary to protected areas, key ecological features and threatened ecological communities in the environment that may be affected

Value/Sensitivity	Name	Zone or IUCN Classification	Within OA	Distance to OA
Australian Marine Parks	Montebello Marine Park	Multiple Use Zone (IUCN VI)	Yes	0 km (intersects)
	Gascoyne Marine Park	Habitat Protection Zone (IUCN IV)	No	249 km
		Multiple Use Zone (IUCN VI)		120 km
		National Park Zone (IUCN II)		330 km
	Ningaloo Marine Park	Recreational Use Zone (IUCN IV)	No	129 km
		National Park Zone (IUCN II)		258 km
	Dampier Marine Park	Habitat Protection Zone (IUCN IV) National Park Zone (IUCN II)	No	154 km
	Argo-Rowley Terrace Marine Park	Multiple Use Zone (IUCN VI)	No	327 km
	Eighty Mile Beach	Multiple Use Zone (IUCN VI)	No	381 km
	Shark Bay Marine Park	Multiple Use Zone (IUCN VI)	No	439 km
	Carnarvon Canyon Marine Park	Habitat Protection Zone (IUCN IV)	No	466 km
	Mermaid Reef	Multiple Use Zone (IUCN VI)	No	576 km
	Abrolhos Marine Park	Habitat Protection Zone (IUCN IV)	No	614 km
		Multiple Use Zone (IUCN VI)		765 km
		National Park Zone (IUCN II)		725 km
		Special Purpose Zone (IUCN VI)		754 km
	Kimberley	Multiple Use Zone (IUCN VI)	No	714 km
	Jurien Marine Park	Special Purpose Zone (IUCN VI)	No	1,046 km
	Cartier Island	Sanctuary Zone (IUCN Ia)	No	1,242 km
State Marine Parks and Marine Management Areas (coastal marine parks	Barrow Island Marine Management Area	–	Yes	0 km (intersects)
	Barrow Island Marine Park	Sanctuary Zones	No	5.5 km

Value/Sensitivity	Name	Zone or IUCN Classification	Within OA	Distance to OA
are described in Appendix C)	Montebello Islands Marine Park	Sanctuary Zones, Recreation Zones, Special Purpose Zones	No	7.5 km, 17.3 km, 18.2 km, 14.0 km
	Muiron Islands Marine Management Area	–	No	111 km
	Ningaloo Marine Park	Sanctuary Zones, Special Purpose Zones, Recreation Zones, General Use Zone	No	142 km, 143 km, 141 km, 129 km
	Rowley Shoals Marine Park	Sanctuary Zones, Recreation Zones, General Use Zone	No	489 km
	Jurien Bay Marine Park	Sanctuary Zones, Special Purpose Zones, Aquaculture Zones, General Use Zone	No	1,034 km
World and National Heritage Areas	The Ningaloo Coast	–	No	111 km
	Dampier Archipelago (including Burrup Peninsula)	–	No	112 km
	Shark Bay	–	No	473 km
	Dirk Hartog Landing Site 1616 – Cape Inscription Area	–	No	565 km
	HMAS Sydney II and HSK Kormoran Shipwreck Sites	–	No	714 km
Commonwealth Heritage Areas	Ningaloo Marine Area – Commonwealth Waters	–	No	129 km
	HMAS Sydney II and HSK Kormoran Shipwreck Sites	–	No	586 km
	Mermaid Reef – Rowley Shoals	–	No	715 km
	Scott Reef and Surrounds – Commonwealth Area	–	No	988 km
Wetlands of International Importance	None	–	–	–
Wetlands of National Importance	None	–	–	–
Key Ecological Features (KEF)	Ancient coastline at 125 m depth contour	–	No	2 km
	Continental slope demersal fish communities	–	No	11.8 km
	Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	–	No	84.5 km
	Exmouth Plateau	–	No	120 km

Value/Sensitivity	Name	Zone or IUCN Classification	Within OA	Distance to OA
	Commonwealth waters adjacent to Ningaloo Reef	–	No	129 km
	Glomar Shoals	–	No	159 km
	Commonwealth marine environment within and adjacent to the west coast inshore lagoons	–	No	480 km
	Western demersal slope and associated fish communities	–	No	598 km
	Wallaby Saddle	–	No	628 km
	Western rock lobster	–	No	777 km
	Ancient coastline between 90 and 120 m depth	–	No	787 km
	Canyons linking the Argo Abyssal Plain with Scott Plateau	–	No	800 km
	Seringapatam Reef and Commonwealth waters in the Scott Reef complex	–	No	817 km
	Commonwealth marine environment surrounding the Houtman Abrolhos Islands (and adjacent shelf break)	–	No	824 km
	Perth Canyon and adjacent shelf break, and other west-coast canyons	–	No	821 km
	Mermaid Reef and Commonwealth waters surrounding Rowley Shoals	–	No	975 km
	Ashmore Reef and Cartier Island and surrounding Commonwealth waters	–	No	1,225 km
Threatened Ecological Communities	None	–	–	–

Table 3-4: Management zones for the Australian and State Marine Parks found in the environment that may be affected and the associated objectives

Management Zones	Objective
Australian Marine Parks	
Multiple Use (IUCN VI)	The objective is to provide for ecologically sustainable use and the conservation of ecosystems, habitats and native species.
Recreational Use (IUCN IV)	The objective is to provide for the conservation of ecosystems, habitats and native species in as natural a state as possible, while providing for recreational use.

Management Zones	Objective
Habitat Protection Zone (IUCN IV)	The objective is to provide for the conservation of ecosystems, habitats and native species in as natural a state as possible, while allowing activities that do not harm or cause destruction to seafloor habitats.
National Park Zone (IUCN II)	The objective is to protect natural biodiversity with its underlying ecological structure and supporting environmental processes, and to promote education and recreation.
Special Purpose Zone (IUCN VI)	The objective is to protect natural ecosystems and use natural resources sustainably, when conservation and sustainable use can be mutually beneficial.
State Marine Parks	
Sanctuary Zones	The primary purpose of sanctuary zones is for the protection and conservation of marine biodiversity. Sanctuary zones are 'no-take' areas managed solely for nature conservation and low-impact recreation and tourism.
Special Purpose Zones	Special purpose (benthic protection) zone: This zone has the priority purpose of conservation of benthic habitat. Special purpose (shore-based activities) zone: Special purpose zones in marine parks are managed for a priority purpose or use, such as a seasonal event (e.g., wildlife breeding, whale watching) or a commercial activity (e.g., pearling).
Recreation Zones	Recreation zones have the primary purpose of providing opportunities for recreational activities, including fishing, for visitors and for commercial tourism operators, where these activities are compatible with the maintenance of the values of the zone
General Use Zones	Conservation of natural values is still the priority of general use zones, but activities such as sustainable commercial and recreational fishing, aquaculture, pearling and petroleum exploration and production may be permitted provided they do not compromise the ecological values of the marine park.

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 in the North-west Marine Parks Network Management Plan (North-west MPNMP) (Director of National Parks, 2018). The Class Approval – Mining Operations and Greenhouse Gas Activities for the North-west MPNMP, which is applicable to petroleum-related activities, came into effect on 1 July 2018. Prescriptions / conditions of the North-west MPNMP and Class Approval for the North-west MPNMP that are considered relevant to the scope of this EP are provided in Table 3-5.

Table 3-5: : Prescriptions/conditions from the North-west and North Marine Parks Network Management Plan 2018 and associated class approval – mining operations and greenhouse gas activities relevant to the activities in this Environment Plan

Prescription/ Condition Number	Prescription/Condition	Relevant Section of EP
North-West MPNMP (Director of National Parks, 2018)		
4.2.9.8	Notwithstanding Section 4.2.9.1 (of the North-West MPNMP), actions required to respond to oil pollution incidents, including environmental monitoring and remediation, in connection with mining operations authorised under the OPGGS Act, may be conducted in all zones without an authorisation issued by the Director, provided that the actions are taken in accordance with: an environment plan that has been accepted by NOPSEMA, and the Director is notified in the event of oil pollution within a marine park, or where an oil spill response action must be taken within a marine park, so far as reasonably practicable, prior to response action being taken.	This EP Section 4 (Stakeholder Consultation), reporting under Section 8.10 and the oil pollution emergency plan (OPEP).
Class Approval – Mining Operations and Green House Gas Activities – for North-West MPNMP (Director of National Parks, 2018)		
1	Approved action must be conducted in accordance with: an Environment Plan accepted under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations (2023)	The OPEP (some proposed response activities in the event of an oil pollution incident may be undertaken within the North-west Marine Park Network).
	the EPBC Act	Appendix B(Legislation)
	the EPBC Regulations	This EP.

Prescription/ Condition Number	Prescription/Condition	Relevant Section of EP
	the North-west Network Management Plan	This table.
	Any prohibitions, restrictions or determinations made under the EPBC Regulations by the Director of National Parks, and	Not applicable.
	all other applicable Commonwealth and state and territory laws (to the extent those laws are capable of operating concurrently with the laws and instruments described in paragraphs a to e)).	**Appendix B** (Legislation), and the OPEP.
2	If requested by the Director of National Parks, an Approved Person must notify the Director prior to conducting Approved Actions within Approved Zones. Note: the timeframe for prior notice will be agreed to by the Director of National Parks and the Approved person.	**Section 8.9** (Reporting) and the OPEP.
3	If requested by the Director of National Parks, an Approved Person must provide the Director with information relating to undertaking the Approved Actions (or gathered while undertaking the Approved Actions), that is relevant to the Director's management of the Approved Zones. Note: the information required, and timeframe within which it is required, will be agreed to by the Director of National Parks and the Approved Person.	Not applicable.

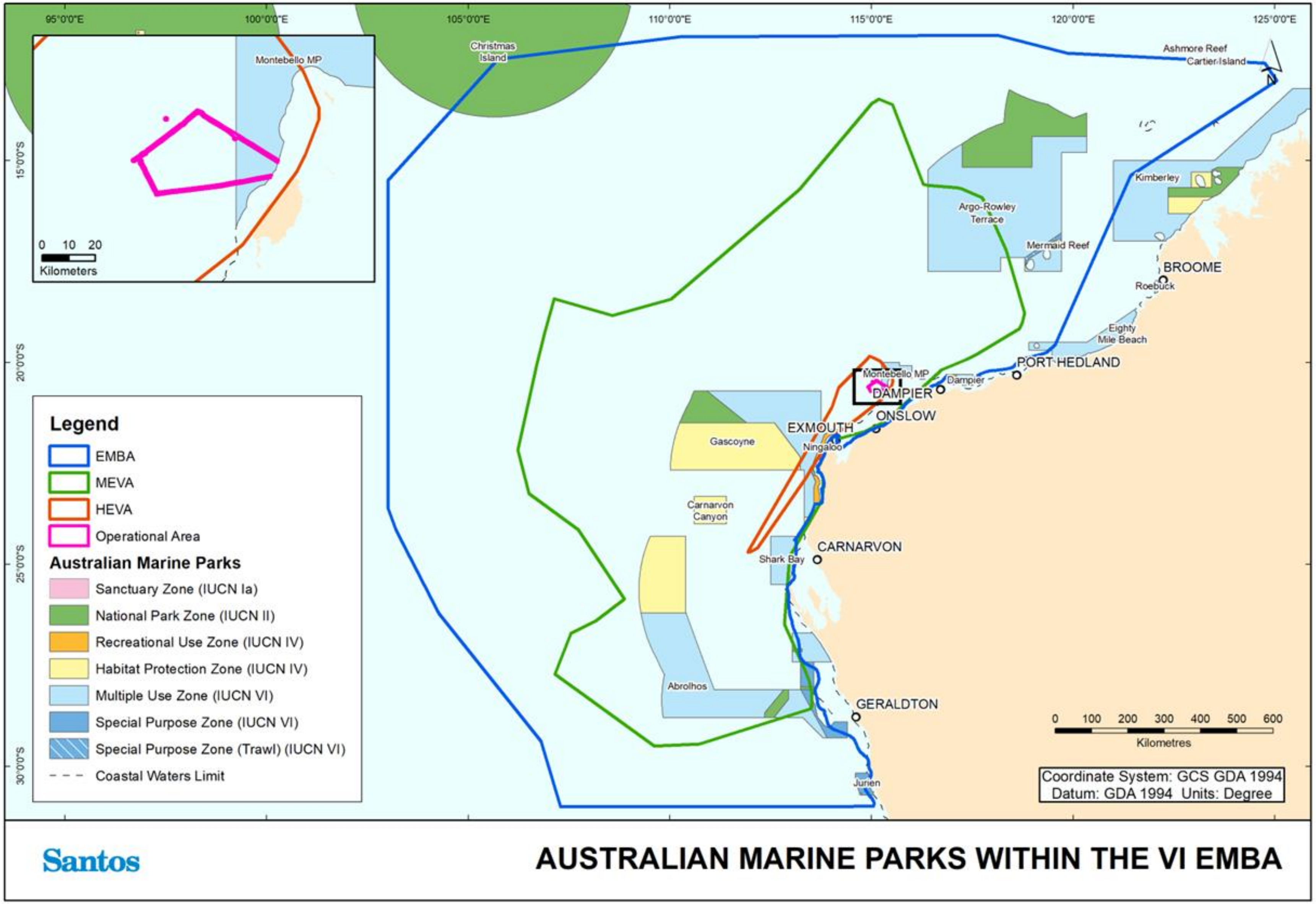

Figure 3-4: Australian Marine Parks in and near the environment that may be affected and operational area

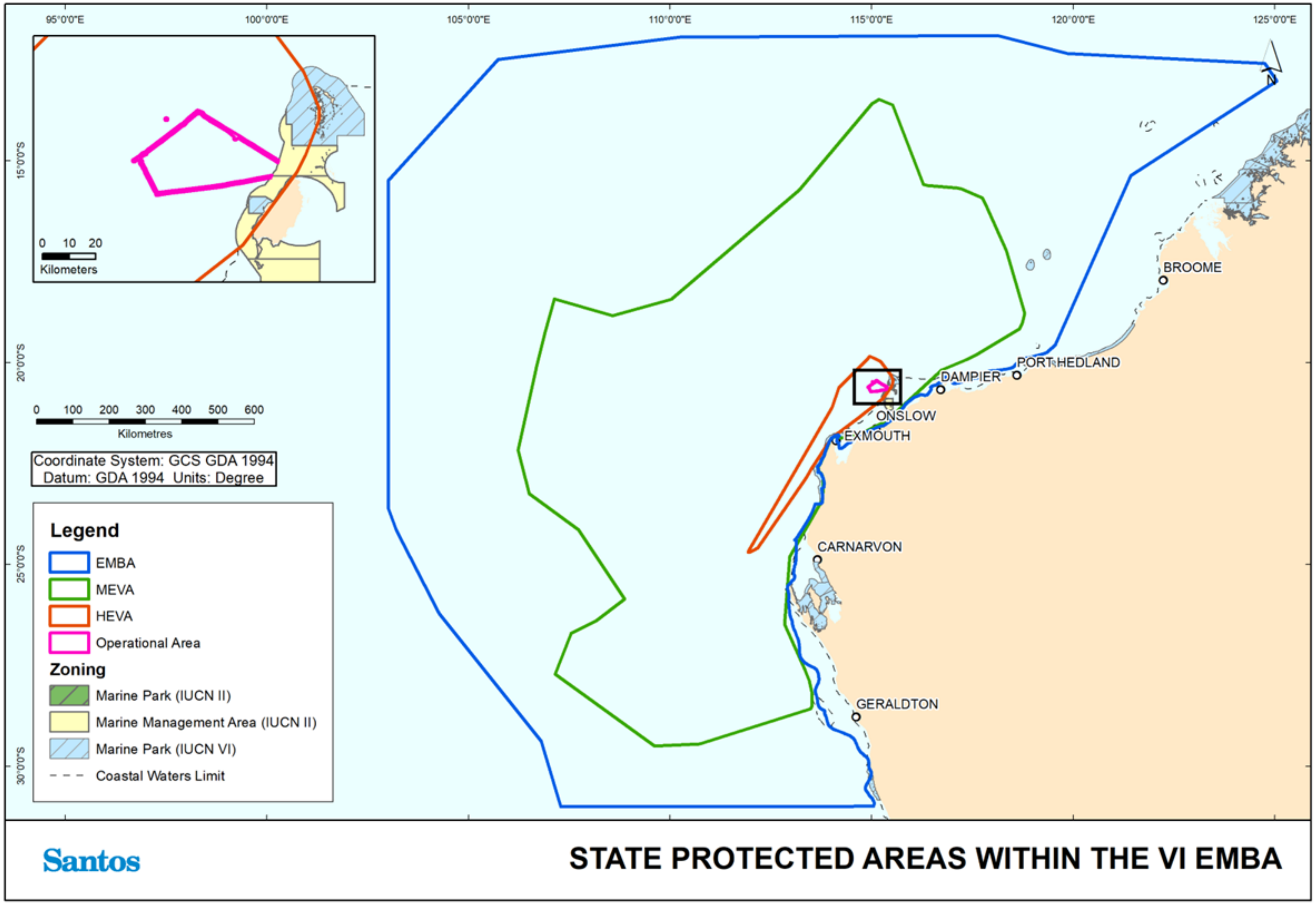

Figure 3-5: Sate protected areas in and near the environment that may be affected and operational area

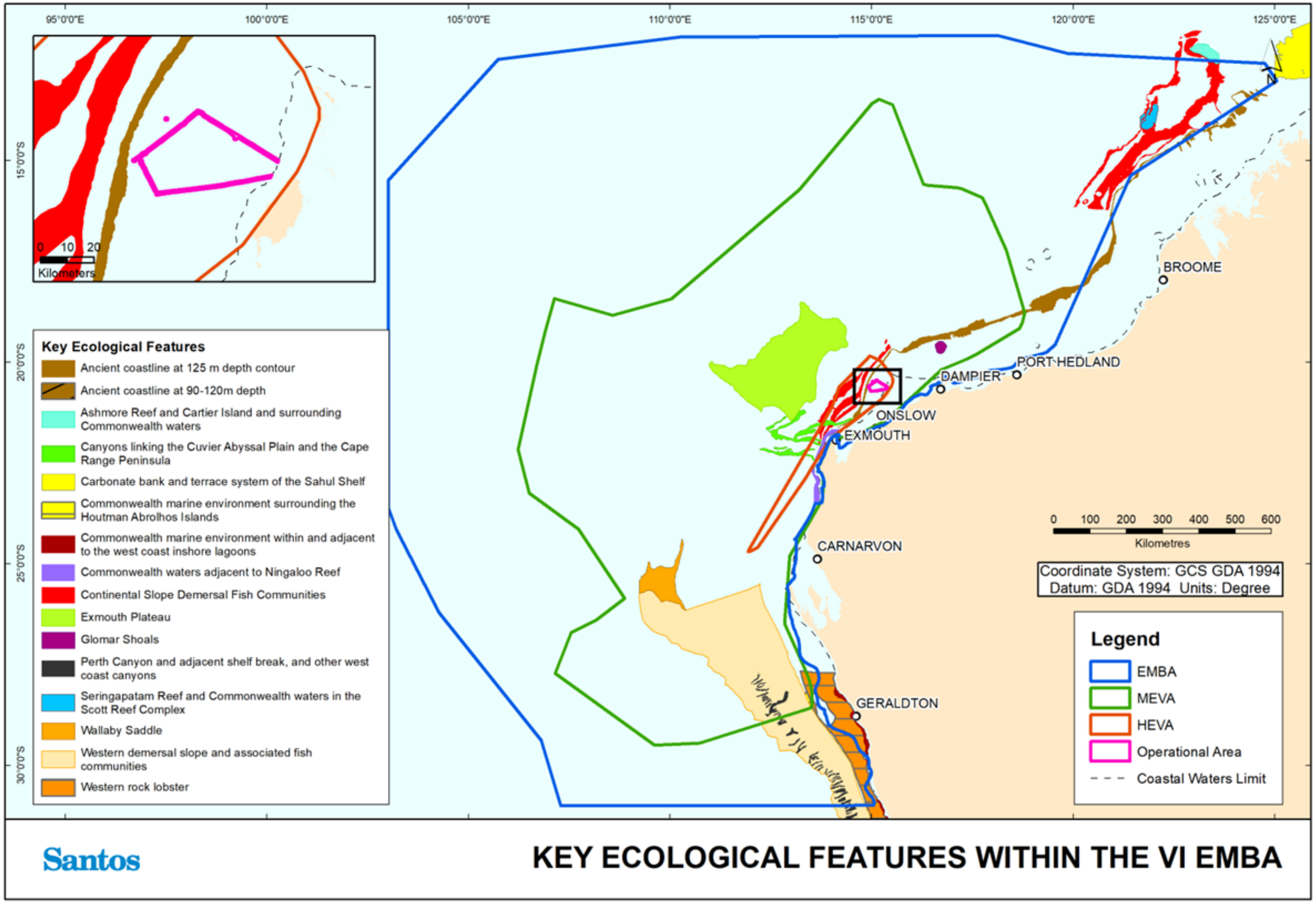

Figure 3-6: Key ecological features in and near the environment that may be affected and operational area

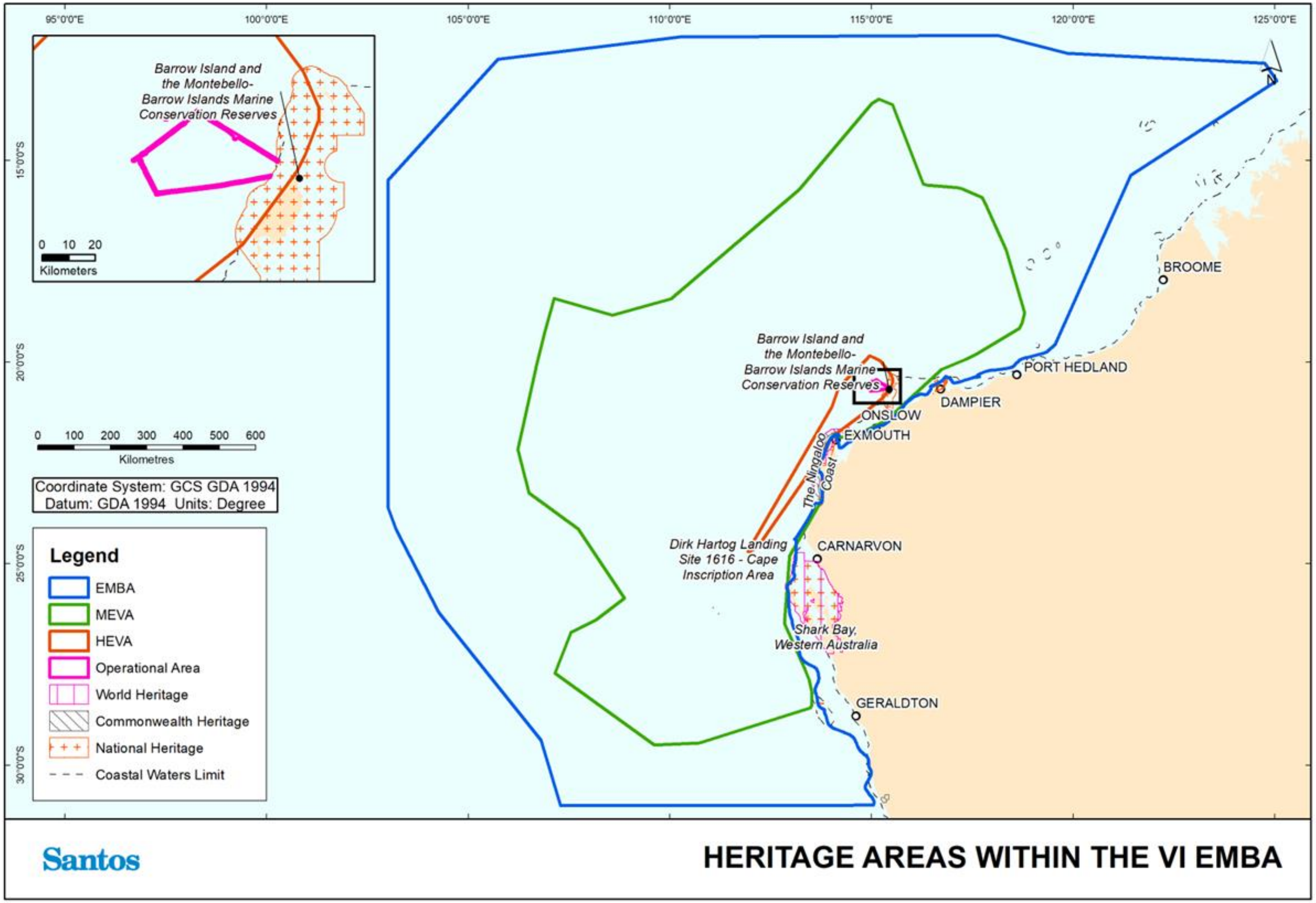

Figure 3-7: Heritage areas in and near the environment that may be affected and operational area

3.2.4 Threatened and Migratory Fauna

The PMST identified 100 listed threatened species and 90 listed migratory species under the EPBC Act 1999 as having the potential to occur in the EMBA. An examination of the species profile and threats database showed that some listed threatened species are not expected to occur in significant numbers in the marine and coastal environments due to their terrestrial distributions. These species will not come into contact with any potential oil spill and therefore are not discussed further.

Those listed as threatened species groups or vulnerable species groups and that have been identified as potentially being present in the operational area or the EMBA and the relevant planned and unplanned events that may impact them are discussed in Table 3-6. Threatened and vulnerable species within these species groups are further described in Appendix C.

Note, terrestrial species that occur in the EPBC Protected Matters searches of the EMBA have been excluded where not relevant with respect to hydrocarbon concentrations of floating oil, in-water hydrocarbons (entrained and dissolved oil) and shoreline accumulations used to define the EMBA. Species that may occur on shorelines include shorebirds, but terrestrial mammals, reptiles (such as pythons) and bird species that do not have habitats along shorelines have been excluded. It should also be noted that seabirds and shorebirds are classified as marine fauna for the purposes of impact assessment within this EP.

Biologically important areas (BIAs), such as aggregation, breeding, resting, reproduction or feeding areas or known migratory routes, for whales, dugongs, Australian sea lions, various marine turtles, sharks and bird species in the operational area and the EMBA are shown in Figure 3-8 to 3-16 and are also identified in Table 3-6 and further described in Appendix C.

The relevant BIAs that occur in the operational area, with examples of the species that use these BIAs, are:

+ reproduction (loggerhead, green, hawksbill and flatback turtles)
+ foraging (whale shark, sooty tern)
+ migration (humpback and blue whales)
+ reproduction and foraging (lesser frigatebird)
+ reproduction (wedge-tailed shearwater, Australian fairy tern, lesser crested tern, white-tailed tropicbird and roseate tern).

Nesting habitat, identified as habitat critical to the survival of green, hawksbill and flatback turtles also occurs in the operational area.

Figure 3-11 to Figure 3-14 show the BIA and habitat critical categories for each of these turtle species in the operational area and EMBA.

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Table 3-6: Environmental Values and Sensitivities – Threatened and Migratory Marine Fauna

Value/Sensitivity		EPBC Act Status	Operational Area Presence	Particular Values or Sensitivities Within Operational Area	Offshore EMBA Presence	Particular Values or Sensitivities Within the EMBA	Relevant Events
Common Name	Scientific Name	(CE = Critically Endangered E = Endangered V = Vulnerable M = Migratory CD = Conservation Dependent)					
Protected species and communities: Fish and Sharks							
Whale shark	Rhincodon typus	V, M	✓	Foraging, feeding, or related behaviour known to occur within area. Overlap with foraging BIA	✓	Foraging, feeding, or related behaviour known to occur within area. Overlap with foraging BIAs	<u>Planned</u> Light emissions Noise emissions Planned operational discharges Spill response operations <u>Unplanned</u> Hydrocarbon releases Non-hydrocarbon releases Marine fauna interaction
Grey nurse shark (west coast population)	Carcharias taurus (west coast population)	V	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	
Great white shark	Carcharodon carcharias	V, M	✓	Species or species habitat may occur within area	✓	Foraging, feeding, or related behaviour known to occur within area. Overlaps with foraging BIA (Abrolhos Islands)	
Dwarf sawfish	Pristis clavata	V, M	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	Introduction of Invasive Marine Species
Green sawfish	Pristis zijsron	V, M	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	
Narrow sawfish	Anoxypristis cuspidata	M	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area	
Shortfin mako	Isurus oxyrinchus	M	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	

Value/Sensitivity		EPBC Act Status					
Common Name	Scientific Name	(CE = Critically Endangered E = Endangered V = Vulnerable M = Migratory CD = Conservation Dependent)	Operational Area Presence	Particular Values or Sensitivities Within Operational Area	Offshore EMBA Presence	Particular Values or Sensitivities Within the EMBA	Relevant Events
Longfin mako	Isurus paucus	M	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	
Oceanic whitetip shark	Carcharhinus longimanus	M	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	
Reef manta ray	Mobula alfredi	M	✓	Species or species habitat known to occur within area	✓	Species or species habitat known to occur within area	
Giant manta ray	Mobula birostris	M	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area	
Southern bluefin tuna	Thunnus maccoyii	CD	X	Breeding known to occur within area	✓	Breeding known to occur within area	
Scalloped hammerhead shark	Sphyrna lewini	CD	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	
Blind gudgeon	Milyeringa veritas	V	X	N/A	✓	Species or species habitat known to occur within area	
Blind cave eel	Ophisternon candidum	V	X	N/A	✓	Species or species habitat known to occur within area	
Northern river shark	Glyphis garricki	E	X	N/A	✓	Species or species habitat may occur within area	
Largetooth sawfish	Pristis pristis	V	X	N/A	✓	Species or species habitat known to occur within area	
Porbeagle (mackerel shark)	Lamna nasus	M	X	N/A	✓	Species or species habitat may occur within area	

Value/Sensitivity		EPBC Act Status					
Common Name	Scientific Name	(CE = Critically Endangered E = Endangered V = Vulnerable M = Migratory CD = Conservation Dependent)	Operational Area Presence	Particular Values or Sensitivities Within Operational Area	Offshore EMBA Presence	Particular Values or Sensitivities Within the EMBA	Relevant Events
Little gulper shark	Centrophorus uyato	CD	X	N/A	✓	Species or species habitat likely to occur within area	
Salt-water Crocodile, Estuarine Crocodile	Crocodylus porosus	M	✓	N/A	✓	Species or species habitat likely to occur within area	
Protected Species and Communities: Marine Mammals							
Humpback whale	Megaptera novaeangliae	M	✓	Species or species habitat known to occur within area Overlap with BIA for migration	✓	Congregation or aggregation known to occur within area Overlap with BIA for migration and resting	Planned Light emissions Noise emissions Interaction with other marine users Planned operational discharges Spill response operations Unplanned Hydrocarbon releases Non-hydrocarbon releases Marine fauna interaction Introduction of invasive marine species
Blue whale	Balaenoptera musculus	E, M	✓	Species or species habitat likely to occur within area	✓	Migration route known to occur within area Overlap with BIA for migration, and foraging	
Sei whale	Balaenoptera borealis	V, M	✓	Species or species habitat likely to occur within area	✓	Foraging, feeding or related behaviour likely to occur within area	
Fin whale	Balaenoptera physalus	V, M	✓	Species or species habitat likely to occur within area	✓	Foraging, feeding or related behaviour likely to occur within area	
Bryde's whale	Balaenoptera edeni	M	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	

Value/Sensitivity		EPBC Act Status					
Common Name	Scientific Name	(CE = Critically Endangered E = Endangered V = Vulnerable M = Migratory CD = Conservation Dependent)	Operational Area Presence	Particular Values or Sensitivities Within Operational Area	Offshore EMBA Presence	Particular Values or Sensitivities Within the EMBA	Relevant Events
Orca, killer whale	Orcinus orca	M	✓	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	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area	
Dugong	Dugong dugon	M	✓	Species or species known to occur within area	✓	Breeding known to occur within area Overlaps with BIA for foraging and reproduction	
Sperm whale	Physeter macrocephalus	M	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Australian humpback dolphin	Sousa sahulensis	M	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area	
Australian snubfin dolphin	Orcaella heinsohni	M	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	
Southern right whale	Eubalaena australis	E	X	N/A	✓	Species or species habitat likely to occur within area Overlaps with BIAs for reproduction and migration	
Pygmy right whale	Caperea marginata	M	X	N/A	✓	Species or species habitat may occur within area	
Australian sea lion	Neophoca cinerea	V	X	N/A	✓	Breeding known to occur within area	

Value/Sensitivity		EPBC Act Status					
Common Name	**Scientific Name**	**(CE = Critically Endangered E = Endangered V = Vulnerable M = Migratory CD = Conservation Dependent)**	**Operational Area Presence**	**Particular Values or Sensitivities Within Operational Area**	**Offshore EMBA Presence**	**Particular Values or Sensitivities Within the EMBA**	**Relevant Events**
						Overlaps with BIA for foraging	
Antarctic minke whale	Balaenoptera bonaerensis	M	X	N/A	✓	Species or species habitat likely to occur within area	
Protected Species and Communities: Marine Reptiles							
Short-nosed Sea snake	Aipysurus apraefrontalis	CE	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area	<u>Planned</u> Light emissions Noise emissions Planned operational discharges Spill response operations <u>Unplanned</u> Hydrocarbon releases Non-hydrocarbon releases Marine fauna interaction Introduction of IMS
Leaf-scaled snake	Aipysurus foliosquama	CE	✓	Species or species habitat known to occur within area	✓	Species or species habitat may occur within area	
Loggerhead turtle	Caretta caretta	E, M	✓	Congregation or aggregation known to occur within area Overlaps with interesting BIA	✓	Breeding known to occur within area Overlaps with BIAs and critical habitats	
Green turtle	Chelonia mydas	V, M	✓	Congregation or aggregation known to occur within area Overlaps with BIAs and critical habitats	✓	Breeding known to occur within area Overlaps with BIAs and critical habitats	
Leatherback turtle	Dermochelys coriacea	E, M	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	
Hawksbill turtle	Eretmochelys imbricata	V, M	✓	Congregation or aggregation known to occur within area Overlaps with internesting habitat (60 km off Barrow Island)	✓	Breeding known to occur within area Overlaps with BIAs and critical habitats	

Value/Sensitivity		EPBC Act Status					
Common Name	Scientific Name	(CE = Critically Endangered E = Endangered V = Vulnerable M = Migratory CD = Conservation Dependent)	Operational Area Presence	Particular Values or Sensitivities Within Operational Area	Offshore EMBA Presence	Particular Values or Sensitivities Within the EMBA	Relevant Events
Flatback turtle	Natator depressus	V, M	✓	Congregation or aggregation known to occur within area Overlap with reproduction BIA (60 km of Montebello Islands and from Dampier Archipelago)	✓	Breeding known to occur within area Overlaps with BIAs and critical habitats (including reproduction, aggregation, and foraging)	
Olive ridley turtle	Lepidochelys olivacea	E, M	X	N/A	✓	Species or species habitat known to occur within area	
Protected Species and Communities: Marine Birds							
Roseate tern	Sterna dougallii	M	✓	Foraging, feeding or related behaviour likely to occur within area Overlaps with reproduction BIA	✓	Breeding known to occur within area	<u>Planned</u> Light emissions Noise emissions Planned operational discharges Spill response operations <u>Unplanned</u> Hydrocarbon releases Non-hydrocarbon releases Marine fauna interaction Introduction of IMS
Curlew sandpiper	Calidris ferruginea	CE, M	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	
Red knot	Calidris canutus	E, M	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	
Southern giant petrel	Macronectes giganteus	E, M	✓	Species or species habitat may to occur within area	✓	Species or species habitat may occur within area	
Eastern curlew	Numenius madagascariensis	CE, M	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	

Value/Sensitivity		EPBC Act Status					
Common Name	Scientific Name	(CE = Critically Endangered E = Endangered V = Vulnerable M = Migratory CD = Conservation Dependent)	Operational Area Presence	Particular Values or Sensitivities Within Operational Area	Offshore EMBA Presence	Particular Values or Sensitivities Within the EMBA	Relevant Events
Common noddy	Anous stolidus	M	✓	Species or species habitat may occur within area	✓	Species or species habitat likely to occur within area Overlaps foraging BIA (provisioning young)	
Streaked shearwater	Calonectris leucomelas	M	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	
Lesser frigatebird	Fregata ariel	M	✓	Species or species habitat likely to occur within area	✓	Species or species habitat known to occur within area Overlaps with reproduction, foraging BIA	
Common sandpiper	Actitis hypoleucos	M	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	
Sharp-tailed sandpiper	Calidris acuminata	M	✓	Species or species habitat may occur within area	✓	Species or species habitat known to occur within area	
Pectoral sandpiper	Calidris melanotos	M	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Australian fairy tern	Sternula nereis nereis	V	✓	Breeding known to occur within area Overlaps with reproduction BIA	✓	Breeding known to occur within area Overlaps with reproduction and foraging BIAs	
Fork-tailed swift	Apus pacificus	M	✓	Species or species habitat likely to occur within area	✓	Species or species habitat likely to occur within area	

Value/Sensitivity		EPBC Act Status					
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Lesser crested tern	Thalasseus bengalensis	M	✓	Breeding known to occur within area Overlaps with reproduction BIA	✓	Breeding known to occur within area Overlaps with reproduction BIA	
Wedge-tailed shearwater	Ardenna pacifica	M	✓	Was not identified by the Protected Matter Search Tool; however, this area overlaps with reproduction BIA	✓	Breeding known to occur within area Overlaps with reproduction and foraging BIA	
White-tailed tropicbird	Phaethon lepturus	M	✓	Species or species habitat may occur within area	✓	Species or species habitat likely to occur within area Overlaps reproduction BIA	
Christmas Island white-tailed tropic bird	Phaethon lepturus fulvus	E, M	✓	Species or species habitat may occur within area	✓	Species or species habitat may occur within area	
Osprey	Pandion haliaetus	M	✓	Species or species habitat may occur within area	✓	Breeding known to occur within area	
Red-tailed tropicbird	Phaethon rubricauda westralis	E, M	✓	N/A	✓	Breeding known to occur within area	
Great knot	Calidris tenuirostris	CE, M	X	N/A	✓	Species or species habitat known to occur within area	
Whimbrel	Numenius phaeopus	M	X	N/A	✓	Species or species habitat known to occur within area	
Wood sandpiper	Tringa glareola	M	X	N/A	✓	Species or species habitat known to occur within area	

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Sanderling	Calidris alba	M	X	N/A	✓	Species or species habitat known to occur within area	
Ruddy turnstone	Arenaria interpres	M	X	N/A	✓	Species or species habitat known to occur within area	
Grey-tailed tattler	Tringa brevipes	M	X	N/A	✓	Species or species habitat known to occur within area	
Terek sandpiper	Xenus cinereus	M	X	N/A	✓	Species or species habitat known to occur within area	
Red-necked stint	Calidris ruficollis	M	X	N/A	✓	Species or species habitat known to occur within area	
Grey plover	Pluvialis squatarola	M	X	N/A	✓	Species or species habitat known to occur within area	
Red goshawk	Erythrotriorchis radiatus	E	X	N/A	✓	Species or species habitat may occur within area	
Black-tailed godwit	Limosa limosa	M	X	N/A	✓	Species or species habitat known to occur within area	
Bar-tailed godwit	Limosa lapponica	M	X	N/A	✓	Species or species habitat may occur within area	
Northern Siberian bar-tailed godwit	Limosa lapponica menzbierii	CE	X	N/A	✓	Species or species habitat may occur within area	

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Asian dowitcher	Limnodromus semipalmatus	M	X	N/A	✓	Species or species habitat may occur within area	
Greater frigatebird	Fregata minor	M	X	N/A	✓	Species or species habitat may occur within area	
Caspian tern	Hydroprogne caspia	M	X	N/A	✓	Breeding known to occur within area	
Little tern	Sternula albifrons	M	X	N/A	✓	Congregation or aggregation known to occur within area	
Bridled tern	Onychoprion anaethetus	M	X	N/A	✓	Breeding known to occur within area Overlaps foraging BIA	
Oriental plover	Charadrius veredus	M	X	N/A	✓	Species or species habitat may occur within area	
Greater sand plover	Charadrius leschenaultii	V, M	X	N/A	✓	Species or species habitat may occur within area	
Oriental pratincole	Glareola maldivarum	M	X	N/A	✓	Species or species habitat may occur within area	
Greater crested tern	Thalasseus bergii	M	X	N/A	✓	Breeding known occur within area	
Caspian tern	Sterna caspia	M	X	N/A	✓	Breeding known occur within area Overlaps foraging BIA	

Value/Sensitivity		EPBC Act Status					
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Common greenshank	Tringa nebularia	M	X	N/A	✓	Species or species habitat likely to occur within area	
White-winged fairy-wren (Barrow Island)	Malurus leucopterus edouardi	V	X	N/A	✓	Species or species habitat likely to occur within area	
White-winged fairy-wren (Dirk Hartog Island)	Malurus leucopterus leucopterus	V	X	N/A	✓	Species or species habitat likely to occur within area	
Night parrot	Pezoporus occidentalis	E	X	N/A	✓	Species or species habitat may occur within area	
Soft-plumaged petrel	Pterodroma mollis	V	X	N/A	✓	Foraging, feeding or related behaviour known to occur within area Overlaps with foraging BIA	
Campbell albatross	Thalassarache impavida	V, M	X	N/A	✓	Species or species habitat may occur within area	
Flesh-footed shearwater	Ardenna carneipes	M	X	N/A	✓	Foraging, feeding or related behaviour likely to occur within area	
Australian lesser noddy	Anous tenuirostris melanops	V	X	N/A	✓	Foraging, feeding or related behaviour known to occur within area Overlaps with foraging BIA	

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Amsterdam albatross	Diomedea amsterdamensis	E, M	X	N/A	✓	Species or species habitat likely to occur within area	
Southern royal albatross	Diomedea epomophora	V, M	X	N/A	✓	Species or species habitat likely to occur within area	
Wandering albatross	Diomedea exulans	V, M	X	N/A	✓	Species or species habitat likely to occur within area	
Northern giant petrel	Macronectes halli	V, M	X	N/A	✓	Species or species habitat may occur within area	
Abbott’s booby	Papasula abbotti	E	X	N/A	✓	Species or species habitat may occur within area	
Masked booby	Sula dactylatra	M	X	N/A	✓	Breeding known to occur within area	
Red-footed booby	Sula sula	M	X	N/A	✓	Breeding known to occur within area	
Brown booby	Sula leucogaster	M	X	N/A	ü	Breeding known to occur within area	
Black-browed albatross	Thalassarche melanophris	V, M	X	N/A	ü	Species or species habitat may occur within area	
White-capped albatross	Thalassarche steadi	V, M	X	N/A	ü	Foraging, feeding or related behaviour likely to occur within area	
Sooty albatross	Phoebetria fusca	V, M	X	N/A	ü	Species or species habitat may occur within area	

Value/Sensitivity		EPBC Act Status					
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Blue petrel	Halobaena caerulea	V	X	N/A	ü	Species or species habitat may occur within area	
Australian painted snipe	Rostratula australis	E	X	N/A	ü	Species or species habitat may occur within area	
Shy albatross	Thalassarche cauta	E, M	X	N/A	✓	Species or species habitat may occur within area	
Indian yellow-nosed albatross	Thalassarche carteri	V, M	X	N/A	✓	Foraging, feeding or related behaviour may occur within area	
Christmas Island frigatebird	Fregata andrewsi	E, M	X	N/A	✓	Foraging, feeding or related behaviour may occur within area	
Fairy prion (southern)	Pachyptila turtur subantarctica	V	X	N/A	✓	Species or species habitat may occur within area	
Southern Whiteface	Aphelocephala leucopsis	V	X	N/A	✓	Species or species habitat may occur within area	
Red-rumped Swallow	Cecropis daurica	M	X	N/A	✓	Species or species habitat may occur within area	
Grey falcon	Falco hypoleucos	V	X	N/A	ü	Species or species habitat known to occur within area	
Barn swallow	Hirundo rustica	M	X	N/A	ü	Species or species habitat known to occur within area	

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Grey wagtail	Motacilla cinerea	M	X	N/A	ü	Species or species habitat may occur within area	
Yellow wagtail	Motacilla flava	M	X	N/A	ü	Species or species habitat may occur within area	
Painted button-quail (Houtman Abrolhos)	Turnix varius scintillans	E	X	N/A	ü	Species or species habitat likely to occur within area	

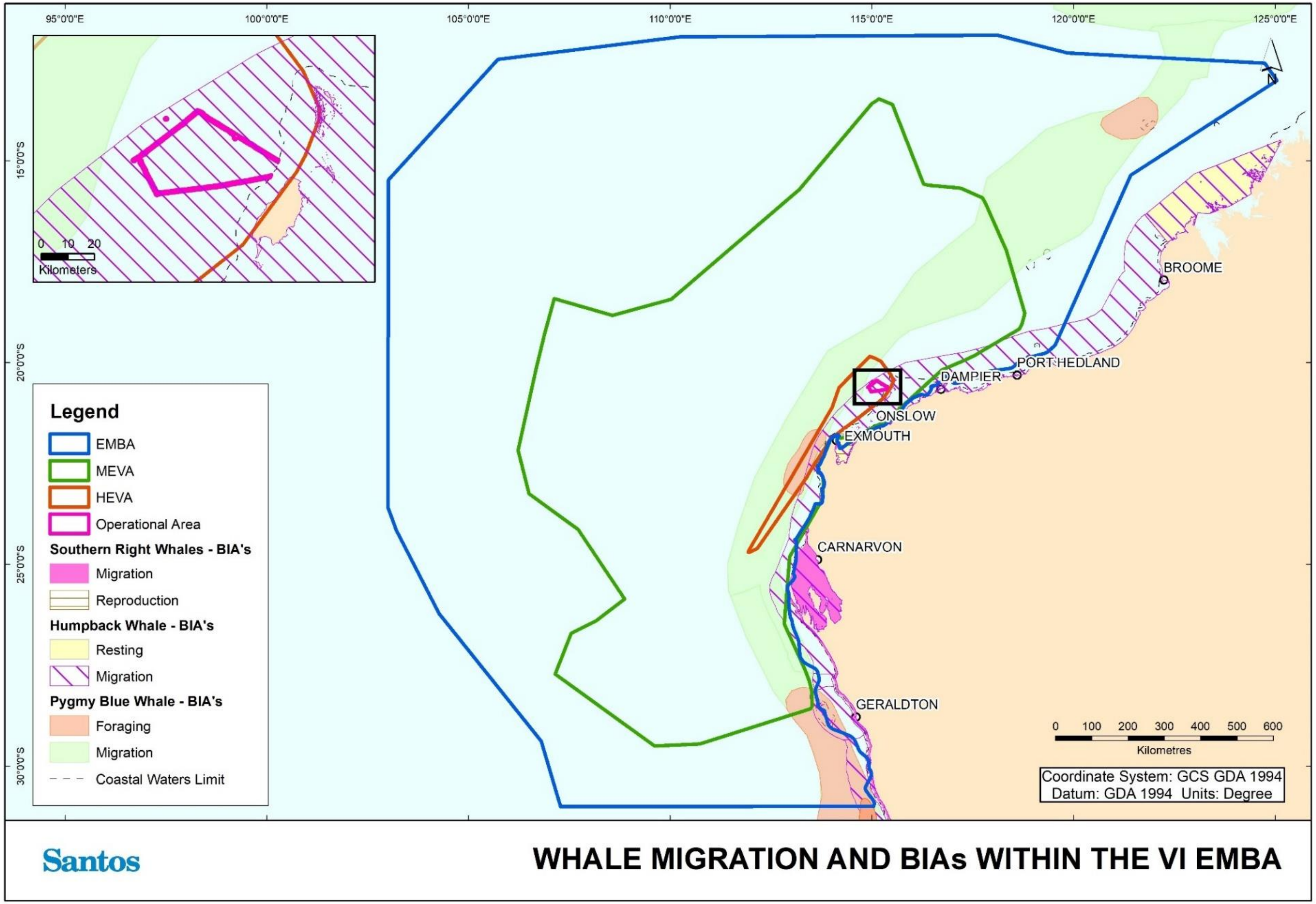

Figure 3-8: Biologically important areas for environment protection and biodiversity conservation protected whale species in the vicinity of the environment that may be affected and operational area

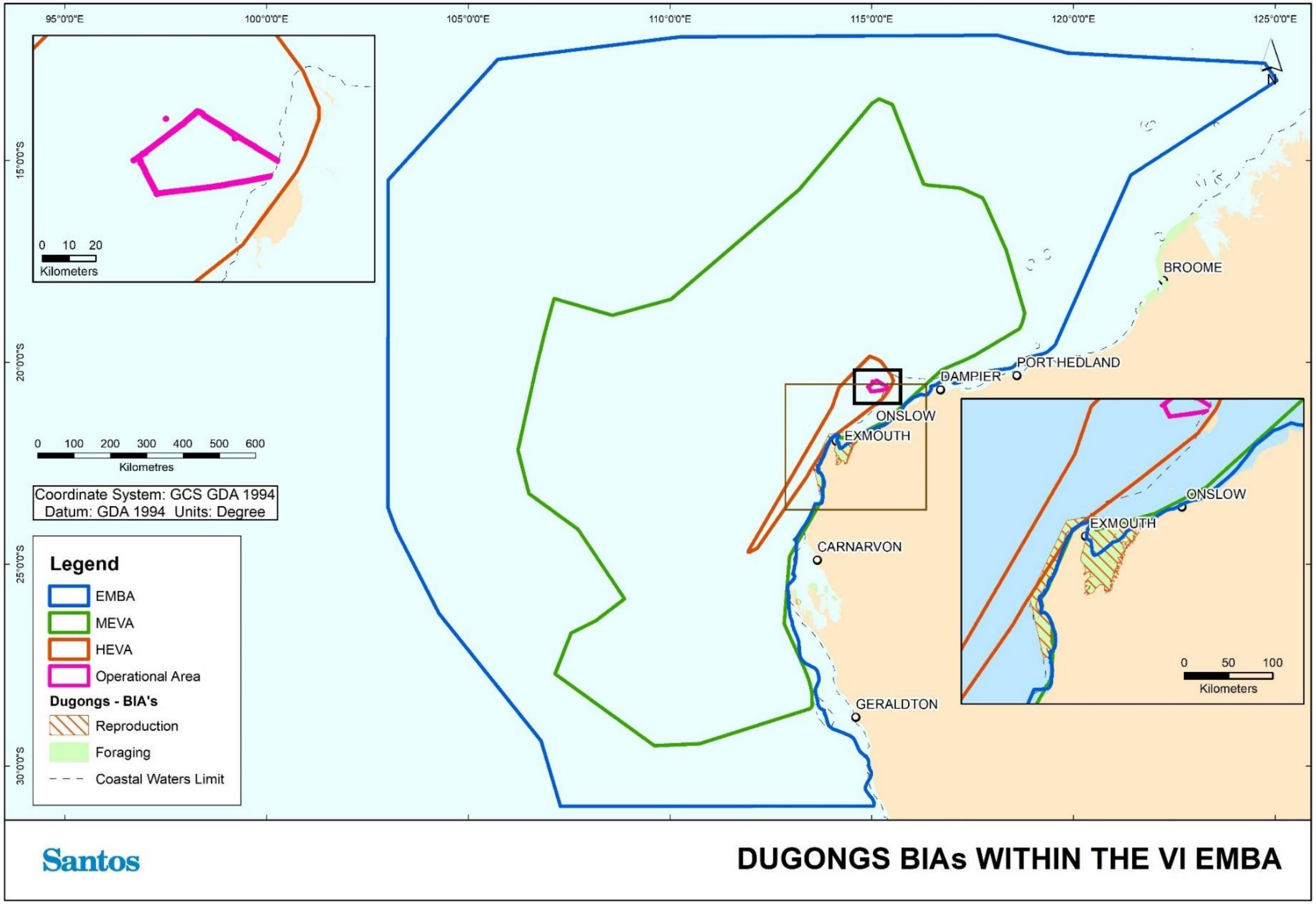

Figure 3-9: Biologically important areas for dugongs in the vicinity of the environment that may be affected and operational area

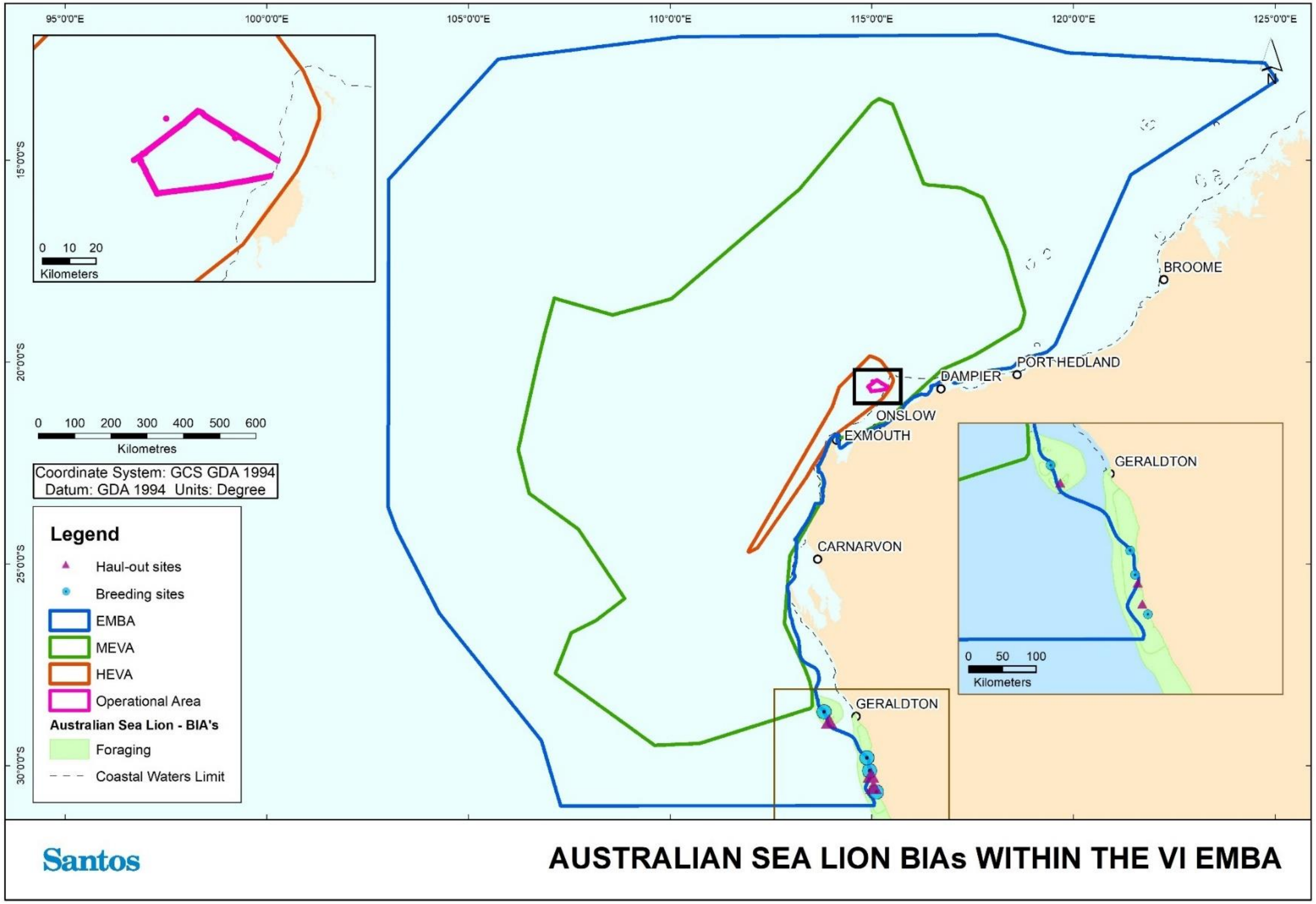

Figure 3-10: Biologically important areas for the Australian sea lion in the vicinity of the environment that may be affected and operational area

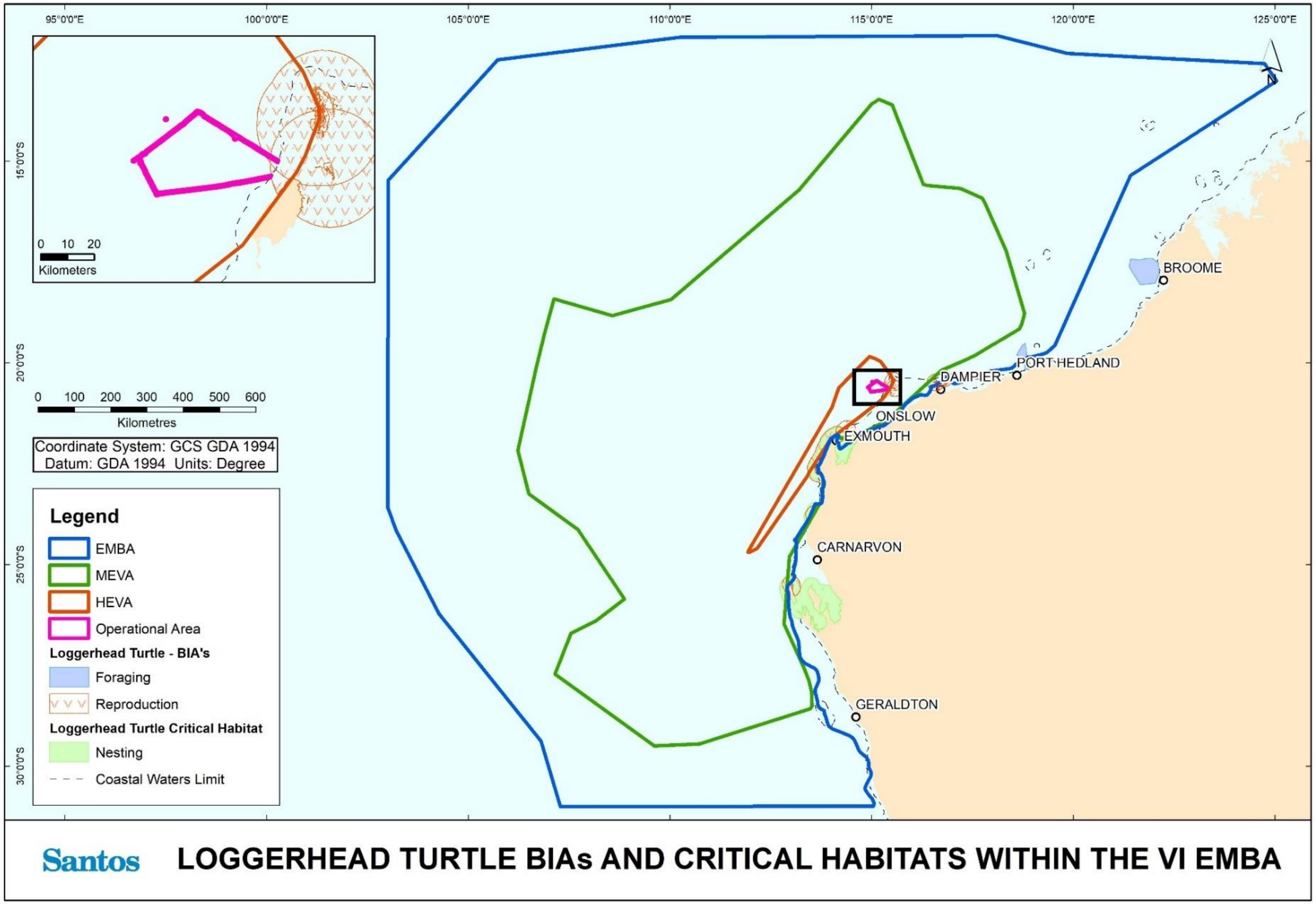

Figure 3-11: Biologically important areas and habitat critical for the loggerhead turtle in the vicinity of the environment that may be affected and operational area

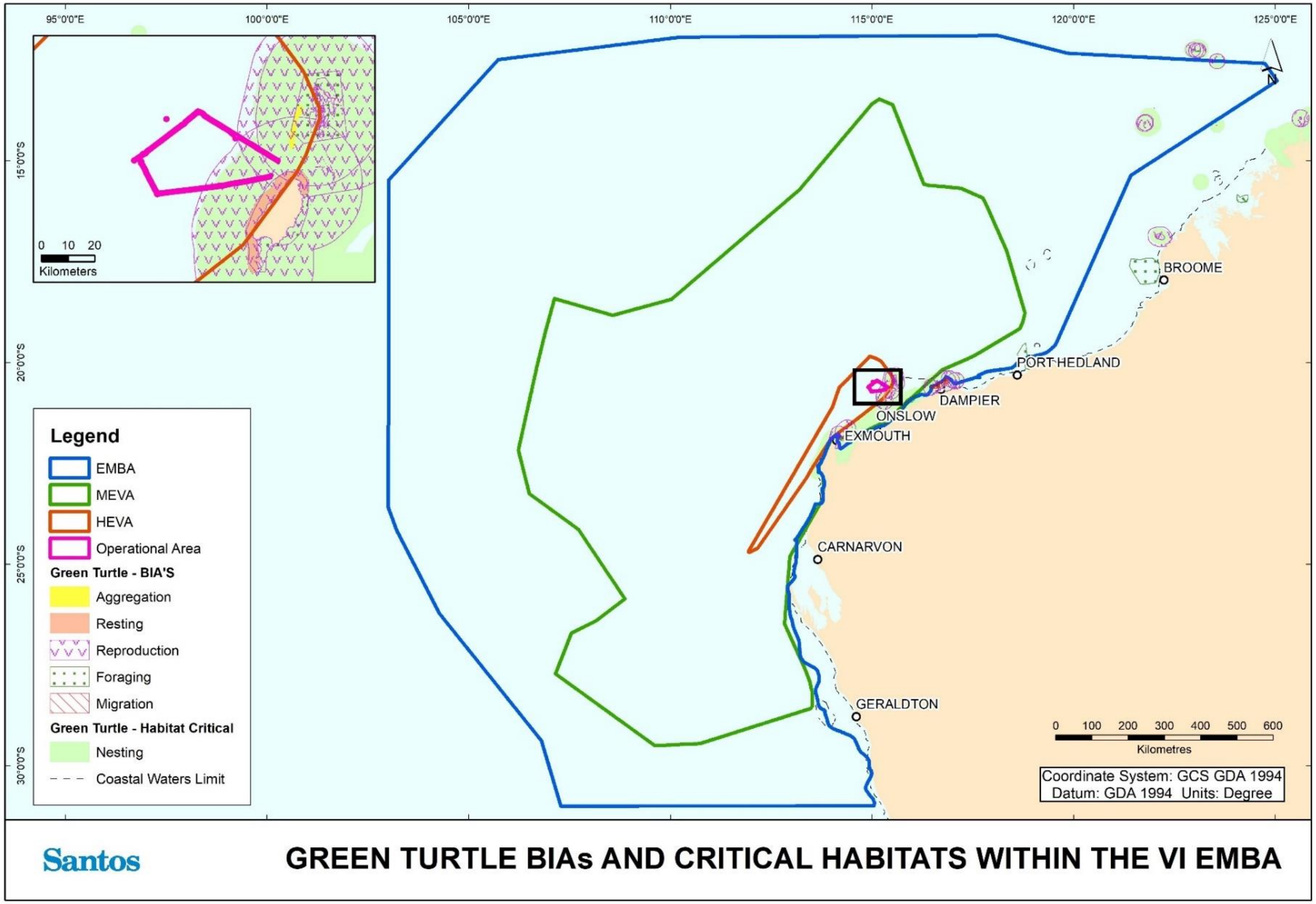

Figure 3-12: Biologically important areas and habitat critical for the green turtle in the vicinity of the environment that may be affected and operational area

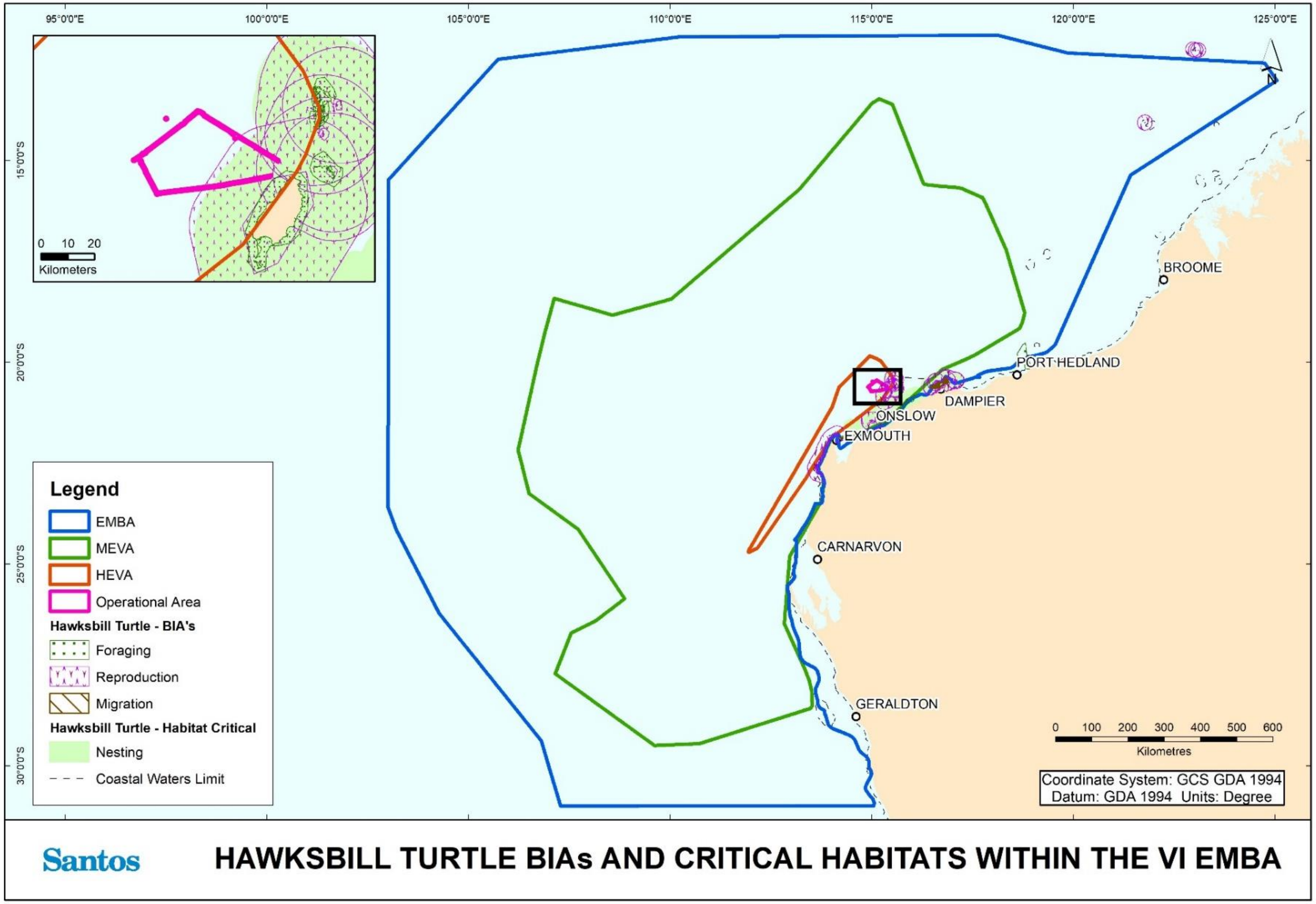

Figure 3-13: Biologically important areas and habitat critical for the hawksbill turtle in the vicinity of the environment that may be affected and operational area

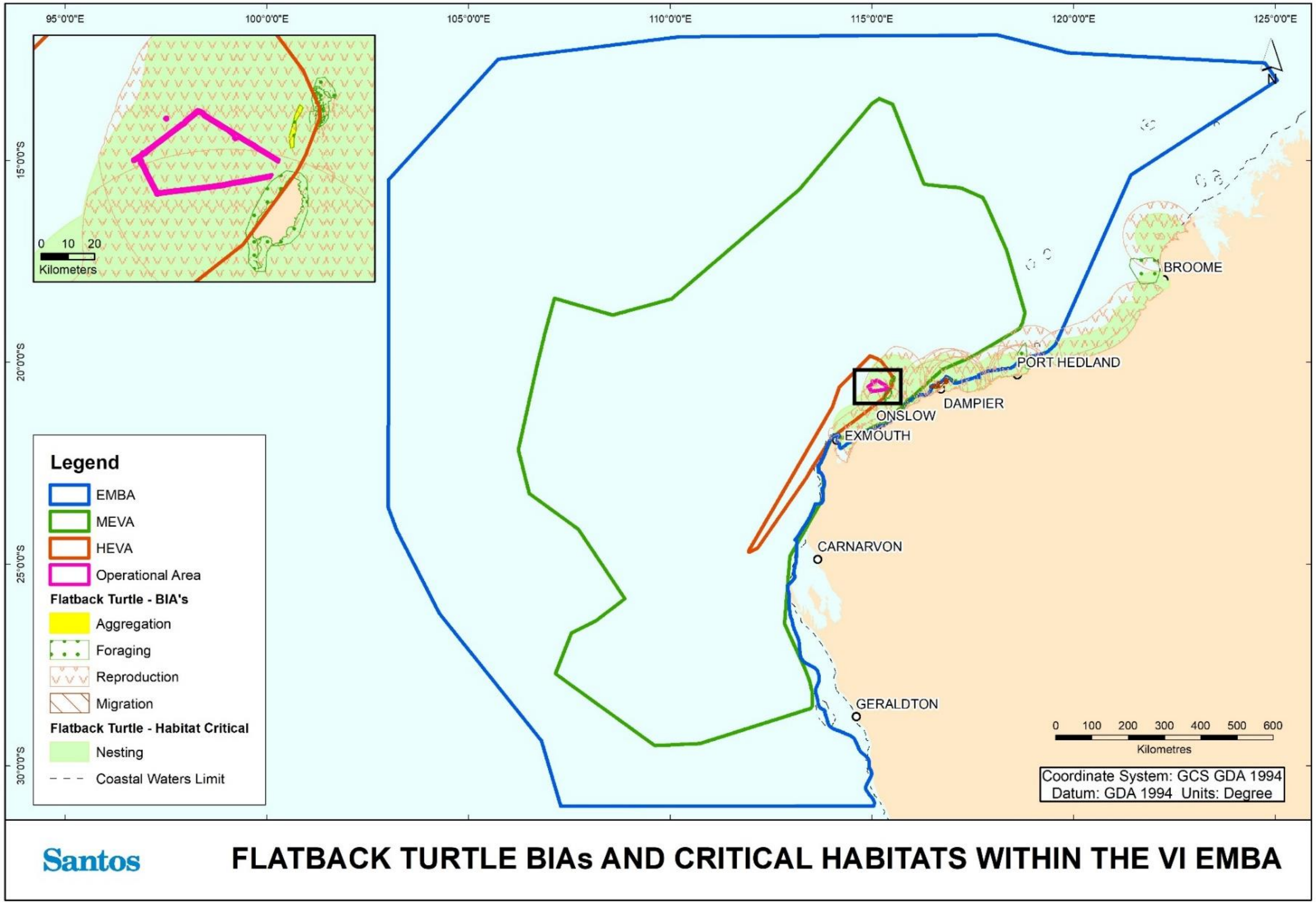

Figure 3-14: Biologically important areas and habitat critical for the flatback turtle in the vicinity of the environment that may be affected and operational area

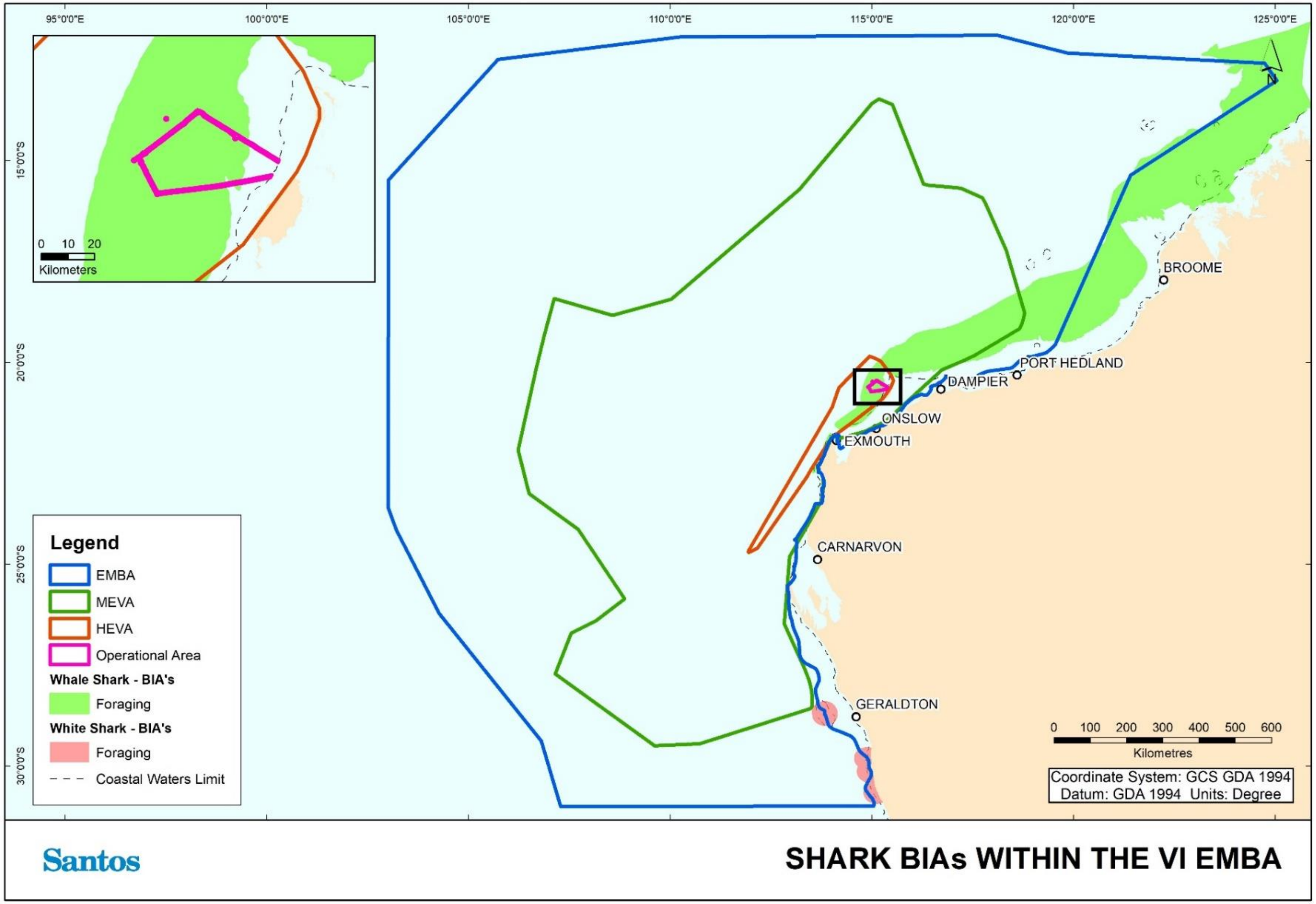

Figure 3-15: Biologically important areas for environment protection and biodiversity conservation protected sharks in the vicinity of the environment that may be affected and operational area

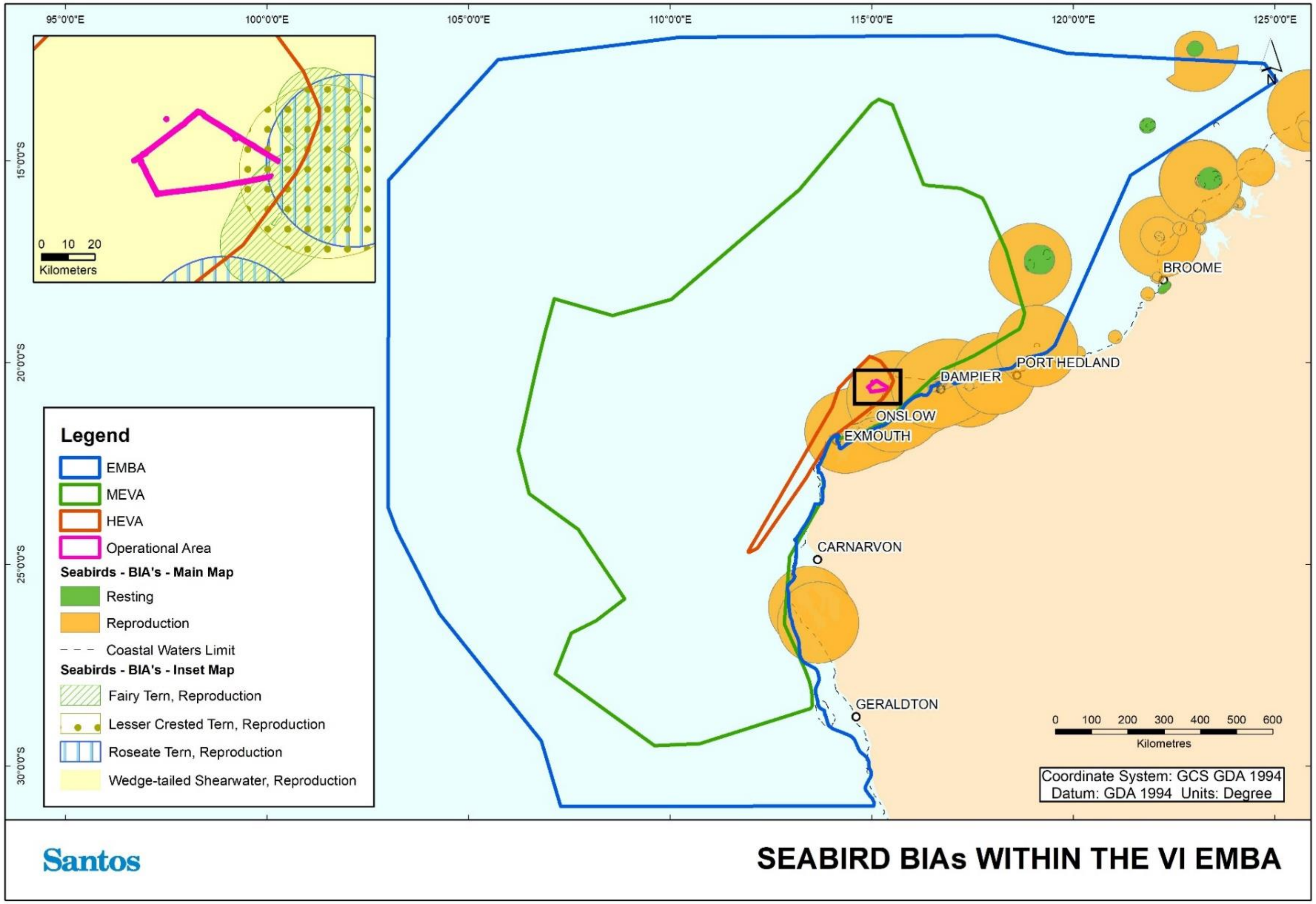

Figure 3-16: Biologically important areas for environment protection and biodiversity conservation protected bird species in the vicinity of the environment that may be affected and operational area

3.2.4.1 Recovery Plans

Relevant conservation advices, recovery plans and management plans for marine fauna are provided in Table 3-7 along with cross-references to the relevant EP section for the assessment of impacts. Species that occur in the EMBA only may be affected by marine pollution (from unplanned hydrocarbon release); species that occur in the operational area have the potential to be impacted by other planned events (e.g., noise emissions) and unplanned events (e.g., vessel strike).

Table 3-7: Threats and strategies from recovery plans, conservation advice and management plans relevant to the activity

Name	Recovery Plan, Conservation Advice or Management Plan	Threats/Strategies Identified as Relevant to the activity	Addressed Where Relevant for Receptor Groups in EP Section
Fish and Sharks			
Dwarf sawfish	Sawfish and River Sharks Multispecies Recovery Plan (DoE, 2015a)	Habitat degradation due to increasing human development	6.5**, 7.6 to 7.9**
	Approved Conservation Advice on *Pristis clavata* (Dwarf Sawfish) (2009)		
Green sawfish	Commonwealth Conservation Advice on *Pristis zijsron* (green sawfish) (DoEE, 2008a)	Habitat degradation and modification	6.5, 7.6 to 7.9
	Sawfish and River Sharks Multispecies Recovery Plan (DoE, 2015a)		
Great white shark	Recovery Plan for the White Shark (*Carcharodon carcharias*) (DSEWPaC, 2013a)	Ecosystem effects as a result of habitat modification and climate change	6.5, 7.6 to 7.9
Grey nurse shark	Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (DoE, 2014)	Pollution and disease	7.6 to 7.9
		Ecosystem effects as a result of climate modification and climate change	6.3,6.4
Whale shark	Approved Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015a)	Boat strike from large vessels	7.2
		Habitat disruption from mineral exploration, production and transportation	7.6 to 7.9
		Marine debris	7.3
		Climate change	6.3,6.4
Northern river shark	Approved Conservation Advice for *Glyphis garricki* (northern river shark) (2014)	Habitat degradation and modification	6.5, 7.6 to 7.9
		Marine debris (potential)	7.3
Large tooth sawfish	Approved Conservation Advice for *Pristis pristis* (largetooth sawfish)	Habitat degradation and modification	6.5, 7.6 to 7.9
		Marine debris (potential)	7.3
	Sawfish and River Sharks Multispecies Recovery Plan (2015a)	Habitat degradation and modification	6.5, 7.6 to 7.9
Blind gudgeon	Approved Conservation Advice for *Milyeringa veritas* (blind gudgeon) (DoEE, 2008b)	Habitat degradation and modification (as relevant to unplanned discharges, given the habitat of this species)	7.6 to 7.9
Blind cave eel	Approved Conservation Advice for *Ophisternon candidum* (blind cave eel) (DoEE, 2008c)	Habitat degradation and modification (as relevant to unplanned discharges, given the habitat of this species)	7.6 to 7.9
Marine Mammals			
Blue whale		Noise interference	6.1

Name	Recovery Plan, Conservation Advice or Management Plan	Threats/Strategies Identified as Relevant to the activity	Addressed Where Relevant for Receptor Groups in EP Section
	Blue Whale Conservation Management Plan 2015 - 2025 (DoE, 2015c)	Habitat degradation	6.5, 7.6 to 7.9
		Vessel disturbance	7.2
		Climate variability and change	6.3,6.4
Southern right whale	National Recovery Plan for the Southern Right Whale *Eubalaena australis* (DCCEEW, 2024)	Vessel strike	7.2
		Habitat modification	6.5, 7.6 to 7.9
		Anthropogenic underwater noise	6.1
		Pollution – acute chemical discharge	6.7, 7.4, 7.6 and 7.9
		Climate change and climate variability	6.3, 6.4
Fin whale	Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015b)	Anthropogenic noise and acoustic disturbance	6.1
		Habitat degradation including coastal development, port expansion and aquaculture	6.5, 7.6 to 7.9
		Pollution (persistent toxic pollutants)	7.6 to 7.9
		Vessel strike	7.2
		Climate and oceanographic variability and change	6.3,6.4
Sei whale	Approved Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015c)	Anthropogenic noise and acoustic disturbance	6.1
		Habitat degradation including pollution (increasing port expansion and coastal development)	6.5, 7.6 to 7.9
		Pollution (persistent toxic pollutants)	7.6 to 7.9
		Vessel strike	7.2
		Climate and oceanographic variability and change	6.3,6.4
Australian sea lion	Recovery Plan for the Australian Sea Lion (*Neophoca cinerea*) (DSEWPaC, 2013b)	Noise	6.1
		Entanglement in marine debris (primary threat)	7.3 to 7.9
		Human disturbance	7.2
		Direct killing (deliberate)	7.2
		Habitat degradation	7.3 to 7.9
		Pollution and oil spills	7.3 to 7.9
		Climate change	6.3,6.4
Marine Reptiles			
Loggerhead turtle (WA genetic stock)	Recovery Plan for Marine Turtles in Australia 2017–2027 (DoEE, 2017)	Marine debris – entanglement and ingestion (moderate, unknown)	7.3
		Vessel disturbance (moderate)	7.2
		Habitat modification – infrastructure/coastal development (moderate)	7.3 to 7.9
		Chemical and terrestrial discharge – acute (high), chronic (low)	6.7, 7.4 to 7.9

Name	Recovery Plan, Conservation Advice or Management Plan	Threats/Strategies Identified as Relevant to the activity	Addressed Where Relevant for Receptor Groups in EP Section
		Noise interference – acute (moderate), chronic (moderate, unknown)	6.1
		Diseases and pathogens (low; unknown)	7.1
		Light pollution (moderate)	6.2
		Climate change and variability	6.3,6.4
Green turtle (NWS genetic stock [NWS], Scott-Browse genetic stock [ScBr], Ashmore genetic stock [AR])	Recovery Plan for Marine Turtles in Australia 2017–2027 (DoEE, 2017)	Chemical and terrestrial discharge – acute (NWS, AR, ScBr – high), chronic (NWS – moderate, AR – high, ScBr – high).	6.7, 7.4 to 7.9
		Habitat modification – infrastructure/coastal development (NWS – moderate, AR – low, ScBr – high)	7.3 to 7.9
		Marine debris – entanglement (NWS – moderate, AR – very high, ScBr – moderate; unknown) and ingestion (NWS – low; unknown, AR – moderate, ScBr – moderate).	7.3
		Vessel disturbance (moderate)	7.2
		Noise interference – acute (NWS – moderate; unknown, AR – low, ScBr – moderate), chronic (NWS – moderate; unknown, AR – low, ScBr – moderate; unknown)	6.1
		Diseases and pathogens (low; unknown for AR and ScBr)	7.1
		Light pollution (NWS – high, AR – moderate, ScBr – moderate)	6.2
		Climate change and variability	6.3,6.4
Leatherback turtle	Approved Conservation Advice on *Dermochelys coriacea* (DoE, 2008) Recovery Plan for Marine Turtles in Australia 2017–2027 (2017)	Boat strike	7.2
		Changes to breeding sites	7.6 to 7.9
		Ingestion of marine debris	7.3
		Chemical and terrestrial discharge – acute (low), chronic (low; unknown)	7.6 to 7.9
		Marine debris – entanglement (moderate) and ingestion (high)	7.3
		Habitat modification – infrastructure/coastal development (moderate)	7.6 to 7.9
		Vessel disturbance (moderate)	7.2
		Noise interference – acute (low; unknown), chronic (low; unknown)	6.1
		Light pollution (low)	6.2
		Climate change and variability	6.3,6.4
Hawksbill turtle	Recovery Plan for Marine Turtles in Australia 2017–2027 (DoEE, 2017)	Chemical and terrestrial discharge – acute (moderate), chronic (moderate)	6.7, 7.4 to 7.9

Name	Recovery Plan, Conservation Advice or Management Plan	Threats/Strategies Identified as Relevant to the activity	Addressed Where Relevant for Receptor Groups in EP Section
(WA genetic stock)		Marine debris – entanglement (moderate) and ingestion (low; unknown)	7.3
		Habitat modification – infrastructure/coastal development (moderate)	6.5, 7.6 to 7.9
		Vessel disturbance (moderate)	7.2
		Noise interference – acute (moderate), chronic (moderate; unknown)	6.1
		Light pollution (high)	6.2
		Climate change and variability	6.3,6.4
Olive ridley turtle (NT genetic stock)	Recovery Plan for Marine Turtles in Australia 2017–2027 (DoEE, 2017)	Chemical and terrestrial discharge – acute (high), chronic (moderate)	6.7, 7.4 to 7.9
		Marine debris – entanglement (very high) and ingestion (moderate; unknown)	7.3
		Habitat modification – infrastructure / coastal development (low)	6.5, 7.6 to 7.9
		Vessel disturbance (moderate)	7.2
		Light pollution (moderate)	6.2
		Climate change and variability	6.3,6.4
Flatback turtle (Pilbara coast genetic stock (Pil) and South-west Kimberley coast genetic stock (swKim))	Recovery Plan for Marine Turtles in Australia 2017–2027 (DoEE, 2017)	Chemical and terrestrial discharge – acute (high), chronic (moderate)	6.7, 7.4 to 7.9
		Marine debris – entanglement (moderate) and ingestion (low)	7.3
		Habitat modification – infrastructure / coastal development (Pil – high, swKim – moderate)	6.5, 7.6 to 7.9
		Vessel disturbance (moderate)	7.2
		Light pollution (Pil – high, swKim – moderate)	6.2
		Climate change and variability	6.3,6.4
Short-nosed seasnake	Approved Conservation Advice on *Aipysurus apraefrontalis* (Short-nosed Seasnake) (DSEWPaC, 2011a)	Degradation of reef habitat, primarily as a result of coral bleaching (primary threat)	7.6 to 7.9
		Oil and gas exploration	6.1, 6.2, 6.5, 7.6 to 7.9
Leaf-scaled seasnake	Approved Conservation Advice for *Aipysurus foliosquama* (Leaf-scaled Seasnake) (DSEWPaC, 2011b)	Degradation of reef habitat, primarily as a result of coral bleaching (primary threat)	7.6 to 7.9
		Oil and gas exploration	6.1, 6.2, 6.7, 7.6 to 7.9
Birds			
All migratory shorebirds	Wildlife Conservation Plan for Migratory Shorebirds (DoE, 2015d)	Ensure all areas of important habitat for birds are considered in the development assessment process	6.1, 6.6, 6.7, 7.6 and 7.9
		Manage the effects of anthropogenic disturbance to bird breeding and roosting areas	6.1, 6.2, 6.7, 7.6 to 7.9

Name	Recovery Plan, Conservation Advice or Management Plan	Threats/Strategies Identified as Relevant to the activity	Addressed Where Relevant for Receptor Groups in EP Section
		Climate variability and change	6.3, 6.4
All seabirds	Wildlife Conservation Plan for Seabirds (Commonwealth of Australia, 2020)	Habitat modification	6.1, 6.6, 6.7, 7.6 and 7.9
		Marine debris	
		Marine debris	
		Climate variability and change	6.3, 6.4
All petrels and albatrosses	National Recovery Plan for Albatrosses and Petrels 2022 (DSEWPaC, 2011c)	Marine pollution	6.7, 7.6 and 7.9
		Climate change	6.3, 6.4
Curlew sandpiper	Approved Conservation Advice for *Calidris ferruginea* (Curlew Sandpiper) (DoEE, 2015)	Habitat loss and degradation from pollution	6.1, 6.6 7.6 and 7.9
Eastern curlew	Approved Conservation Advice for *Numenius madagascariensis* (Eastern Curlew) (DoEE, 2015)	Habitat loss and degradation from pollution	6.1, 6.6 7.6 and 7.9
Australian fairy tern	Approved Conservation Advice for *Sternula nereis* (Fairy Tern) (DSEWPaC, 2011d)	Oil spills, particularly in Victoria (potential threat)	7.6 and 7.9
Red knot	Conservation Advice Calidris canutus (Red Knot) (TSSC, 2016a)	Habitat loss and habitat degradation	6.1, 6.6 7.6 and 7.9
		Climate change	
		Pollution/contamination impacts	
		Direct mortality (bird strike)	7.2
Great knot	Conservation Advice *Calidris tenuirostris* Great Knot (Threatened Species Scientific Committee, 2016b)	Habitat loss and degradation	6.1, 6.6, 7.6 and 7.9
		Climate change	
		Oil pollution	
Red goshawk	National Recovery Plan for the Red Goshawk *Erythrotriorchis radiatus* (Department of Environment and Resource Management, 2012)	Habitat loss and degradation	6.1, 6.6, 7.6 and 7.9
		Climate change	
		Oil pollution	
Bar-tailed godwit	Conservation Advice for *Limosa lapponica baueri* (Bar-tailed godwit (western Alaskan)) (TSSC, 2016b)	Habitat loss and habitat degradation	7.6 and 7.9 6.1, 6.6 6.3, 6.4
		Climate change and variability	
		Pollution/contamination impacts	
Northern Siberian bar-tailed godwit	Conservation Advice *Limosa lapponica menzbieri* (Bar-tailed godwit (northern Siberian)) (TSSC, 2016c)	Habitat loss and habitat degradation	6.1, 6.6 7.6 and 7.9
		Pollution/contamination impacts	
		Climate change and variability	6.3, 6.4
White-winged fairy-wren (Barrow Island)	Approved Conservation Advice for *Malurus leucopterus edouardi* (White-winged Fairy-wren (Barrow Island)) (DEWHA, 2008a)	Degradation of habitat by fire and development	6.1, 6.6, 7.6 and 7.9
Christmas Island white-tailed tropicbird	Conservation Advice *Phaethon lepturus fulvus* white-tailed tropicbird (Christmas Island) (Threatened Species Scientific Committee, 2014)	Habitat disturbance	6.1, 6.6, 7.6 and 7.9
White-winged fairy-wren (Dirk Hartog Island)	Approved Conservation Advice for *Malurus leucopterus* (White-winged Fairy-wren (Dirk Hartog Island)) (DEWHA, 2008b)	N/A – all threats are related to terrestrial environment	N/A

Name	Recovery Plan, Conservation Advice or Management Plan	Threats/Strategies Identified as Relevant to the activity	Addressed Where Relevant for Receptor Groups in EP Section
Australian lesser noddy	Approved Conservation Advice for *Anous tenuirostris melanops* (Australian lesser noddy) (TSSC, 2015e)		
Soft-plumaged petrel	Approved Conservation Advice for *Pterodroma mollis* (soft-plumaged petrel) (2015f)		
Christmas Island frigatebird	Approved Conservation Advice for *Fregata andrewsi* (Christmas Island frigatebird) (TSSC, 2016e)		
Australian painted snipe	Approved Conservation Advice for *Rostratula australis* (Australian painted snipe) (DSEWPaC, 2013)		
Abbott's booby	Approved Conservation Advice for *Papasula abbotti* (Abbott's booby) (TSSC, 2015g)		
Night parrot	Approved Conservation Advice for *Pezoporus occidentalis* (night parrot) (TSSC, 2016f)		

3.2.5 Birds

In addition to the details provided Section 3.2.4, this section provides further information regarding the bird species may interact directly with the WHP.

- Table 3-8 lists the bird types known to interact with the WHP. This is derived from visual sightings and previous assessments.
- Table 3-9 lists the bird types that have the potential to interact with the WHP.
- No nesting or breeding has been observed at John Brookes WHP.

3.2.5.1 Birds known to interact with the WHP

Based on visual sightings and previous assessments, several bird types are known to interact with the WHP, as listed in Table 3-8.

Table 3-8: Birds known to interact with the WHP

Common Names	EPBC Act Listing Status	Approved Conservation Advice	Recovery Plan	Marine Bioregional Plans	Population Estimates (CoA 2020)	Life History and Distribution, Breeding season and habits
Brown Booby	Marine; Migratory	Nil	Nil	Marine bioregional plan for the North-west Marine Region Marine bioregional plan for the North Marine Region	The global population is estimated to number > 200,000 individuals.	Wildlife Conservation Plan for Seabirds: The Brown Booby (Sula leucogaster) is a medium sized, sleek looking dark-coloured booby with sharply demarcated brown and white underparts. The Brown Booby can be found throughout the pantropical oceans with few exceptions. Breeding sites include the Caribbean, the Atlantic coasts of Brazil and Africa, oceanic islands off Madagascar, the Red Sea, northern Australia, many oceanic islands in the western and central Pacific, as well as off the coast of Mexico and Peru. Breeding is seasonal in some areas, but elsewhere it breeds opportunistically or more or less continuously. Nests are built on the ground in the midst of vegetation on rocky islands or coral atolls. Individuals form colonies that are usually smaller than those of other Sula species (del Hoyo et al. 1992). This species is strictly marine, generally feeding on inshore waters. Its diet is comprised mainly of flying-fish and squid, but also some halfbeak, mullet and anchovy. Prey is usually caught by plunge-diving and it can also snatch prey off the surface of water. Kleptoparasitism has been observed, mostly by females. Marine bioregional plan for the North-west Marine Region: Breeding recorded from February to October (but mainly in autumn). Population may disperse in non-breeding season (northwards dispersal recorded for east Australian birds).
Masked Booby	Marine; Migratory	Nil	Nil	Marine bioregional plan for the Temperate East Marine Region	The global population size has not been quantified, but this species is described as 'fairly common'.	Wildlife Conservation Plan for Seabirds: The Masked Booby (Sula dactylatra) is the largest booby. It displays typical sulid characteristics of a streamlined body, long narrow wings, long neck, pointed bill and tail. Masked Boobies tend to be more solitary that Australasian Gannets (Morus serrator) sometimes in loose congregations, particularly when returning to breeding islands. This species ranges widely in tropical waters, being found in every ocean except the eastern Atlantic Ocean, northern Indian Ocean and the central-eastern Pacific Ocean (del Hoyo et al. 1992). Its breeding season depends on locality, forming small to medium-sized colonies

Common Names	EPBC Act Listing Status	Approved Conservation Advice	Recovery Plan	Marine Bioregional Plans	Population Estimates (CoA 2020)	Life History and Distribution, Breeding season and habits
						of variable densities on rocky islands offshore. Nests are preferably built on cliff ledges, but a variety of other sites are used (del Hoyo et al. 1992). In Australia, breeding is largely confined to islands and cays in the Great Barrier Reef and Coral Sea Marine Park with other colonies occurring on Lord Howe and Norfolk Islands. Masked Boobies banded at Lord Howe Island have been found on two occasions on North East Herald Cay (Coral Sea Marine Park) suggesting that Lord Howe Island birds may regularly disperse into the Coral Sea before returning to breed at their natal colonies (Baker et al. 2008). Small colonies also occur on the islands of Ashmore Reef Marine Park, Lacepede, Bedout and Adele Islands, Western Australia. There is some conjecture on the subspecies of Masked Booby breeding within Ashmore Reef Marine Park. At sea, the species can normally be found over pelagic waters, preferring deeper waters than other boobies. It feeds on large species of shoaling fish, especially flying fish, but will also take large squid.
Greater Crested Tern	Marine; Migratory	Nil	Nil	Marine bioregional plan for the Temperate East Marine Region Marine bioregional plan for the North Marine Region	The global population is estimated to number 150,000–1,100,000 individuals.	Wildlife Conservation Plan for Seabirds: The Crested Tern (Thalasseus bergii) is a large slender tern with long narrow strongly angled wings, long deeply forked tail and a long decurved bill and long legs. At all ages the combination of large size, shaggy crest and yellow bill make the species diagnostic. The species can be found on islands and coastlines of tropical and subtropical areas, ranging from the Atlantic Coast of South Africa, south around the Cape and continuing along the coast of Africa and Asia almost without break to south-east Asia and Australia. It can also be found on Madagascar, islands of the western Indian Ocean and islands of the western and central Pacific Ocean. Outside the breeding season it can be found at sea throughout this range, with the exception of the central Indian Ocean (del Hoyo et al. 1996). Many populations remain sedentary in their breeding areas or disperse locally (del Hoyo et al. 1996), although some are more migratory (Urban et al. 1986). The species breeds in large dense colonies, or in small groups of fewer than 10 pairs amidst colonies of other species (e.g. Silver Gull Chroicocephalus novaehollandiae) (del Hoyo et al. 1996). The nest is a shallow scrape in bare sand, rock or coral (del Hoyo et al. 1996) in flat open sites (Urban et al. 1986) on offshore islands (Urban et al. 1986, del Hoyo et al. 1996), low-lying coral reefs, sandy or rocky coastal islets, coastal spits, lagoon mudflats (del Hoyo et al. 1996) or islets in saltpans and sewage works (Urban et al. 1986, del Hoyo et al. 1996).
Bridled Tern	Marine; Migratory	Nil	Nil	Marine bioregional plan for the North Marine Region Marine bioregional plan for the	The global population is estimated to number between 610,000–1,500,000 individuals.	Wildlife Conservation Plan for Seabirds: The Bridled Tern (Onychoprion anaethetus) is a medium-sized tropical tern, with a stout bill about the same length as head, long slender wings and a long deeply forked tail. The species is slightly smaller and slimmer than Sooty Tern (O. fuscata). The Bridled Tern breeds off the Pacific and Atlantic coast of Central America including the Caribbean, off small areas of western Africa, around Arabia and eastern Africa down to South Africa, off the coast of India, and in much of south-east Asia and Australasia excluding southern Australia and New Zealand (del Hoyo et al. 1996). It breeds on the periphery of vegetated

Common Names	EPBC Act Listing Status	Approved Conservation Advice	Recovery Plan	Marine Bioregional Plans	Population Estimates (CoA 2020)	Life History and Distribution, Breeding season and habits
				South-west Marine Region		coastal and continental (Haney et al. 1999) coral, rock or rubble islands and beaches (Higgins and Davies 1996, del Hoyo et al. 1996, Haney et al. 1999), volcanic stacks and exposed reefs (Haney et al. 1999). The nest is a scrape or depression in shingle or sand (Higgins and Davies 1996) that may be freshly excavated or re-used from a previous season (Higgins and Davies 1996). Nests are placed in a variety of concealed locations (Higgins and Davies 1996, del Hoyo et al. 1996). The species is not strictly colonial but solitary pairs usually congregate in suitable habitats (Haney et al. 1999) with neighbouring nests spaced according to nest-site availability (usually 1-5 m apart, minimum 30 cm) (del Hoyo et al. 1996). Most populations are migratory and dispersive and abandon their breeding sites at the end of the breeding season to overwinter at sea (Haney et al. 1999). Migratory movements have been documented from Houtman Abrolhos to the Celebes Sea, 3,800 km north (Surman et al. 2018) and some populations in the Indian Ocean seem entirely sedentary or only partially migratory (Haney et al. 1999). The timing of breeding varies geographically, most populations breeding annually in suitable habitat (Haney et al. 1999). Marine bioregional plan for the North Marine Region: On some islands, or in some years, breeding is concentrated in a short season, but on other islands breeding has been recorded in most months. Breeding occurs during March–June (low numbers) and September–December with a peak in November. Dispersal/migration during non-breeding period.
Common Noddy / Brown Noddy	Marine; Migratory	Nil	Nil	Marine bioregional plan for the South-west Marine Region Marine bioregional plan for the Temperate East Marine Region Marine bioregional plan for the North Marine Region (2012)	The global population is estimated to number between 180,000–1,100,000 individuals	Wildlife Conservation Plan for Seabirds: The Common Noddy (Anous stolidus), also known as Brown Noddy, is the largest noddy, bigger and bulkier than Black Noddy (A. minutus) and Lesser Noddy (A. tenuirostris). The Common Noddy is a slender dark-brown seabird, with long rather stout bill, about the same length as head and appearing decurved over whole length. The Common Noddy is a tropical seabird with a worldwide distribution, ranging from the Pacific Ocean, including colonies off the Pacific coast of north-west South and Central America, the Indian Ocean including south-east Asia and in the Atlantic Ocean including a colony off the coast of Cameroon. Some colonies are also present in the sub-tropics with individuals from these colonies wintering in the tropics (del Hoyo et al. 1996). The species occurs around isolated, bare or vegetated, inshore or oceanic islands or coral reefs with rocky cliffs or offshore stacks (del Hoyo et al. 1996) and coral or sand beaches (Higgins and Davies 1996). It forages in the inshore waters surrounding such islands, often along the line of breakers or in lagoons (Higgins and Davies 1996), and disperses up to 180 km out into the oceanic zone to forage (Surman and Wooller 2003) and up to 950 km when not breeding (Surman et al. 2018). Out at sea it often rests on buoys, flotsam, ships and on the open water (del Hoyo et al. 1996). Although its migratory movements are poorly known and the species is present all year round at most tropical colonies, it is seasonally absent from subtropical colonies and is known to disperse to the open ocean after breeding (del Hoyo et al. 1996). The timing of breeding varies throughout the species range (del Hoyo et al. 1996). It may breed colonially in groups numbering up to 100,000 or more pairs (Higgins and Davies 1996) although it also nests almost solitarily depending on the availability of

Common Names	EPBC Act Listing Status	Approved Conservation Advice	Recovery Plan	Marine Bioregional Plans	Population Estimates (CoA 2020)	Life History and Distribution, Breeding season and habits
						nesting sites (del Hoyo et al. 1996). Even when not breeding the species remains gregarious and can occur in huge flocks in some areas, although it is more usually observed in smaller flocks of 50-100 individuals (Higgins and Davies 1996). The nest may be a simple layer of debris or a more elaborate construction of seaweed and sticks (del Hoyo et al. 1996), and may be placed in a number of sites including flat shingle beaches, bare ground, cliff ledges, offshore stacks, low bushes and tall trees (del Hoyo et al. 1996). It nests in colonies that can be very dense or more open depending on the availability of nesting sites (del Hoyo et al. 1996). Its diet consists predominantly of small fish as well as squid, pelagic molluscs, medusae and insects (del Hoyo et al. 1996; Higgins and Davies 1996; Surman and Wooller 2003).
Lesser Crested Tern	Marine	Nil	Nil	Marine bioregional plan for the North-west Marine Region Marine bioregional plan for the North Marine Region	The global population estimate is estimated to number 225,000 pairs, more than half occur in Australia.	Wildlife Conservation Plan for Seabirds: The Lesser Crested Tern (Thalasseus bengalensis) is a large tern very similar in shape and proportions to Crested Tern (T. bergii). Lesser Crested Terns have a diagnostic long bright-orange bill. The species breeds in subtropical coastal parts of the world mainly from the Red Sea across the Indian Ocean to the western Pacific, and Australia, with a significant population on the southern coast of the Mediterranean, on two islands off the coast of Libya. Outside the breeding season it ranges on the north African coast (both Mediterranean and Atlantic), on much of the Indian Ocean nearby continents, and in the western Pacific north of Australia up to New Guinea and Vietnam. Details of this species movements are poorly known. The species inhabits tropical and subtropical (del Hoyo et al. 1996) sandy and coral coasts and estuaries (Urban et al. 1986), breeding on lowlying offshore islands, foraging in the surf and over offshore waters (del Hoyo et al. 1996). Then est is a shallow scrape (del Hoyo et al. 1996) on ridges or bare areas surrounded by vegetation (del Hoyo et al. 1996) on flat sandy beaches (Snow and Perrins 1998), low-lying sandy islands, coral flats, small coral islets and sandbanks (del Hoyo et al. 1996). Its diet consists predominantly of small pelagic fish (Urban et al. 1986, del Hoyo et al. 1996) and shrimps (del Hoyo et al. 1996).
Australasian Gannet	Marine	Nil	Nil	Nil	A global population estimate has not been quantified. The population is suspected to be increasing following a reduction in human persecution and the establishment of new colonies	Wildlife Conservation Plan for Seabirds: The Australasian Gannet (Morus serrator) is a large, conspicuous, predominantly white seabird. Generally, Australasian Gannets are unmistakeable from other seabirds except other sulids with a long neck, slender wings, spear-like bill and pointed tail. The species is confined to waters around Australia and New Zealand, mainly in the temperate zone. Breeding colonies are found off the coast of Victoria, Tasmania and New Zealand. One small colony is also found farther north at Norfolk Island. Breeding is highly seasonal (October to May), nesting on the ground in small but dense colonies. Adults tend to stay within the vicinity of the colony after breeding, with young birds dispersing (del Hoyo et al. 1992). Birds winter in adjacent waters and up the east and west coasts of Australia as far north as the Tropic of Capricorn (del Hoyo et al. 1992). Their diet is comprised mainly of pelagic fish, especially pilchard, anchovies and jack mackerel, but also squid and garfish. Prey is caught mainly by plunge-diving, but the species is also seen regularly attending trawlers.

Common Names	EPBC Act Listing Status	Approved Conservation Advice	Recovery Plan	Marine Bioregional Plans	Population Estimates (CoA 2020)	Life History and Distribution, Breeding season and habits
					in Victoria and Tasmania in recent years.	
Silver Gull	Marine	Nil	Nil	Nil	The species is thought to be abundant across its range.	Wildlife Conservation Plan for Seabirds: The Silver Gull (Chroicocephalus novaehollandiae) is a familiar small gull of Australian coasts and inland areas. Adults are readily identified by the bright red bill and legs and distinctive pattern of the underwing. This species can be found at both coastal and inland locations in a variety of habitats including artificial habitats such as rubbish dumps. It has a very varied, opportunistic diet including fish, marine and terrestrial invertebrates, seeds, insects and bird eggs. Kleptoparasitism has been observed. It breeds on small islands and points, mainly offshore, but also on freshwater and brackish lakes, and on causeways in salt-pans. The breeding season covers all months, with the exact timing varying depending on locality and age. It is colonial and occasionally solitary, with smaller colonies in the tropics (3-25 pairs) up to 10,000 pairs in southern Australia (del Hoyo et al. 1996; Carlile et al. 2017). Colony size depends on food availability. Individuals may wander widely outside the breeding season (del Hoyo et al. 1996).
Notes: The Wildlife Conservation Plan for Seabirds (2020) is relevant to all birds in this table. Threat abatement plans relating to terrestrial activities are not relevant to the WHP activities and therefore not included.						

3.2.5.2 EPBC listed Threatened and/or Migratory species in the Regional Area

- The Santos Offshore - Impact Assessment of Bird Deterrent Systems at Offshore Wellhead Platforms on Seabirds (Santos 2020) evaluated the various EPBC listed Threatened and/or Migratory species that are present in the regional area. The impact assessment was reviewed by a subject matter expert for seabird ecology and considered to appropriate and inclusive of the species and potential impact pathways relevant to the bird deterrent activity. The impact assessment ranked the otential likelihood of the birds interacting with the WHP in Table 3-9. The common noddy and bridled tern were ranked as having the 'potential' to interact with the WHP.
- Caspian tern and roseate tern were ranked as having an 'unlikely' potential to interact with the WHP.
- Other birds were ranked as having a 'very unlikely' potential to interact with the WHP.

Table 3-9: EPBC listed Threatened and/or Migratory species in the Regional Area

Common Names	EPBC Act Listing Status	Approved Conservation Advice	Recovery Plan	Wildlife Conservation Plans	Marine Bioregional Plans	Breeding and habitat use in the regional area	Potential WHP Interaction	Comments
Red Knot	Vulnerable; marine; migratory	Conservation Advice for Calidris canutus (red knot) (DCCEEW 2024).	Nil	Wildlife Conservation Plan for Migratory Shorebirds	Nil	Species or species habitat known to occur within area – the red knot has a global distribution and an extremely large range. It breeds in the northern hemisphere and undertakes migrations to spend the boreal winter in Australasia. The species generally	Very Unlikely	These species are typically migrating birds and while there is no previous record of these

Common Names	EPBC Act Listing Status	Approved Conservation Advice	Recovery Plan	Wildlife Conservation Plans	Marine Bioregional Plans	Breeding and habitat use in the regional area	Potential WHP Interaction	Comments
						inhabits intertidal mudflats, sandflats and sandy beaches during the non-breeding season.		species utilising It is assumed that due to the physical presence of the structure there is potential for one or more of the species to use the platforms as a resting location only.
Curlew Sandpiper	Critically endangered; marine; migratory	Conservation Advice for Calidris ferruginea (curlew sandpiper) (DCCEEW 2023)	Nil	Wildlife Conservation Plan for Migratory Shorebirds	Marine bioregional plan for the North-west Marine Region	Species or species habitat known to occur within area – The species breeding range is restricted to the Russian Arctic. In the non-breeding period, the species occurs throughout Australia around the coast and is also found inland. The general habitat includes intertidal mudflats in sheltered coastal areas such as estuaries, bays, inlets and lagoons.	Very Unlikely	
Bar-tailed Godwit	Marine; migratory	Nil	Nil	Wildlife Conservation Plan for Migratory Shorebirds	Marine bioregional plan for the North-west Marine Region	Species or species habitat may occur within area – The bar tailed godwit has an extremely large global range. Breeding does not take place in Australia. During the non-breeding season, the species is found in coastal areas of all Australian states. The species is known to occur mainly in coastal habitats, such as large intertidal sandflats, banks, mudflats, estuaries and coastal lagoons.	Very Unlikely	
Northern Siberian Bar-tailed Godwit	Endangered	Conservation Advice for Limosa lapponica menzbieri (Yakutian bar-tailed Godwit) 2024	Nil	Nil	Nil	Species or species habitat may occur within area – has an extremely large global range. Breeding does not take place in Australia. During the non-breeding season, the species is found in coastal areas of all Australian states. The species is known to occur mainly in coastal habitats, such as large intertidal sandflats, banks, mudflats, estuaries and coastal lagoons.	Very Unlikely	
Southern Giant Petrel	Endangered; marine; migratory	Nil	National Recovery Plan for albatrosses and petrels (DCCEEW 2022)		Marine bioregional plan for the Temperate East Marine Region	Species or species habitat may occur within area – Southern giant petrels are highly migratory species with a large natural range. They occur in Antarctic to subtropical waters and breed on six subantarctic and Antarctic islands. It is not expected they will use the area for breeding or resting.	Very Unlikely	
Eastern Curlew	Critically endangered;	Conservation Advice for Numenius madagascariensis	Nil	Wildlife Conservation Plan for Migratory Shorebirds	Nil	Species or species habitat known to occur within area – the species is found in all states of Australia, with a continuous distribution from Barrow Island and Dampier Archipelago	Very Unlikely	

Common Names	EPBC Act Listing Status	Approved Conservation Advice	Recovery Plan	Wildlife Conservation Plans	Marine Bioregional Plans	Breeding and habitat use in the regional area	Potential WHP Interaction	Comments
	marine; migratory	(far eastern curlew) (DCCEEW 2023)		(Commonwealth of Australia, 2006		through the Kimberley and along the Northern Territory, QLD and NSW coasts. The species nests in the northern hemisphere summer, and travel to Australia for the non-breeding season. In Australia, the species occur in sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons.		
Soft plumaged Petrel	Vulnerable; marine	Conservation Advice Pterodroma Mollis soft-plumaged petrel 2015	Nil	Nil	Marine bioregional plan for the South-west Marine Region	Species or species habitat may occur within area – this species is found over both temperate and sub-Antarctic offshore waters. Breeding is believed to take place in very low numbers at Mastsuyker Island, Tasmania (6 pairs) with the rest of the population breeding on two southern Australian subAntarctic islands and there is a general northerly dispersion after chicks fledge during May to June. Softplumaged petrels breed in burrows among rocks and tussocks	Very Unlikely	
Fork tailed Swift	Migratory; marine	Nil	Nil	Nil	Nil	Species or species habitat likely to occur within area – the species breeds in Siberia and is a nonbreeding visitor to all states and territories of Australia. It is found scattered along the Pilbara coast and migrates between Australia and Indonesia. In Australia, they mostly occur over inland plains, above foothills or in coastal areas. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. The Fork-tailed Swift is almost exclusively aerial	Very Unlikely	
Common Noddy	Migratory; marine	Nil	Nil	Wildlife Conservation Plan for Seabirds (2020)	Marine bioregional plan for the South-west Marine Region Marine bioregional plan for the Temperate East Marine Region	Species or species habitat likely to occur within area – the species occurs mainly in ocean off the Queensland coast, but also occurs off the north-west and central Western Australian coast. Western Australia has the largest numbers of Common Noddies – 74% of Australian population, with approximately 132,000 pairs migrating through area from the Houtman Abrolhos alone (Surman et al 2018). During the breeding season, the Common Noddy usually occurs on or near islands, on rocky islets and stacks with precipitous cliffs,	Potential	These birds are known to nest in the region under similar conditions. No nesting or breeding has been observed at the WHP.

Common Names	EPBC Act Listing Status	Approved Conservation Advice	Recovery Plan	Wildlife Conservation Plans	Marine Bioregional Plans	Breeding and habitat use in the regional area	Potential WHP Interaction	Comments
					Marine bioregional plan for the North Marine Region	or on shoals or cays of coral or sand. The birds may nest in bushes, saltbush, or other low vegetation. They may also nest on the ground on grass or bare rock and in the forks of tall trees. Common Noddies migrate north from the Houtman Abrolhos to the Monte Bello Islands and into the offshore areas north (Surman et al 2018).		
Caspian Tern	Migratory; marine	Nil	Nil	Wildlife Conservation Plan for Seabirds (2020)	Marine bioregional plan for the South-west Marine Region Marine bioregional plan for the North Marine Region	Breeding known to occur within area – this species is widespread throughout Australia and occurs in both coastal areas (including islands) and inland habitats. They breed in small colonies throughout northwest Australia, including on the islands of the Dampier Archipelago and the Montebello/ Lowendal Islands. Nests may be in the open, or among low or sparse vegetation, including herb field, tussocks, samphire or other prostrate sand-binding plants. They sometimes nest near bushes or other shelter such as large sticks, driftwood, piles of beach cast seagrass. Caspian Terns are sedentary and forage in inshore waters adjacent islands so are unlikely to forage at WHP.	Unlikely	
Bridled Tern	Migratory; marine	Nil	Nil	Wildlife Conservation Plan for Seabirds (2020)	Marine bioregional plan for the North Marine Region Marine bioregional plan for the South-west Marine Region	Breeding known to occur within area – widespread around tropical and sub-tropical regions of Australia, most common on offshore islands. Breeding populations exist on Ashmore Reef and islands of the Kimberly region and the Montebello/Lowendal/Barrow Islands. Nests are usually found in rocky areas or on coral, concealed in crevices or caves up to 1.5 m deep, under rocks, among talus or coral rubble, on ledges of cliffs, or on the ground beneath low shrubs, roots of Pandanus, vines or among grasses. Migration of WA population appears to be to the north to Indonesian waters. Bridled Terns migrate to the Celebes Sea where they overwinter Surman et al 2018.	Potential	
Roseate Tern	Migratory; marine	Nil	Nil	Wildlife Conservation Plan	Marine bioregional	Breeding known to occur within area – the species inhabits a variety of habitats including	Unlikely	

Common Names	EPBC Act Listing Status	Approved Conservation Advice	Recovery Plan	Wildlife Conservation Plans	Marine Bioregional Plans	Breeding and habitat use in the regional area	Potential WHP Interaction	Comments
				for Seabirds (2020)	plan for the North-west Marine Region Marine bioregional plan for the North Marine Region Marine bioregional plan for the South-west Marine Region Marine bioregional plan for the Temperate East Marine Region	beaches, reefs and sandy/coral islands. The Roseate Tern forage offshore and inshore, often in association with pelagic fish activity. Breeding mainly occurs off the coast of Western Australia and populations are located around Bedout Island, Lowendal Group, Montebello islands and Ashmore Reef. Little information is available about migratory movements or timing.		
Threat abatement plans relating to terrestrial activities are not included.								

3.2.6 Socio-economic Receptors

Socio-economic activities that may occur in the operational area include commercial fishing, oil and gas exploration and production, and, to a lesser extent, recreational fishing and tourism as summarised in Table 3-10.

Table 3-10: Summary of socio-economic activities that may occur in the operational area

Value/Sensitivity	Description	OA presence	Relevant events within OA	Relevant events within EMBA
Commercial fisheries – Commonwealth (Figure 3-17)	Three Commonwealth fisheries overlap the operational area: the Western Tuna and Billfish Fishery, the Southern Bluefin Tuna Fishery, and the Western Skipjack Tuna Fishery **(Section 0**). In recent years, fishing effort associated with the Western Tuna and Billfish Fishery has concentrated off south-west Western Australia and South Australia, with no current effort on the NWS (Patterson et al., 2018). The Southern Bluefin Tuna Fishery is only active in waters offshore of south and south eastern Australia, confirmed in consultation with the Australia Southern Bluefin Tuna Association in consultation for previous company offshore activities (ABARES Fishery Status Reports, 2023). There is no current effort on the NWS (Patterson et al., 2018). There has been no fishing effort in the Western Skipjack Tuna Fishery since the 2009 season, and in that season, activity concentrated off South Australia (Patterson et al., 2018).	✓	<u>Planned</u> Interaction with other users (**Section 6.6**)	<u>Unplanned</u> Unplanned hydrocarbon spills (**Sections 7.6 to 7.9)**
Commercial fisheries – State (Figure 3-18 and Figure 3-19)	State fisheries active within the operational area are the Pilbara Trap, Line and Fish Trawl Managed Fisheries, the Mackerel Fishery Area 2, the Onslow and Nickol Bay Prawn Limited Entry Fishery, Pearl Oyster Managed Fishery, and Pilbara Developing Crab Fishery (Section 3.2.6.1).	✓	<u>Planned</u> Interaction with other users (Section 6.6)	<u>Unplanned</u> Unplanned hydrocarbon spills (Sections 7.6 to 7.9)
Oil and gas (Figure 3-21)	Various petroleum exploration and production activities have been undertaken within the North West Shelf. In the operational area, East Spar pipeline is crossed by four pipelines, two flowlines and two umbilicals owned by Chevron. Outside of the operational area, but within the permit area, the Pluto gas pipeline transects the southwest corner (approximately 5 km from the operational area). Vessels servicing oil and gas operations in the region may pass through the area enroute to facilities; however, since vessel transit is not classed as a petroleum activity, potential impacts to vessels are discussed under 'Shipping' below. Oil and gas facilities occur within the EMBA, as do permits operated by other titleholders. Thus, oil and gas activities	✓	<u>Planned</u> Interaction with other users (Section 6.6)	<u>Unplanned</u> Unplanned hydrocarbon spills (Sections 7.6 to 7.9)

Value/Sensitivity	Description	OA presence	Relevant events within OA	Relevant events within EMBA
	could be impacted by unplanned events.			
Shipping (Figure 3-21)	Shipping using North West Shelf waters includes iron ore carriers, oil tankers and other vessels proceeding to or from the ports of Dampier, Port Walcott and Port Hedland; however, these are predominantly heading north from these ports. The proposed operational area does not overlap any major shipping lanes (more than 20 km away), although vessel traffic may be encountered throughout the operational area as commercial vessels transit around the Montebello Islands and support vessels conduct operations with the offshore infrastructure.	✓	<u>Planned</u> Interaction with other users (Section 6.6)	<u>Unplanned</u> Unplanned hydrocarbon spills (Sections 7.6 to 7.9)
Recreational fishing	Within the operational area, there are no known natural seabed features that would aggregate fishes and that are typically targeted by recreational fishers. Given the water depths and distance from the nearest mainland, it is unlikely recreational fishing would occur in the vicinity. Recreational fishing does occur within the EMBA and therefore could be impacted by a loss of well control.	–	N/A	<u>Unplanned</u> Unplanned hydrocarbon spills (Sections 7.6 to 7.9)
Defence	In consultation, Defence has advised no concerns with this proposed activity (Section 0).	–	N/A	N/A
Shipwrecks	One hundred and thirty three shipwrecks are sited within the EMBA. The closest shipwreck to the operational area is the Perentie, wrecked in 1976 on Barrow Island.	–	N/A	<u>Unplanned</u> Unplanned hydrocarbon spills (Sections 7.6 to 7.9)
Tourism	Owing to the water depths of the operational area, planned events are not predicted to have an impact on tourism. There are sources of marine-based tourism within the EMBA. Aquatic recreational activities, such as boating, diving and fishing, occur near the coast and Montebello Islands. These activities are concentrated in the vicinity of the population centres, such as Exmouth, Dampier and Onslow. The EMBA encompasses the Montebello Islands Marine Park, Barrow Island Marine Park and Marine Management Area, Jurien Bay Marine Park and Rowley Shoals Marine Park; shoreline accumulation of oil may also occur within the Ningaloo Marine Park and Muiron Islands Marine Management Area (**Section 3.2.3**). Thus, ecotourism based on specific local values (game fish, nearshore reef snorkelling and diving) could be impacted by unplanned events.	–	N/A	<u>Unplanned</u> Unplanned hydrocarbon spills (Sections 7.6 to 7.9))

Value/Sensitivity	Description	OA presence	Relevant events within OA	Relevant events within EMBA
Cultural Heritage	No known sites of Aboriginal Heritage significance occur within the operational area. There are no Native Title or Indigenous Land Use Agreements (ILUAs) within the operational area. Eight Native Title and eleven certified ILUAs overlap the EMBA. Aboriginal Heritage Inquiry System identified 92 registered Aboriginal heritage sites that occur within the EMBA. Within the EMBA, Barrow Island, Montebello Islands, Exmouth, Dampier Peninsula, Kimberley coast, Eighty-mile beach, Ningaloo Reef and the adjacent foreshores have a long history of occupancy by Indigenous communities.	–	N/A	Unplanned Unplanned hydrocarbon spills (Sections 7.6 to 7.9)

3.2.6.1 Commercial Fisheries

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 respectively. Table 3-11 describes each of these fisheries and indicates which events associated with the activity may impact on these.

Consultation with the Department of Primary Industries and Regional Development (DPIRD) has previously identified commercial fishing interests that exist in or in close proximity to proposed activities under this EP. This includes commercial fisheries identified in Table 3-11. This consultation also identified key fish species that may be aggregating or spawning in the EMBA. This information is provided, together with other key periods of sensitivity for socio-economic receptors in Table 3-12.

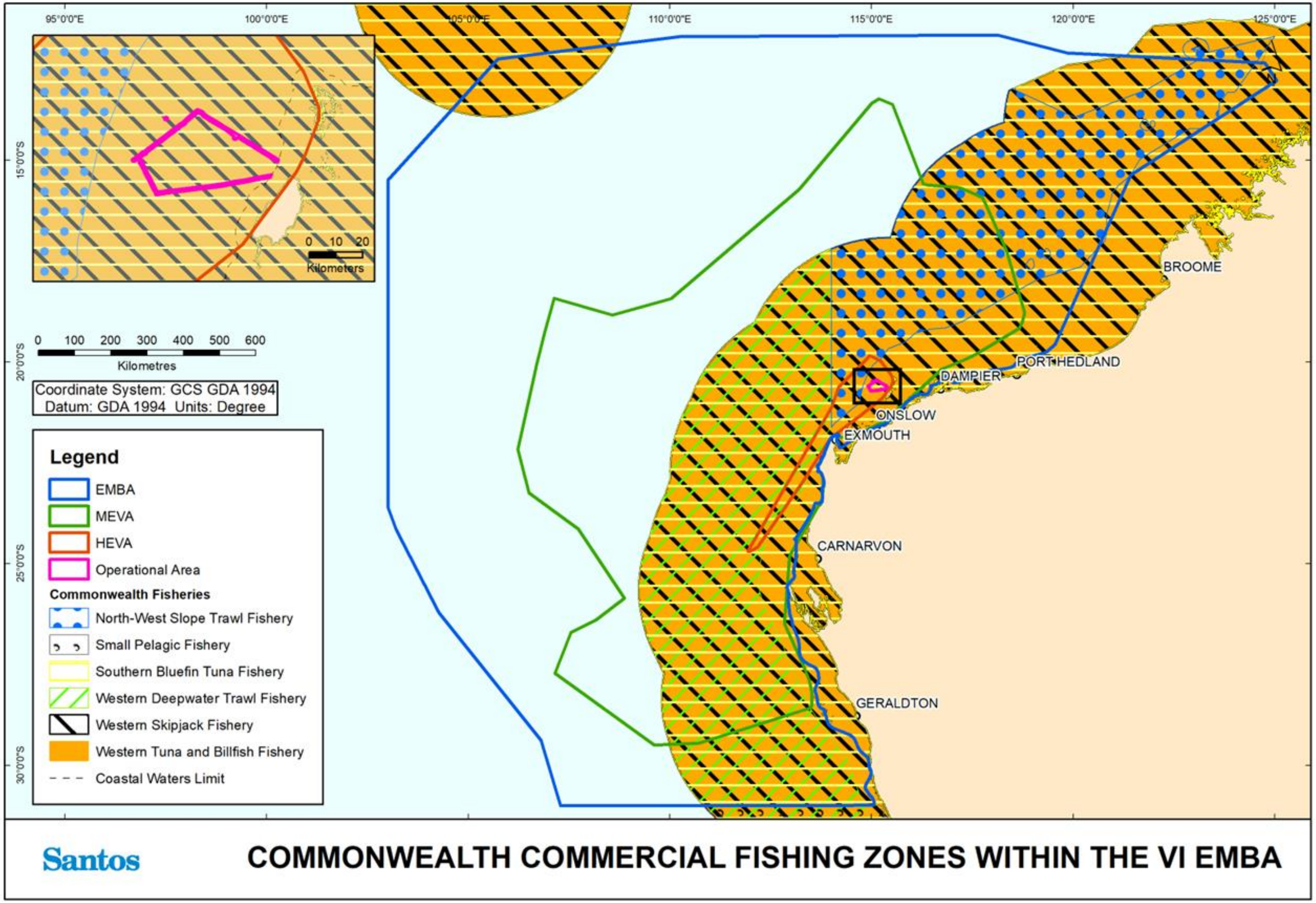

Figure 3-17: Commonwealth Commercial Fishing Zones in the EMBA and Operational Area

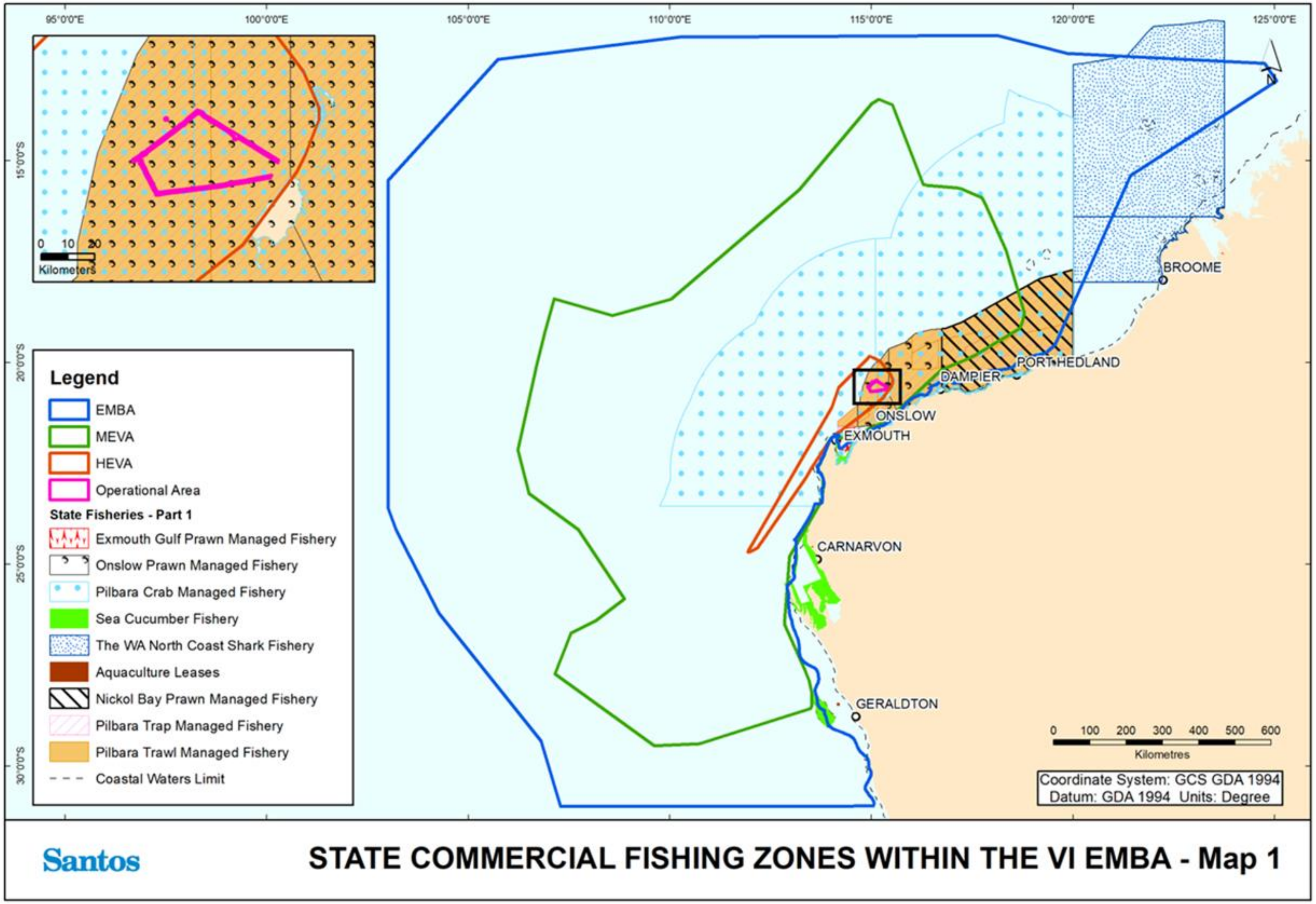

Figure 3-18: State commercial fishing zones in the environment that may be affected and operational area

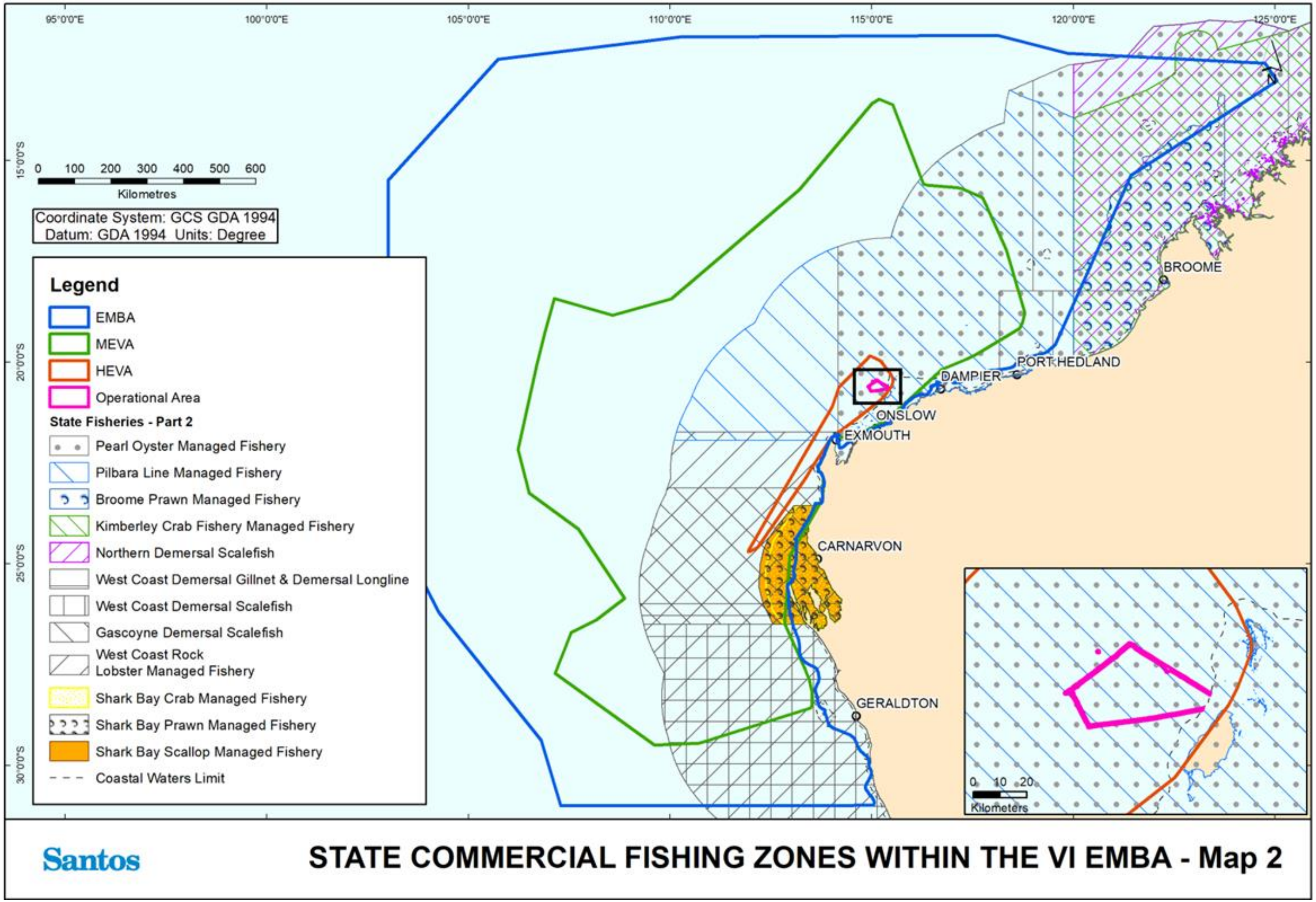

Figure 3-19: State commercial fishing zones in the environment that may be affected and operational area

Table 3-11: Commonwealth and state fisheries in the vicinity of the operational area and environment that may be affected

Value/Sensitivity	Description	Operational Area Presence	EMBA Presence	Relevant Events within the Operational Area and the EMBA
Commonwealth-managed Fisheries				
Northwest Slope Trawl	Extends from 114° E to approximately 125° E off the WA coast between the 200 m isobath and the outer limit of the Australian Fishing Zone.	X	✓	Historical effort in the EMBA, targeting scampi and prawns.
Western Deepwater Trawl Fishery	Demersal trawl seaward of the 200 m isobaths.	X	✓	Fishing effort for a diverse range of tropical and temperate species.
Small Pelagic Fishery	Purse-seine and midwater trawling.	X	✓	Historical effort in the EMBA, targeting sardines, mackerel and redbait.
Western Tuna and Billfish Fishery	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.	✓	✓	No active commercial fishing in the area in the past years. However, fisheries overlap the EMBA and therefore fishing vessels could be encountered in low density.
Western Skipjack Tuna Fishery	There has been no fishing effort since the 2009 season in South Australia. No current effort on North West Shelf.	✓	✓	
Southern Bluefin Tuna	No current effort on North West Shelf.	✓	✓	
State-managed Fisheries (North, Gascoyne and West Coast Bioregions)				
Abrolhos Islands and Mid-West Trawl Managed Fishery	All the waters of the Indian Ocean adjacent to Western Australia between 27°51' S latitude and 29°03' S latitude on the landward side of the 200 m isobath.	X	✓	Low opening otter trawl systems operating to target saucer scallops and prawns.
Broome Prawn Managed Fishery	Operates off Broome and targets western king and coral prawns.	X	✓	Unplanned events that may occur in the operational area and the EMBA could disrupt fishing activities; however, the likelihood of these events is low.
Exmouth Gulf Prawn Managed Fishery	Sheltered waters of Exmouth Gulf. Essentially the	X	✓	Unplanned events that may occur in the operational area and

Value/Sensitivity	Description	Operational Area Presence	EMBA Presence	Relevant Events within the Operational Area and the EMBA
	western half of the Exmouth Gulf (eastern part is a nursery ground). The Muiron Islands and Point Murat provide the western boundary; Serrurier Island provides the northern limit.			the EMBA could disrupt fishing activities; however, the likelihood of these events is low.
Nickol Bay Prawn Managed Fishery	Primarily targets banana prawns using otter trawl methods along the western part of the North West Shelf in coastal shallow waters.	X	✓	Unplanned events that may occur in the operational area and the EMBA could disrupt fishing activities; however, the likelihood of these events is low.
Kimberley Prawn Managed Fishery	Operates off the north of the state between Koolan Island and Cape Londonderry. Primarily targets banana prawns.	X	✓	Unplanned events that may occur in the operational area and the EMBA could disrupt fishing activities; however, the likelihood of these events is low.
Pearl Oyster Managed Fishery	Mostly operate March to June. Operational area does occur within the boundaries of Zone 1 for the fishery. There was no active fishing in Zone 1 of the Pearl Oyster Managed Fishery since 2016, however a small number of culture shells have been taken, which is restricted to shallow diving depths.	✓	✓	Given the water depths of the operational area, disruption to fishing activities are unlikely to occur. Unplanned events that may occur in the operational area and the EMBA could disrupt fishing activities; however, the likelihood of these events is low.
Onslow Prawn Managed Fishery	The boundaries of this 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'.	✓	✓	Significant disruption unlikely to occur due to vast area fished.
Pilbara Fish Trawl (interim), Trap and Line Managed 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	✓	✓	The Pilbara Fish Trawl fishery is seaward of the 50 m isobath and landward of the 200 m isobaths. The Trap Fishery generally operates in shallow waters around rocky outcrops and reefs. The Line Fishery is

Value/Sensitivity	Description	Operational Area Presence	EMBA Presence	Relevant Events within the Operational Area and the EMBA
	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, and while the Line Fishery catch comprises a similar number it also includes some deeper offshore species.			seaward of the 30 m isobath and landward of the 200 m isobaths. As the maximum water depth in the operational area is 110 m, significant impacts are not expected. Unplanned events that may occur in the operational area and the EMBA could disrupt fishing activities; however, the likelihood of these events is low. Consultation with DPIRD confirmed the Halyard-2 and VI Hub locations have been closed to trawl fishing since 1998 and hence were not consulted with.
Pilbara Developing Crab Fishery	Targets blue swimmer and mud crabs. Crabbing activity along the Pilbara coast is centered largely on the inshore waters.	✓	✓	Given the water depths of the operational area, disruption to fishing activities are unlikely to occur.
Northern Demersal Scalefish Managed Fishery	Primarily trap-based fishery targeting red emperor and goldband snapper.	X	✓	Unplanned events that may occur in the operational area and the EMBA could disrupt fishing activities; however, the likelihood of these events is low.
West Coast Demersal Scalefish (Interim) Managed Fishery	The offshore management area targets eightbar grouper, hapuku, blue-eye trevalla and ruby snapper. Fishing method is handline and drop line.	X	✓	Unplanned events that may occur in the EMBA could disrupt fishing activities; however, the likelihood of these events is low.
West Coast Rock Lobster Managed Fishery	This fishery targets the western rock lobster between Shark Bay and Cape Leeuwin. Baited traps (pots) and with a commercial and recreational fishing season.	X	✓	Unplanned events that may occur in the EMBA could disrupt fishing activities; however, the likelihood of these events is low.
West Coast Demersal Gillnet and Demersal Longline	This fishery targets gummy, dusky, whiskery and sandbar sharks using demersal	X	✓	Unplanned events that may occur in the EMBA could disrupt fishing activities;

Value/Sensitivity	Description	Operational Area Presence	EMBA Presence	Relevant Events within the Operational Area and the EMBA
	gillnets and demersal longline.			however, the likelihood of these events is low.
Gascoyne (West Coast) Demersal Scalefish (Interim) Managed Fishery	Handline and drop line for west coast inshore and offshore demersal species.	X	✓	Unplanned events that may occur in the EMBA could disrupt fishing activities; however, the likelihood of these events is low.
Shark Bay Scallop, Crab and Prawn Limited Entry Fishery	Low opening otter trawls. The boundaries of the Shark Bay Prawn Managed Fishery and the Shark Bay Scallop managed Fishery are located in and near the waters of Shark Bay.	X	✓	Unplanned events that may occur in the EMBA could disrupt fishing activities; however, the likelihood of these events is low.
Gascoyne Demersal Scalefish Managed Fishery	Mechanised handlines. Unlikely to occur.	X	✓	Unplanned events that may occur in the EMBA could disrupt fishing activities; however, the likelihood of these events is low.
Octopus Interim Managed Fishery	Lines and pots, trawl and trap land octopus as by-product. Fishery is in development phase and occurs between Kalbarri and Esperance.	X	✓	Unplanned events that may occur in the EMBA could disrupt fishing activities; however, the likelihood of these events is low.
State Managed Fisheries (Whole of State)				
Marine Aquarium Fish Managed Fishery	All year. Effort in the operational area and the EMBA is unknown but is unlikely due to the depth and the dive-based method of collection.	✓	✓	Unplanned events that may occur in the EMBA could disrupt fishing activities; however, the likelihood of these events is low. While, these are open fisheries, based on Fish Cube data they are inactive. On this basis, they were not consulted with.
Specimen Shell Managed Fishery	All year. Effort in the operational area and the EMBA is unknown, but it is unlikely due to the depth and the dive-based method of collection. Unlikely to occur.	✓	✓	
West Coast Deep Sea Crustacean (Interim) Managed Fishery	Baited pots targeting crabs; occurs between Cape Leeuwin and the Northern Territory border on the seaward side of the 150-m isobath.	✓	✓	
Hermit Crab Fishery	Land-based hand collection operating in	✓		

Value/Sensitivity	Description	Operational Area Presence	EMBA Presence	Relevant Events within the Operational Area and the EMBA
	Western Australian waters north of Exmouth Gulf.			
Western Australian Sea Cucumber Fishery (formerly known as bêche-de-mer)	All year. Although permitted to fish in the operational area and the EMBA, the fishery is restricted to shallow coastal waters suitable for diving and wading. Unlikely to occur.	✓		
Mackerel Fishery	Trolling or handline. Near-surface trolling gear from vessels in coastal areas around reefs, shoals and headlands.	✓	✓	The majority of the catch is taken in the Kimberley area; therefore, disruption is unlikely.

3.2.6.2 Recreational Fisheries

The operational area occurs in the Gascoyne Coast Bioregion, which is a focal point for winter recreational fishing and is a key component of many tourist visits. Angling activities include beach and cliff fishing (e.g., Steep Point and Quobba), embayment and shallow-water boat angling (e.g., Shark Bay, Exmouth Gulf and Ningaloo lagoons), and offshore boat angling for demersal and larger pelagic species (e.g., off Ningaloo, which may include the operational area).

The predominant target species include the tropical species, such as emperors, tropical snappers, groupers, mackerels, trevallies and other game fish. Temperate species at the northern end of their ranges, such as pink snapper, tailor and whiting, also provide significant catches, particularly in Shark Bay (WAFIC, 2016).

3.2.6.3 Petroleum Industry

There are several exploration and production permits and leases throughout the Western Australian and Commonwealth waters in the operational area and the EMBA, as shown in Figure 3-21. There are also domestic gas plants on Varanus Island in the Northwest Shelf, Devil Creek Gas Plant onshore and Macedon Gas Plant in the Pilbara region, and an oil facility near Dongara called Cliff Head.

3.2.6.4 Shipping

Large commercial vessels associated with the oil and gas industry and Western Australian major ports move through the operational area and the EMBA in transit. Closer proximity shipping also includes construction vessels, barges, and dredges; domestic support vessels; and offshore survey vessels.

The Australian Maritime Safety Authority (AMSA) has established a network of shipping fairways off the northwest coast of Australia to manage traffic patterns (AMSA, 2013a). AMSA shipping routes in and in close proximity to the operational area and the EMBA are shown in Figure 3-22.

3.2.6.5 Tourism

Tourism is concentrated in the vicinity of population centres in and in the vicinity of the EMBA, such as Dampier, Exmouth, Coral Bay and Shark Bay. Popular water-based activities that may occur in the EMBA include fishing, swimming, snorkelling, diving, surfing, windsurfing, kiting and boating.

Seasonal nature-based tourism, such as humpback whale watching, whale shark encounters and tours of turtle hatching, mainly occurs around Ningaloo Reef and Cape Range National Park (Tourism Western Australia, 2014). Seasonal aggregations of whale sharks, manta rays, sea turtles and whales, as well as the annual mass spawning of coral, attract large numbers of visitors to Ningaloo each year (CALM, 2005).

Given the water depths of the operational area and the lack of notable seabed features, there are unlikely to be any tourism-based activities in the surrounding waters of the operational area. The nearest area where recreation is likely to occur is the Montebello Islands, which are located approximately 20 km from the operational area.

3.2.6.6 Traditional Owners

Native Title determinations and Registered Native Title Bodies Corporate (RNTBC)

There are seven Native Title determinations where the EMBA is either immediately adjacent to the coastal land of the determination area, or offshore, but still highly proximal. These determinations are:

- Ngarla and Ngarla #2 (Determination Area A)
- Kariyarra People
- Ngarluma / Yindjibarndi
- Yaburara and Marduhunera People
- Thalanyji
- Gnulli, Gnulli #2 and Gnulli #3 - Yinggarda, Baiyungu and Thalanyji People
- Malgana Part A.

The corresponding RNTBCs that administer these determinations are as follows:

Native Title Determination	RRNTBC
Ngarla and Ngarla #2 (Determination Area A)	Wanparta Aboriginal Corporation (Wanparta)
Kariyarra People	Kariyarra Aboriginal Corporation (KAC)
Ngarluma / Yindjibarndi	Ngarluma Aboriginal Corporation (NAC) This determination is jointly managed by two RNTBCs: NAC manages the western and coastal section; Yindjibarndi Aboriginal Corporation manages the inland, eastern section and is not a Relevant Person for the purposes of this consultation.
Yaburara and Marduhunera People	Wirrawandi Aboriginal Corporation (Wirrawandi)
Thalanyji	Buurabalayji Thalanyji Aboriginal Corporation (BTAC)
Gnulli, Gnulli #2 and Gnulli #3 - Yinggarda, Baiyungu and Thalanyji People	Nganhurra Thanardi Garrbu Aboriginal Corporation (NTGAC)
Malgana Part A.	Malgana Aboriginal Corporation
Ngarla and Ngarla #2 (Determination Area A)	Wanparta Aboriginal Corporation (Wanparta)

In addition, Yamatji Marlpa Aboriginal Corporation (YMAC) is considered relevant. They are not a RNTBC but provide a range of support services to Aboriginal Corporations, including NTGAC. Murujuga Aboriginal Corporation is also considered relevant. They are not an RNTBC, but an Aboriginal Corporation representing interests of Traditional Owners on the Burrup Peninsula.

Indigenous Land Use Agreements

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

The Register of Indigenous Land Use Agreements (ILUA) is kept by the Native Title Registrar in accordance with s199A of the Native Title Act 1993 (NTA Act) 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 in July 2024 found the following:

There are no ILUAs within the operational area.

11 certified ILUAs intersect the EMBA:

ILUAs are:

- Alinta-Kariyarra Electricity Infrastructure ILUA
- KM & YM ILUA 2018

- Cape Preston Project Deed (YM Mardie ILUA)
- Anketell Port, Infrastructure Corridor and Industrial Estates Agreement
- Kuruma Marthudunera and Yaburara and Coastal Mardudhunera ILUA
- Macedon ILUA
- Ashburton Salt Project ILUA (Body Corporate Agreement)
- Ningaloo Conservation Estate ILUA
- Yamatji Nation Agreement
- Yued ILUA
- The FMG-Kariyarra Land Access ILUA

Indigenous Protected Areas

Indigenous Protected Areas (IPAs) are areas of land and sea that Traditional Owners have agreed to manage for biodiversity conservation, delivering outcomes for the benefit of all Australians, through voluntary agreements with the Australian Government. 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 there are no IPAs within the operational area or EMBA.

3.2.6.7 Cultural Heritage

Santos acknowledges that the tradition of the Aboriginal and Torres Strait Islander people of Australia includes a cultural and spiritual connection to their land and waters. These connections are rooted in traditional communal beliefs and practices. Aboriginal and Torres Strait Islander 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 Aboriginal and Torres Strait Islander people includes a vast array of tangible and intangible cultural artifacts, practices and beliefs. The heritage is also of cultural value to Australia and the global community. The cultural value of protected heritage to Australia is given force by a range of laws, regulations and institutions that are designed specifically to protect Aboriginal and Torres Strait Islander rights and interests in relation to sacred sites and other aspects of cultural heritage, including the Native Title Act 1993 (Cth; NT Act), Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Cth; ATSIHP Act) and Underwater Cultural Heritage Act 2018 (Cth; UCH Act).

Country is an important concept to Aboriginal and Torres Strait Islander people. The term Country is often used 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 Aboriginal and Torres Strait Islander people, Country is a combination of the land, sea, rivers and islands and all that they contain and sustain. Aboriginal 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 Aboriginal groups have connections to different parts of Country. These groups are representative of many different Aboriginal language groups, but also include kinship, cultural and family 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 Aboriginal people and the sea (McCarthy et al 2022.

To identify sites associated with cultural heritage in the EMBA a search using the Department of Planning, Lands and Heritage (DPLH) Aboriginal Cultural Heritage Inquiry System (ACHIS) Tool was completed on 21 May 2024. To overcome data processing limitations of the ACHIS web app, the EMBA was split into eight polygons, to generate a series of smaller queries and reports.

Figure 3-20demonstrates the EMBA as eight polygons that were used to generate the series of ACHIS search report. The Aboriginal Heritage Inquiry System identified 92 registered Aboriginal heritage sites that occur within the EMBA. Within the EMBA, Barrow Island, Montebello Islands, Exmouth, Dampier Peninsula, Kimberley coast, 80 Mile Beach, Ningaloo Reef and the adjacent foreshores have a long history of occupancy by Indigenous communities. No known sites of Aboriginal Heritage significance occur within the operational area. The results of this search are appended at Appendix E.

3.2.6.7.1 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. Aboriginal people continue to assert inherited rights and responsibilities over Sea Country.

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 very different from the broader Australian view of land and sea (NOO, 2002).

Animals can be totems for Aboriginal people. They 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.

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".

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 with features of the Northwest Marine Park networks and management plans in respect of these networks identify natural, cultural and spiritual features. The operational area and/or the EMBA of this EP overlap the Northwest Marine Park and the South West Marine Park.

North West Marine Park:

The Gnulli and Malgana people (represented by NTGAC and Malgana Aboriginal Corporation) are listed as being relevant to the management of sea country in the Shark Bay Marine Park. The Gnulli people (represented by NTGAC) are listed as being relevant to the management of sea country in the Gascoyne Marine Park.

There is limited information about the cultural significance of the Montebello Marine Park.

The Ngarluma/ Yindibarndi, Yaburara and Mardudhunera people (represented by Ngarluma and Wirrawandi Aboriginal Corporations) are listed as being relevant to the management of sea country in the Dampier Marine Park.

For the Shark Bay, Gascoyne, , Ningaloo, Montebello and Dampier Marine Parks, YMAC is listed in the Management Plan as the Native Title Representative Body.

While the EMBA also includes the Carnarvon Canyon, the North West Marine Parks Management Plan does not reference a relevant Native Title body in relation to this Marine Park.

Nyangumarta, Karajarri and Ngarla people (represented by Nyangumarta Warrarn Aboriginal Corporation, Karajarri Traditional Lands Association and Wanparta Aboriginal Corporation) have management responsibilities that extend into Eighty Mile Beach Marine Park. Sea country is culturally significant and important to their identity. They have an unbroken, deep spiritual connection to their sea country, with traditional practices continuing today. Staple foods of living cultural value for the Nyangumarta, Karajarri and Ngarla people include saltwater fish, turtles, dugong, crabs and oysters. Access to sea country by families is important for cultural traditions, livelihoods and future socio-economic development opportunities.

The Northwest Marine Park Management Plan describes the following fauna as having cultural value for the Nyangumarta, Karajarri and Ngarla people: saltwater fish; turtles; dugong crabs; and oysters

As noted, Ngarla people are represented by Wanparta Aboriginal Corporation. This Corporation notes on its web site that the Ngarla People are the traditional owners who speak for the 80 Mile Beach Marine Park. The VI Hub Ops EP EMBA extends into the very western part of the Commonwealth Marine Park. The Wanparta Aboriginal

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Corporation web site also states that the adjacent eastern portion of the 80 Mile Beach Marine Park extends into the traditional lands of the Karajarri and Nyangumarta People. The VI Hub Ops EP EMBA does not extend over the Karajarri and Nyangumarta Native Title determined areas.

For the Kimberley, Ashmore Reef and Argo/ Rowley Terrace Marine Parks, KLC is listed in the Management Plan as the Native Title Representative Body.

Southwest Marine Park

For the Abrolhos Marine Park, YMAC is listed in the Management Plan as the Native Title Representative Body.

For the Jurien Marine Park, the Southwest Aboriginal Land and Sea Corporation (SWALSC) is listed in the Management Plan as the Native Title Representative Body.

Consultation with Aboriginal and Torres Strait Islander people, RNTBCs, NTRBs and other First Nations relevant persons is described in Section 4.

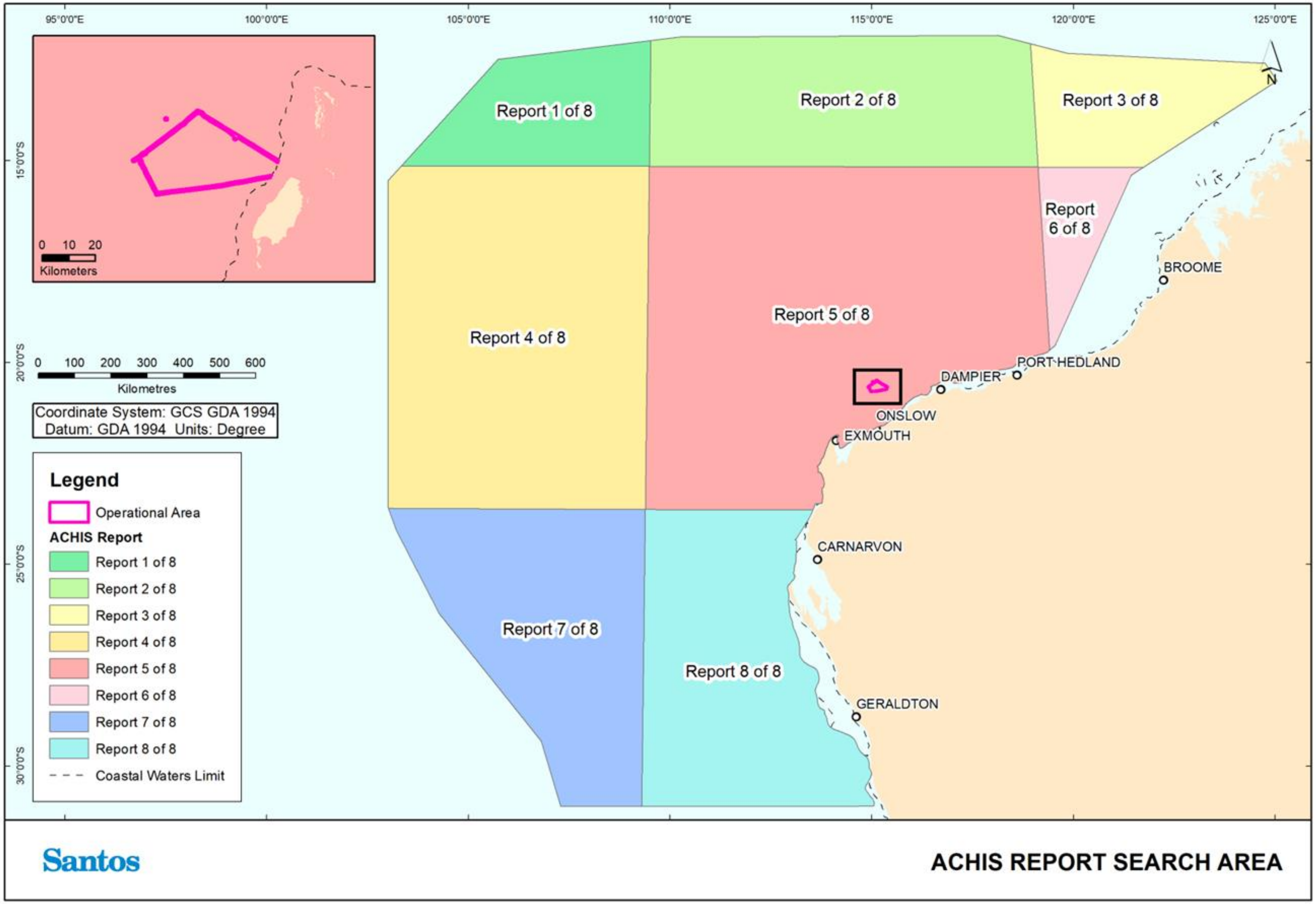

Figure 3-20:Varanus Island Hub environment that may be affected based on Aboriginal Cultural Heritage Inquiry System Report search areas

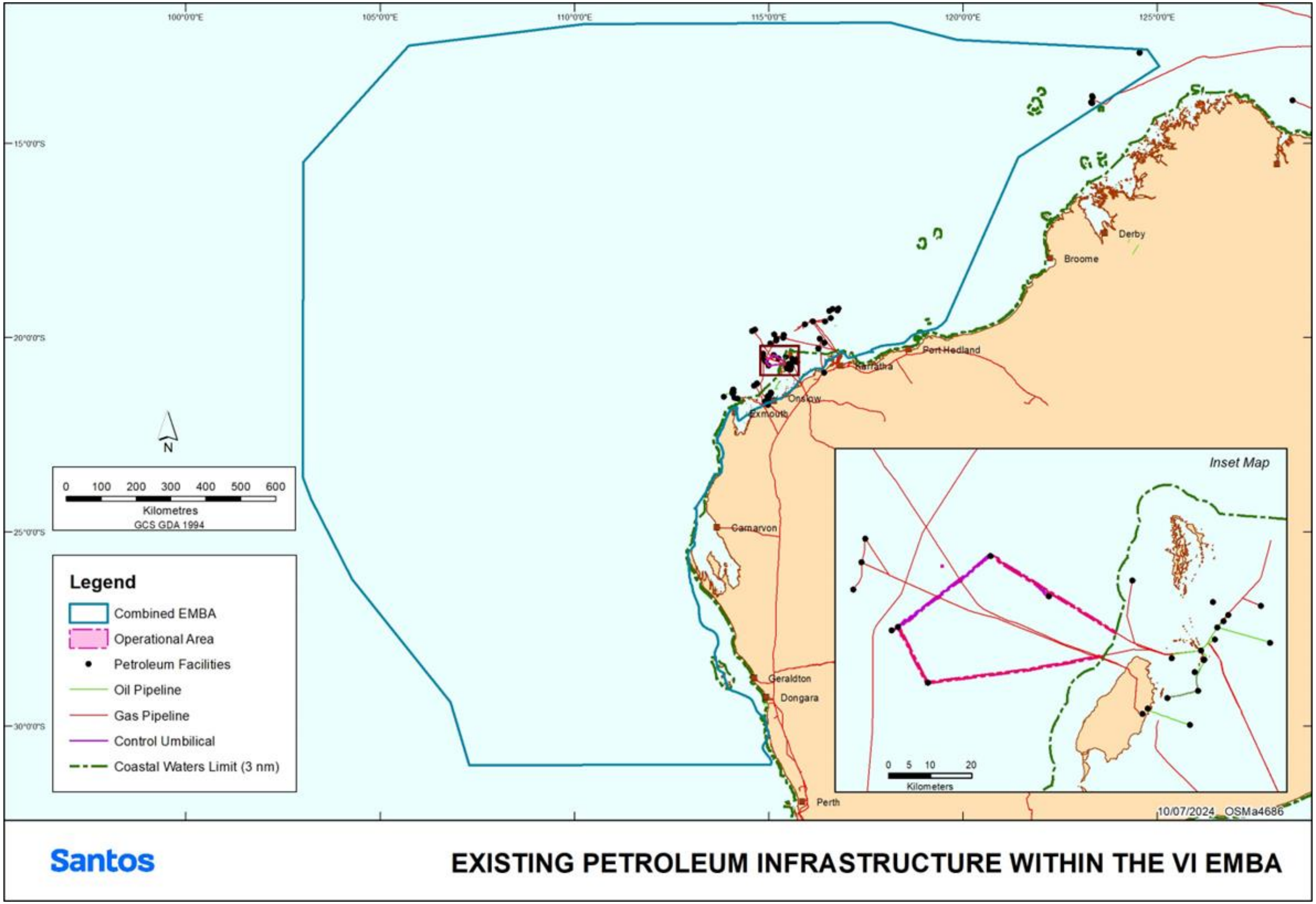

Figure 3-21: Existing petroleum infrastructure, permits and licences in the environment that may be affected and operational area

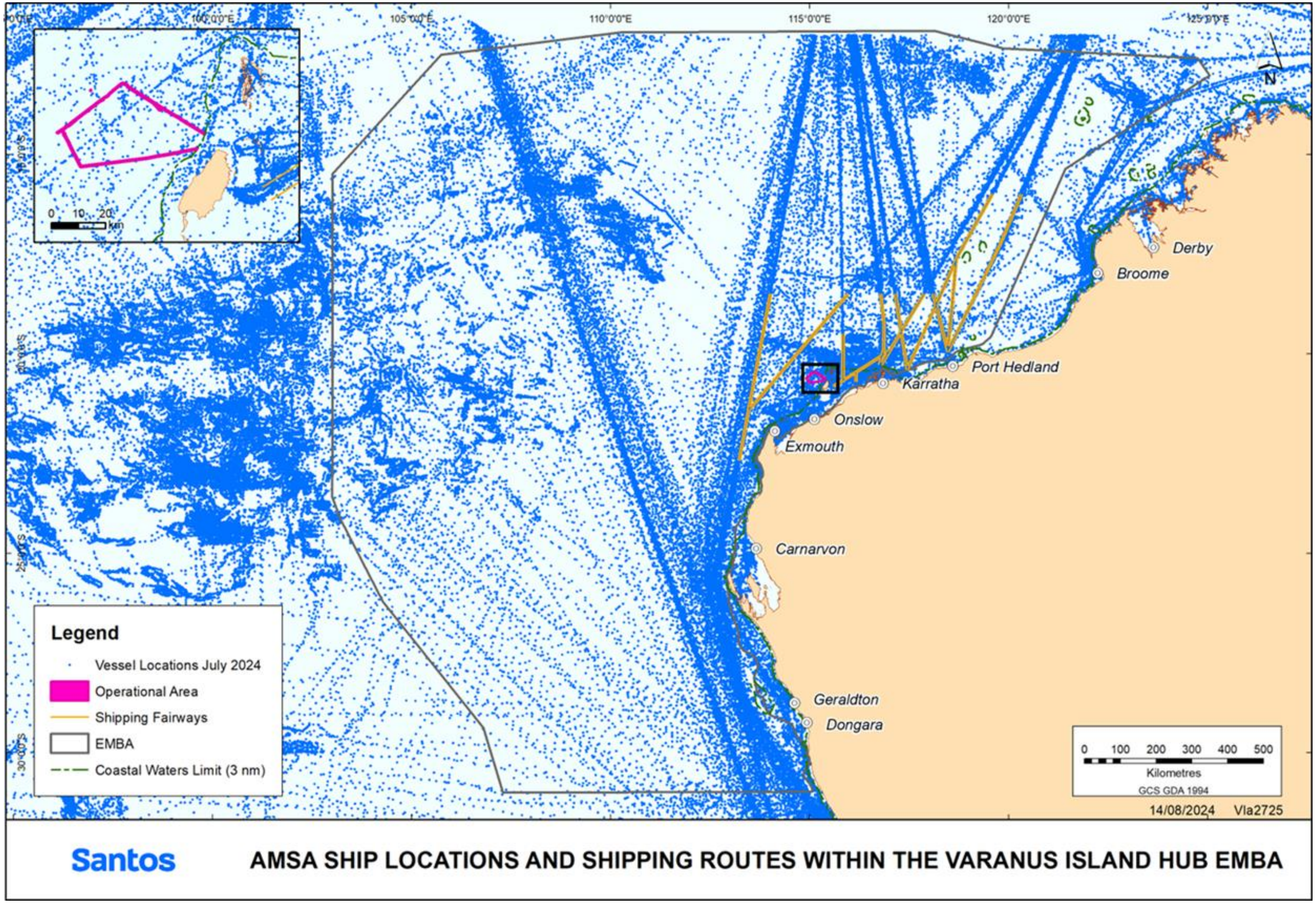

Figure 3-22: Australian Maritime Safety Authority ship locations and shipping routes in and in close proximity to the environment that may be affected and operational area

3.2.7 Windows of Sensitivity

Timing of peak activity for threatened species and other relevant, significant sensitivities is given in Table 3-12

Table 3-12: Windows of sensitivity in the vicinity of the environment that may be affected

Categories	Receptors (Critical Lifecycle Stages)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Physical environment and habitats	Non-coral benthic invertebrates												
	Coral (spawning periods)												
	Macroalgae	growing				Shedding fronds				growing			
	Other benthic habitats												
	Fish/ Sharks and Fisheries Species												
	Whale sharks			Aggregations at Ningaloo Coast									
	Fisheries species spawning/aggregation times												
	Baldchin groper												
	Blacktip shark												
	Crystal crab												
	Goldband snapper												
	King George whiting												
	Pink snapper												
	Rankin cod												
	Red emperor												
	Spangled emperor												
	Sandbar shark												
	Spanish mackerel												
	Marine Mammals												
	Dugong (breeding)	Breeding								Breeding			
	Australian sea lion (breeding)	Breeding and caring for young											
	Humpback whale (migration)												
	Blue whale (migration)												
	Southern right whale (migration)												

Categories	Receptors (Critical Lifecycle Stages)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	Southern right whale (reproduction)												
	Marine Reptiles												
	Hawksbill turtles (resident adult and juveniles)[2]	Widespread throughout North West Shelf 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 North West Shelf waters, increased density over soft bottom habitat 10 to 60 m 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 North West Shelf waters, highest density associated with seagrass beds and macroalgae communities, high density juveniles in shallow waters off beaches, among 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 North West Shelf waters, increased density associated with soft bottom habitat supporting their bivalve food source, juveniles associated with nearshore reef habitat											
	Loggerhead turtle (mating aggregations)[2]												

Categories	Receptors (Critical Lifecycle Stages)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	Loggerhead turtle (nesting and internesting)[2]												
	Loggerhead turtle (hatching)[2]												
	Leatherback turtles	Can occur at low density across the North West Shelf year round											
	Olive ridley turtles	Can occur at low density across the North West Shelf year round											
	Short-nosed seasnake	Can occur at low density across the North West Shelf year round											
	Leaf-scaled seasnake	Can occur at low density across the North West Shelf year round											
	Birds												
	Terns, shearwaters, petrels (nesting)												
	Commercial Managed Fisheries												
	Oil and gas												
	Shipping												
	Tourism/ recreational	Non-Applicable											

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

4. Stakeholder Consultation

OPGGS(E)R 2023 Requirements
Regulation 28(1)
If the Regulator's provisional decision under regulation 27 is that the environment plan includes material apparently addressing all the provisions of Division 2 (Contents of an environment plan), the Regulator must publish on the Regulator's website as soon as practicable: a. the plan with the sensitive information part removed, and b. the name of the titleholder who submitted the plan, and c. a description of the activity or stage of the activity to which the plan relates, and d. the location of the activity, and e. a link or other reference to the place where the accepted offshore project proposal (if any) is published, and f. details of the titleholder's nominated liaison person for the activity. Note: If the plan is a seismic or exploratory drilling environment plan, the Regulator must also publish an invitation for public comment on the plan: see regulation 30.
Regulation 24
The environment plan must contain the following: I. a report on all consultations under regulation 25 of any relevant person by the titleholder, that contains: II. a summary of each response made by a relevant person, and III. an assessment of the merits of any objection or claim about the adverse impact of each activity to which the environment plan relates, and IV. a statement of the titleholder's response, or proposed response, if any, to each objection or claim, and V. a copy of the full text of any response by a relevant person.

4.1 Consultation Background

The Varanus Island Hub has been in operation since 1986. Activities governed under this EP in Commonwealth waters include the John Brookes WHP, Spartan, Greater East Spar and Halyard fields. Stakeholders have been engaged regarding ongoing activities in these petroleum permits since their development.

Prior to the consultation that was undertaken to support this revision, consultation was undertaken in 2013, 2018 and again in 2021 to support the VI Hub Ops EP accepted in June 2022. Feedback provided during previous consultation has been considered for this revision and all related commitments have been maintained within the revision to this EP. Consultation summaries and associated records were submitted and assessed by NOPSEMA as part of the June 2022 EP.

Consultation for this revision to the EP has been undertaken in May 2023 to August 2024.

In 2023 consultation was primarily undertaken via the Spar Halyard Infill Project EP Consultation Package. The 2023 consultation material and engagement included details of the Halyard-2 drilling & completion activities (drilling, installation and pre-commissioning), along with the inclusion of Halyard-2 in the ongoing operation of the VI Hub (operation of Halyard-2 through the Greater East Spar Infrastructure) which comprises the new stage which is the subject of this revision of the Varanus Island Hub Operations Environment Plan for Commonwealth Waters.

In June and July 2024, as the EMBA for this EP is a different shape than Halyard-2 Drilling & Completion EP EMBA, in offshore waters close to Port Hedland and the Mid-west, Santos undertook consultation with six additional relevant persons.

In August 2024 an activity update was issued to all Relevant Persons for the Varanus Island Hub Operations activity which:

- advised Relevant Persons on the anticipated timing of the Halyard-2 commissioning, start up and operations (i.e. the New Stage of the Activity under Regulation 39(1));
- highlighted that there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP; and
- provided information about those impacts and risks (already described in the in-force and publicly available VI Hub Operations EP).

The activity update gave Relevant Persons the opportunity to provide any further feedback.

The 2023 and 2024 consultation is detailed in Sections 4.2– 4.6 of this EP.

Some consultation commitments made as part of the Spar Halyard Infill Project in 2023 are relevant only to the Halyard-2 drilling and completions activity, such as notifications prior to drilling rig mobilisation. As the 2023 consultation process also covered both the Halyard-2 drilling, the Halyard-2 drilling and completions commitments are included in Table 4-10 however the notification commitments are outside the scope of this EP and therefore not included in this EP.

In the unlikely event of a spill, Santos will assess and engage with potentially affected relevant persons as per the VI Hub Ops OPEP.

As the 2023 consultation material and engagement covered both the Halyard-2 drilling & completions EP and the new stage which is the subject of this revision of the Varanus Island Hub Operations Environment Plan, the 2023 records of consultation apply to both and as such the sensitive information report provided to NOPSEMA for the Halyard-2 Drilling and Completion EP is also provided as the sensitive information report to support this revision. However, this report has been updated for 2024 consultation on this revision.

Records for the additional Relevant Persons consulted in 2024 (only for this revision of the Varanus Island Hub Operations Environment Plan) is set out in an addendum to the Halyard-2 Drilling and Completion sensitive information report. Table 4-1presents a summary of the Sensitive Information Report and addendum contents.

Ongoing consultation will continue throughout the life of this EP.

In addition, Santos' wider stakeholder group is regularly updated on Santos' activities through Quarterly Update documents which list Varanus Island as a key operating facility for the company.

Outside of the regulatory approval process, Santos continuously engages with regional stakeholders to ensure they are informed of the company's operational, development and planning activities in the region, and to seek input on issues of relevance and concern to them. Santos maintains relationships with community partners, focusing on the Karratha and Exmouth communities, allowing the business to align community investments with the strategic objectives of the communities in which Santos operates. Other interested stakeholders are able to find information regarding the Varanus Island Hub Operations on Santos' external website.

Given Santos' long-term presence at Varanus Island, stakeholders are familiar with the facility.

Table 4-1: Summary of Sensitive Information Report Contents

Consultation Activity	Period	Relevant Sensitive Information Report
Consultation with all Relevant Persons in the Halyard-2 EMBA in relation to the drilling, completion, commissioning and operation of the Halyard-2 well (i.e. both the Halyard-2 EP and the new stage which is the subject of this revision of the VI Hub EP.) Note, consultation was undertaken based on the Halyard-2 EMBA, which is larger than the VI Hub Operations EMBA. As the associated Sensitive Information Report is an accepted document the records arising from consultation outside the VI Hub Operations EMBA have not been removed from the Halyard-2 Sensitive Information Report, even though they do not relate to consultation with Relevant Persons for the proposed activity for this revision. For example, the Shire of Capel was a Relevant Person for the Halyard-2 Drilling and Completion EP but it is not relevant for VI Hub Operations as this shire falls outside the VI Hub Operations EMBA. As such the Shire of Capel appears in the Halyard-2 SIR but not in Section 4.5 of this EP.	Mid 2023 to May 2024	NOPSEMA accepted Halyard-2 Sensitive Information Report
Consultation with six additional Relevant Persons that are within the VI Hub Operations EMBA but outside the Halyard-2 EMBA. 1) KLC 2) Port Hedland Chamber of Commerce and Industry 3) Town of Port Hedland 4) Shire of Carnamah 5) Shire of Coorow 6) Port Hedland Game Fishing Club	June and July 2024	Addendum to Halyard-2 Sensitive Information Report
Activity update to all Relevant Persons in the VI Hub Operations EMBA, specifically addressing the commissioning, start up and operation of the Halyard-2 well and confirming that these activities do not present a new or increased environmental impact or risk.	August 2024	Addendum to Halyard-2 Sensitive Information Report

4.2 Regulatory Requirements

Table 4-2 outlines the applicable regulatory requirements for consultation with relevant persons for this EP.

Table 4-2:Applicable regulatory requirements

Regulation	Relevant Extract of Regulation
Section 280(2) of the OPGGS Act	2) A person (the first person) carrying on activities in an offshore area under the permit, lease, licence, authority or consent must carry on those activities in a manner that does not interfere with: a. navigation, or b. fishing, or c. the conservation of the resources of the sea and seabed, or d. any activities of another person being lawfully carried on by way of: i exploration for, recovery of or conveyance of a mineral (whether petroleum or not), or ii construction or operation of a pipeline, or iii offshore infrastructure activities (within the meaning of the Offshore Electricity Infrastructure Act 2021), or iv the enjoyment of native title rights and interests (within the meaning of the Native Title Act 1993) v to a greater extent than is necessary for the reasonable exercise of the rights and performance of the duties of the first person.
Regulation 5 of the OPGGS(E)R	environment means: a. ecosystems and their constituent parts, including people and communities, and b. natural and physical resources, and c. the qualities and characteristics of locations, places and areas, and d. the heritage value of places, and includes e. the social, economic and cultural features of the matters mentioned in paragraphs (a), (b), (c) and (d).
Regulation 26(8) of the OPGGS(E)R	(8) All sensitive information (if any) in an environment plan, and the full text of any response by a relevant person to consultation under regulation 25 in the course of preparation of the plan, must be contained in the sensitive information part of the plan and not anywhere else in the plan.
Regulation 34 of the OPGGS(E)R	For the purposes of section 33, the criteria for acceptance of an Environment Plan for an activity are that the plan demonstrates that: vi the titleholder has carried out the consultations required by regulation 25, and vii the measures (if any) that the titleholder has adopted, or proposes to adopt, because of the consultations are appropriate
Regulation 25(1) of the OPGGS(E)R	(1) In the course of preparing an environment plan, or a revision of an Environment Plan, a titleholder must consult each of the following (a relevant person): a. each Commonwealth, State or Northern Territory agency or authority to which the activities to be carried out under the environment plan may be relevant b. if the plan relates to activities in the offshore area of a State—the Department of the responsible State Minister c. if the plan relates to activities in the Principal Northern Territory offshore area—the Department of the responsible Northern Territory Minister d. a person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the environment plan, or the revision of the environment plan e. any other person or organisation that the titleholder considers relevant.
Regulation 25(2) of the OPGGS(E)R	(2) For the purpose of the consultation, the titleholder must give each relevant person sufficient information to allow the relevant person to make an informed assessment of the possible consequences of the activity on the functions, interests or activities of the relevant person.
Regulation 25(3) of the OPGGS(E)R	(3) The titleholder must allow a relevant person a reasonable period for the consultation.
Regulation 25 (4) of the OPGGS(E)R	4) The titleholder must tell each relevant person the titleholder consults that: a. the relevant person may request that particular information the relevant person provides in the consultation not be published, and b. information subject to such a request is not to be published under this Part.
Regulation 21(2)-(3) of the OPGGS(E)R	Description of the environment

Regulation	Relevant Extract of Regulation
	(2) The Environment Plan must: a. describe the existing environment that may be affected by the activity, and b. include details of the particular relevant values and sensitivities (if any) of that environment. Note: The definition of environment in regulation 5 includes its social, economic and cultural features. (3) Without limiting paragraph (2)(b), particular relevant values and sensitivities may include any of the following: a. the world heritage values of a declared World Heritage property within the meaning of the EPBC Act b. the national heritage values of a National Heritage place within the meaning of that Act c. the ecological character of a declared Ramsar wetland within the meaning of that Act d. the presence of a listed threatened species or listed threatened ecological community within the meaning of that Act e. the presence of a listed migratory species within the meaning of that Act f. any values and sensitivities that exist in, or in relation to, part or all of: i a Commonwealth marine area within the meaning of that Act, or ii Commonwealth land within the meaning of that Act.
Regulation22(15) of the OPGGS(E)R	(9) The implementation strategy must provide for appropriate consultation with: a. relevant authorities of the Commonwealth, a State or Territory; and other relevant interested persons or organisations.
Regulation 24(b) of the OPGGS(E)R	The Environment Plan must contain: a report on all consultations under regulation 25 of any relevant person by the titleholder, that contains: a. a summary of each response made by a relevant person, and b. an assessment of the merits of any objection or claim about the adverse impact of each activity to which the environment plan relates, and c. a statement of the titleholder's response, or proposed response, if any, to each objection or claim, and d. a copy of the full text of any response by a relevant person

4.3 Government and Industry Practice

Santos has considered the following NOPSEMA guidance in developing its most recent consultation activities and approach, specifically:

- GL2086 – Consultation in the course of preparing an environment plan – May 2023 (EP Consultation Guideline)
- GL1887 – Consultation with Commonwealth agencies with responsibilities in the marine area – January 2023
- GL1721 – Environment Plan decision making – December 2022
- GN1344 – Environment plan content requirement – December 2022
- GN1488 – Oil Pollution Risk Management – July 2021.
- 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 and Offshore Installations Biosecurity Guide
- Commonwealth Department of Climate Change, Energy, the Environment and Water: Interim Engaging with First Nations People and Communities on Assessments and 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 and Consultation Approach for Unplanned Events.

4.4 Applicable Case Law and Guidance

In addition to considering the regulatory requirements and guidance set out above, in developing this revision Santos has considered the judgments of:

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

The EP Consultation Guideline referred to above provides a summary of the Full Federal Court's interpretation of ‘functions’, ‘activities’ and ‘interests’ referenced in regulation 25(1)(d), adopted by NOPSEMA to assist in informing who may be a relevant person and how relevant persons may be identified, as shown in Table 4-3.

Table 4-3: Relevant person terms and definitions

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

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

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

4.5 Santos’ Consultation Methodology

4.5.1 Overview

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

- consistent with the principles of ecologically sustainable development set out in section 3A of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)
- by which the environmental impacts and risks of the activity will be reduced 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 key steps of:
- 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.

4.5.2 Identifying Relevant Persons

This section outlines the methodology and steps that Santos has used to identify relevant persons for the purposes of its recent consultation.

As described in Table 4-4, 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.

Table 4-4: Relevant person identification process steps

Term
1. Identify the impacts of the planned activities and the risks and impacts of unplanned events.
2. Consider the spatial extent of the environment that may be affected by the activity impacts and risks.
3. Consider and identify aspects of the environment within 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 and Western Australian 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. Update during consultation based on new information, if appropriate.
5. Identify relevant persons within relevant person categories, having regard to items 1-4 above.

Santos considered the nature of the activity (and key component activities) (described in Section 2), the location of the activity (described and depicted in Section 2.1), the impacts of planned activities and the risks and impacts of unplanned events (described in Sections 6 and 7).

Santos also considered the spatial extent of the environment that may be affected by the activity impacts and risks (described in Section 3 and Appendix C).

In June and July 2024, as the EMBA for this EP is slightly larger than Halyard-2 Drilling & Completion EP, in offshore waters close to Port Hedland and the Mid-West, Santos undertook consultation with six additional relevant persons. These were the Kimberley Land Council, Port Hedland Chamber of Commerce and Industry, Town of Port Hedland, Shire of Carnamah, Shire of Coorow and Port Hedland Game Fishing Club (refer to Table 4-9 Summary of Consultation Activities). The City of Karratha was also contacted in addition to being contacted in 2023.

The significant geographical extent of the EMBA (Refer to Section 3.1.1), has resulted in Santos providing information Relevant Persons with interests stretching from the Mid-West region of WA to the Western Kimberley region (see Table 4-7). The EMBA, however, includes large areas where only unplanned activities such as a spill event with an unlikely probability of occurrence, could have any impact on the environment.

There is significant conservatism associated with the EMBA based on low exposure values (as described in Section 3.1.1) which Santos has used in identifying the EMBA, and especially given the modelling process combines a large number of individual spill simulations (120). As such, Santos' methodology has provided for a very broad capture of potential relevant persons and provided ample opportunities for them to provide input on the development of the EP if they feel they may be impacted by the activities.

The modelling at low exposure values is also primarily used to inform Santos' preparedness for potential spill response. The EMBA as modelled does not take into account any spill response activities by Santos which would be implemented and reduce the EMBA extent in event of a spill.

There is also a low likelihood of impacts by unplanned events. In the unlikely event of a worst-case oil spill (Section 7.5.1), the risk for those Relevant Persons who have interests at the extremities of the EMBA is considered to be low, given the significant distances from the activity location.

Therefore, while Santos' methodology has provided for very broad consultation, Santos has given particular focus to those Relevant Persons that are most proximate to the activity location. In addition to direct consultation, Santos also undertakes a range of communications to promote opportunities for other organisations or individuals, to self-identify as potentially relevant persons if they feel that their functions, interests or activities may be affected. These promotional activities include widespread public information campaigns using a range of appropriate media, including, radio, print media, and targeted social media. Details of the public information campaign for this EP are included in Table 4-8 and a schedule of advertising is included in Table 4-9. Advertisements used during this widespread campaign also noted that further information is available on the Santos Consultation Hub website.

Santos also has an online self-nomination form on its Consultation Hub website, where fact sheets and other consultation materials are published and available for download.

Such activities provide a more than reasonable opportunity for organisations or individuals to self-identify as a relevant person for the purpose of Reg 25 consultation, where they considered themselves to have interests, functions or activities that may be affected by the planned activities and for relevant persons to provide their input.

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

Table 4-5 outlines the environmental aspects (described in detail in Section 3) Santos considered for the purpose of identifying relevant person categories.

Table 4-5: Environmental aspects considered for relevant person category identification

Aspects of the Environment	EP Reference
Physical environment	Section 3.2 of this EP
Provincial bioregions	Section 3.2.1 of this EP
Benthic habitats	Section 3.2.2 of this EP
Australian marine parks and state marine parks, management areas, reserves	Section 3.2.3 of this EP
Key ecological features	Section 3.2.3 of this EP
Commonwealth heritage areas (Indigenous and non-Indigenous)	Section 3.2.3 of this EP
Wetlands of international and national significance	Section 3.2.3 of this EP
Biologically important areas and critical habitat	Section 3.2.4 of this EP
Recovery plans	Section 3.2.4 of this EP
Commercial fisheries	Section 0 of this EP
Energy industry	Section 0 of this EP
Telecommunication cables	Section 0 of this EP
Defence activities	Section 0 of this EP
Shipping	Section 0 of this EP
Recreation and tourism	Section 0 of this EP
Cultural features	Section 0 of this EP

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

Reg 25(1)(a)

Commonwealth Government Departments/Agencies.

Reg 25(1)(b) and (c)

Western Australian Government Departments/Agencies.

Reg 25(1)(d)

- 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 and recognised community reference/liaison groups
- recreational fishing
- shipping
- tourism operators.

Santos then undertook the actions outlined in Table 4-6 to identify relevant persons within those categories.

Table 4-6: 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 4-8
Reg 25(1)(a)	
Commonwealth Government departments/agencies	• Review of government agency websites and directories to understand agency roles, functions and responsibilities. • Review of NOPSEMA and government agency guidance on consultation expectations.
Reg 25(1)(b) and (c)	
Western Australian Government departments/agencies	• Review of government agency websites and directories to understand agency roles, functions and responsibilities. • Review of NOPSEMA and government agency guidance on consultation expectations.
Reg 25 (1) (d)	
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.

Relevant person category	Actions to identify relevant persons
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; e.g., websites of conservation organisations whose functions, interests or activities within the EMBA may be affected.
First Nations peoples and groups	• Review of the Judgment and the Appeal Judgment. • Review of publicly available studies, reports and/or other information sources that may assist in identifying or mapping relevant cultural features interests in the EMBA. • Review of EMBA overlap with Native Title determined areas and claims, 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 Representative Aboriginal/Torres Strait Island Bodies (RATSIBs) on Native Title website. • Review of prescribed bodies corporate on the Native Title website. • Conducting searches of public cultural heritage databases relevant to the EMBA. • Review of marine park management plans relevant to the EMBA. • Engagement with government departments/agencies with relevant knowledge or relevant responsibilities.
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 and recognised community reference/liaison groups	• Review of EMBA overlap with boundaries of Local Government Areas. • Review of community reference/liaison groups where EMBA overlaps the 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.

4.5.3 Identification and Consultation of First Nations People and Groups

Santos has developed a comprehensive process for identifying and undertaking effective consultation with First Nations Relevant Persons, which includes, but is not limited to:

Active steps to identify First Nations people and groups who may be Relevant Persons as per actions outlined in Table 4-6 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 to EP development, including:

- Registered Native Title Prescribed Bodies Corporate (RNTBCs, also referred to as 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 that self-identify as relevant (if any).

For this revision, consultation effort has focused in particular on providing opportunities for PBCs to provide input, 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 recognises that PBCs are bound by the traditional laws and customs of the native title group they represent. This includes, among other things, management and protection of cultural values.

Santos provided consultation opportunities and supporting information to PBCs where the EMBA intersects Native Title Determined Areas, allowing them to participate in the consultation process.

The significant geographical extent of the EMBA (Refer to Section 3.1.1), has resulted in Santos providing information to PBCs with coastal interests stretching from the Mid-West region of WA to the Western Kimberley region (see Table 4-7). As described in Section 4.5.2, there is significant conservatism associated with the EMBA and it includes large areas where only unplanned activities with an unlikely probability of occurrence, could have any impact on the environment.

There is also a low likelihood of impacts to cultural values by unplanned events. In the unlikely event of a worst-case oil spill (Section 7.5.1), the risk for those groups with Natives Title interests at the extremities of the EMBA is considered to be low, given the significant distances from the activity location.

Therefore, while Santos' methodology has provided for very broad consultation, Santos has given particular focus to those PBCs that are most proximate to the activity location, including PBCs with interests in lands and waters of the Pilbara region. Santos has been, since mid-2023, actively working with PBCs in this region to establish consultation agreements to support ongoing, regular and effective consultation and engagement activities.

In addition to direct consultation, as described in Section 4.5.2, Santos also undertakes a range of communications to promote opportunities for other First Nations people and groups, and other organisations or individuals, to self-identify as potential Relevant Persons if they feel that their functions, interests or activities may be affected.

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

4.5.4 Relevant Persons

A list of potential relevant persons was developed through application of the above methodology for the purposes of undertaking preliminary consultation to confirm consultation expectations.

This consultation phase was supported by an advertising campaigned outlined in Table 4-9 to raise public awareness about the activity and provide opportunities for authorities, persons or organisations to identify themselves as relevant persons.

For this consultation, no authorities, persons or organisations self-nominated as relevant persons.

Relevant persons consulted for this revision are listed in Table 4-7.

Table 4-7: Relevant persons

Relevant person	Summary of Relevance
Regulation 25(1)(a): Agencies or authorities of the Commonwealth to which the activities to be carried out under the environment plan may be relevant	
Australian Fisheries Management Authority (AFMA)	AFMA is responsible for managing Commonwealth fisheries and is a relevant agency where the activity has the potential to impact on fisheries resources in AFMA managed fisheries. 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 Notice to Mariners.

Relevant person	Summary of Relevance
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 when proposed offshore activities may impact on the safe navigation of commercial shipping in Australian waters.
Department of Agriculture, Forestry and Fisheries (DAFF) – Fisheries	DAFF (fisheries) has primary policy responsibility for promoting the biological, economic and social sustainability of Australian fisheries. The Department is the relevant agency where the activity has the potential to negatively impact fishing operations and/or fishing habitats in Commonwealth waters.
Department of Defence (DoD)	DoD manages the development, maintenance and disposal of the Defence estate, including unexploded ordinance (UXO).
Department of Foreign Affairs and Trade (DFAT)	DFAT promotes and protects Australia's international interests to support our security and prosperity. DFAT works with international partners and other countries to tackle global challenges, increase trade and investment opportunities, protect international rules, keep our region stable and help Australians overseas.
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 greenhouse gas storage.
Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA)	DITRDCA administers the Indian Ocean Territories of the Commonwealth Government.
Director of National Parks (DNP)	DNP is the statutory authority responsible for administration, management and control of Commonwealth marine reserves (CMRs). The DNP is a Relevant Person for consultation where: the activity or part of the activity is within the boundaries of a proclaimed Commonwealth marine reserve activities proposed to occur outside a reserve may impact on the values within a Commonwealth marine reserve, and/or an environmental incident occurs in Commonwealth waters surrounding a Commonwealth marine reserve and may impact on the values within the reserve.
Regulation 25(1)(a): Agencies or authorities 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 the management of protected marine fauna and flora.
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 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)	DPIRD is responsible for managing West Australian fisheries.
Department of Transport (DoT)	DoT is the control agency for marine pollution emergencies in Western Australian State waters.
Department of Water and Environmental Regulation (DWER)	DWER is responsible for environment and water regulation.
Gascoyne Development Commission (GDC)	GDC is a statutory authority of the WA Government that partners with communities, government, business and industry to identify and support projects that benefit its region of interest.
Mid-West Development Commission (MWDC)	MWDC is a statutory authority of the WA Government that partners with communities, government, business and industry to identify and support projects that benefit its region of interest.

Relevant person	Summary of Relevance
Ningaloo Coast World Heritage Advisory Committee (NCWHAC)	The NCWHAC provides advice to the Commonwealth and State Environment Ministers on the protection, conservation and management of the Outstanding Universal Value of the World Heritage area.
Pilbara Development Commission (PDC)	PDC is a statutory authority of the WA Government that partners with communities, government, business and industry to identify and support projects that benefit its region of interest.
Pilbara Ports Authority (PPA)	PPA manages port land and waters for the Ports of Dampier, Port Hedland, Ashburton, Varanus Island and Cape Preston West.
Shark Bay World Heritage Advisory Committee (SBWHAC)	The SBWHAC provides advice to the Commonwealth and State Environment Ministers on the protection, conservation and management of the Outstanding Universal Value of the World Heritage area.
Western Australian Museum (WAM)	WAM maintains a database of shipwrecks off the Western Australian coast.
Wheatbelt Development Commission (WDC)	WDC is a statutory authority of the WA Government that partners with communities, government, business and industry to identify and support projects that benefit its region of interest.
Regulation 25(1)(b): Department of the responsible Western Australian Minister	
Department of Energy, Mines, Industry Regulation and Safety (DEMIRS)	DEMIRS is the department of the relevant State Minister and is required to be consulted under sub regulation 25 (1) of the Environment Regulations.
Regulation 25(1)(d): Persons or organisations whose functions, interests or activities may be affected by the activities to be carried out under the environment plan, or the revision of the environment plan	
Academic and research organisations	
Australian Marine Sciences Association (WA Branch)	Marine research organisation
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	Marine research organisation
Geoscience Australia (GA)	Marine research organisation
Charles Darwin University (CDU)	Marine research organisation
University of Tasmania - Marine Biodiversity Hub (UTAS)	Marine research organisation
University of Western Australia (UWA)	Marine research organisation
Western Australian Marine Science Institution (WAMSI)	Marine research organisation
Commercial fishing – Commonwealth managed	
Commonwealth fisheries that overlap the EMBA (based on AFMA guidance): • Australian Southern Bluefin Tuna Fishery • North West Slope Trawl Fishery • Small Pelagic Fishery • Western Deep Water Trawl Fishery • Western Skipjack Fishery • Western Tuna and Billfish Fishery	Licence holders of these fisheries are entitled to fish within the EMBA and should be consulted based on published AFMA guidance. Licence holders of Commonwealth fishery overlapping the EMBA.
Commercial fishing – Western Australian managed	
State fisheries that overlap the EMBA and are active in the operational area (based on WAFIC guidance). • Mackerel Managed Fishery (Area 2) • Onslow Prawn Managed Fishery	Licence holders of these fisheries are active at the activity location and should be consulted based on published WAFIC guidance.

Relevant person	Summary of Relevance
• Pilbara Line Fishery (Condition) • Pilbara Trap Managed Fishery • West Coast Deep Sea Crustacean Managed Fishery	
Energy industry – Petroleum titleholders and GHG permit holders	
3D Energi Ltd (previously known as 3D Oil Ltd)	Titleholder within the EMBA
Beagle No. 1	Titleholder within the EMBA
BP Developments Australia	Titleholder within the EMBA
Carnarvon Energy	Titleholder within the EMBA
Chevron Australia	Titleholder within the EMBA
Coastal Oil & Gas	Titleholder within the EMBA
Eni Australia	Titleholder within the EMBA
Finder	Titleholder within the EMBA
INPEX	Titleholder within the EMBA
Jadestone Energy	Titleholder within the EMBA
KATO Energy	Titleholder within the EMBA
KUFPEC	Titleholder within the EMBA
Mobil Australia	Titleholder within the EMBA
Pathfinder Energy	Titleholder within the EMBA
Skye Energy	Titleholder within the EMBA
Vermilion Oil & Gas Australia	Titleholder within the EMBA
Western Gas	Titleholder within the EMBA
Woodside Energy Ltd	Titleholder within the EMBA
Environmental conservation organisations	
Australian Conservation Foundation (ACF)	ACF is a peak conservation body with an interest in activities that may affect the marine environment.
Cape Conservation Group	CCG is a volunteer, not-for-profit organisation that is involved in protecting the terrestrial and marine environment of the North West Cape.
Care for Hedland	Care for Hedland is an independent environmental interest group, that pursues a shared vision of environmental awareness and improvements for the townships of Port and South Hedland, along with the wider Pilbara region.
Conservation Council of WA (CCWA)	CCWA is a peak conservation body with an interest in activities that may affect the marine environment.
Greenpeace Australia Pacific (GAP)	GAP is a peak conservation body with an interest in activities that may affect the marine environment.
International Fund for Animal Welfare (IFAW)	IFAW is a peak conservation body with an interest in activities that may affect the marine environment.
Protect Ningaloo	The Protect Ningaloo campaign aims to protect Exmouth Gulf from the threat of industrialisation, and conserve its outstanding natural, cultural and social values.
Wilderness Society (WS)	WS is a peak conservation body with an interest in activities that may affect the marine environment.
World Wildlife Fund (WWF)	WWF is a peak conservation body with an interest in activities that may affect the marine environment.
First Nations Peoples 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.	

Relevant person	Summary of Relevance
In addition, targeted regional advertising was conducted across the Pilbara region to provide opportunity for individuals whose functions, interests and activities may be affected by the proposed activity to self-identify as relevant persons. No groups or individuals self-identified as relevant persons and none were identified via consultation with the following organisations.	
Representative organisations – Regional	
Kimberley Land Council	Native Title Representative Body, which 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
Yamatji Marlpa Aboriginal Corporation	Native Title Representative Body, which 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.
Murujuga Aboriginal Corporation	Body Corporate that represents the interests of five language groups with interest in the lands and waters of the Burrup Peninsula.
Native Title Prescribed Bodies Corporate – Pilbara region	
Buurabalayji Thalanyji Aboriginal Corporation	Native Title Prescribed Body Corporate that represents the interests of the Corporation's membership who may have interests or activities at the activity location.
Kariyarra Aboriginal Corporation	Native Title Prescribed Body Corporate that represents the interests of the Corporation's membership who may have interests or activities at the activity location.
Nganhurra Thanardi Garrbu Aboriginal Corporation	Native Title Prescribed Body Corporate that represents the interests of the Corporation's membership who may have interests or activities at the activity location.
Ngarluma Aboriginal Corporation	Native Title Prescribed Body Corporate that represents the interests of the Corporation's membership who may have interests or activities at the activity location.
South West Aboriginal Land and Sea Council	Native Title Prescribed Body Corporate that represents the interests of the Corporation's membership who may have interests or activities at the activity location.
Wanparta Aboriginal Corporation	Native Title Prescribed Body Corporate that represents the interests of the Corporation's membership who may have interests or activities at the activity location.
Wirrawandi Aboriginal Corporation	Native Title Prescribed Body Corporate that represents the interests of the Corporation's membership who may have interests or activities at the activity location.
Yinggarda Aboriginal Corporation	Native Title Prescribed Body Corporate that represents the interests of the Corporation's membership who may have interests or activities at the activity location.
Native Title Prescribed Body Corporate – Gascoyne region	
Malgana Aboriginal Corporation	Native Title Prescribed Body Corporate that represents the interests of the Corporation's membership who may have interests or activities at the activity location.
Native Title Prescribed Body Corporate – Mid West region	
Bundi Yamatji Aboriginal Corporation	Native Title Prescribed Body Corporate that represents the interests of the Corporation's membership who may have interests or activities at the activity location.
Industry associations - Commercial fishing	
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	ASBTIA represents the interests of 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.
South East Trawl Fishing Industry Association (SETFIA)	SETFIA represents the interests of represents the interests of the Small Pelagic Fishery.
Tuna Australia (TA)	TA represents the interests of the Western Tuna and Billfish Fishery.

Relevant person	Summary of Relevance
Western Australian Fishing Industry Council (WAFIC)	WAFIC represents the interests of the WA commercial fishing, pearling and aquaculture sector,
Western Rock Lobster (WRL)	WRL is the peak industry body representing the interests of the western rock lobster fishery.
Industry associations - Energy industry	
Australian Energy Producers (AEP), (previously known as Australian Petroleum Production and Exploration Association (APPEA))	AEP represents the interests of oil and gas explorers and producers in Australia and companies providing goods and services to those explorers and producers.
Industry associations - Local government	
Western Australian Local Government Association (WALGA)	WALGA is an independent, member based, not for profit organisation representing and supporting the WA Local Government sector.
Industry associations-Local Industry	
Chamber of Commerce and Industry WA	Regional representative organisation representing the interests of local business in Perth metropolitan areas.
Mid-West Chamber of Commerce and Industry	Regional representative organisation representing the interests of local business in the City of Geraldton-Greenough.
Carnarvon Chamber of Commerce and Industry	Regional representative organisation representing the interests of local business in the Shires of Shark Bay and Carnarvon.
Exmouth 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.
Karratha and Districts Chamber of Commerce and Industry	Regional representative organisation representing the interests of local business.
Port Hedland Chamber of Commerce and Industry	Regional representative organisation representing the interests of local business.
Industry associations – Recreational fishing	
Recfishwest	Recfishwest represents the interests of Western Australia's recreational fishing sector.
Western Australian Game Fishing Association (WAGFA)	WAGFA coordinates the activities of game fishing throughout Western Australia, maintains State game fishing records and data concerning open game fishing tournaments of its member clubs: • Broome Fishing Club • Cockburn Power Boats • Exmouth Game Fishing Club • Fremantle Sailing Club • Geraldton and District Offshore Fishing Club • King Bay Game fishing Club • Marmion Angling and Aquatic Club • Naturaliste Game and Sports Fishing Club • Nor-West Game Fishing Club • Perth Game Fishing Club.
Industry associations – Commercial shipping	
Maritime Industry Australia Ltd (MIAL)	MIAL is Australia's national shipping industry peak body.
Industry Associations – Tourism	
Australian Tourism Industry Council (ATIC)	ATIC is the national representative body for tourism.
Tourism Council of Western Australia (TCWA)	Tourism Council WA is the peak body representing tourism businesses, industries and regions in Western Australia.
Marine Tourism WA (MTWA)	The MTWA is an association made up of charter industry owners and operators.

Relevant person	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	Operator of the following infrastructure, which is in the EMBA: • Darwin-Jakarta-Singapore Cable (DJSC) • North West Cable System (NWCS).
Local government and community liaison groups	
City of Greater Geraldton	The City of Greater Geraldton is a local government area in the Mid West region of Western Australia.
Shire of Shark Bay	The Shire of Carnarvon is a local government area in the Gascoyne region of Western Australia.
Town of Port Hedland	The Town of Port Hedland is a local government area in the Pilbara region of Western Australia.
Shire of Carnarvon	The Shire of Carnarvon is a local government area in the Gascoyne region of Western Australia.
Shire of Carnamah	The Shire of Carnamah is a local government area in the Mid-West region of Western Australia.
Shire of Coorow	The Shire of Coorow is a local government area in the Mid-West region of Western Australia.
Shire of Exmouth	The Shire of Exmouth is a local government area in the Gascoyne region of Western Australia.
Shire of Ashburton	The Shire of Ashburton is a local government area in the Pilbara region of Western Australia.
City of Karratha	The Shire of Karratha is a local government area in the Pilbara region of Western Australia.
Exmouth Community Liaison Group	The Exmouth Community Liaison Group convenes three times a year in Exmouth, in collaboration with neighbouring oil and gas operators. The membership of this group is diverse and currently includes about 40 community representatives. Santos consults with the CLG as part of informing good environmental management practices.
Recreational fisheries	
Exmouth Game Fishing Club (EGFC)	EGFC is an Exmouth based fishing club that represents local fishers who may be active in the EMBA.
Port Hedland Game Fishing Club	The Port Hedland Game Fishing Club is a Port Hedland based fishing club that represents local fishers who may be active in the EMBA.
Ashburton Anglers	Ashburton Anglers is an Onslow based fishing club that represents local fishers who may be active in the operational area.
King Bay Game Fishing Club (KBFC)	KBFC is a Dampier based fishing club that represents local fishers who may be active in the operational area.
Nickol Bay Sportsfishing Club (NBSC)	NBSC is a Dampier based fishing club that represents local fishers who may be active in the operational area.
Port Hedland Game Fishing Club	The Port Hedland Game Fishing Club is a Port Hedland based fishing club that represents local fishers who may be active in the EMBA.
Tourism Operators	
Exmouth-based operators • Evolution Charters Exmouth • Blue Horizon Charters • Fawesome Expeditions Exmouth • Innkeeper Sport Fishing Charters Exmouth • Onstrike Charters Exmouth • Elite Charters	Marine tourism operators active within the EMBA.

Relevant person	Summary of Relevance
• Ningaloo Sportfishing Charters • Peak Sportfishing Adventures • Top Gun Charters • Fishing Charterbase • Exmouth Boat Hire • Exmouth Fishing Adventures • Aquatic Adventures • Seaestar Boat Charters	
Dampier/Karratha operators • Onslow Bay Boat works • Mackerel Islands Fishing Charters • Blue Juice Charters • Monte Bells Safaris • Apache Charters • Pelican Charters	Marine tourism operators active within the EMBA.

4.5.5 Provision of Sufficient Information

Santos provides 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 new stage proposed under this revision
- the environment that may be affected, including depictions of the modelled EMBA and explaining how the EMBA is determined
- the potential environmental impacts and risks of the new stage 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.

The 2023 consultation material and engagement included details of the Halyard-2 drilling & completion activities (drilling, installation and pre-commissioning), along with the inclusion of Halyard-2 in the ongoing operation of the VI Hub (operation of Halyard-2 through the Greater East Spar Infrastructure) which comprises the new stage which is the subject of this revision of the Varanus Island Hub Operations Environment Plan for Commonwealth Waters. Specifically the 2023 consultation material advised that activities will also be "undertaken to support future production through Santos' Varanus Island facilities" [2] and that "Santos may also undertake the activities described in the accepted Varanus Island Hub Operations EP in addition to the Spar-Halyard Infill Project activities"[3] and included a link to that EP.

In August 2024 an email activity update was issued to all Relevant Persons for the Varanus Island Hub Operations activity, which:

[2] Extract from Spar Halyard Infill Project Environmental Plan July 2023 consultation material

[3] Extract from Spar Halyard Infill Project Environmental Plan July 2023 Consultation material.

- included information on the anticipated timing of the Halyard-2 commissioning, start up and operations (i.e. the New Stage of the Activity under Regulation 39(1));
- highlighting that there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP; and
- provided information on those impacts and risks (already described in the in-force and publicly available VI Hub Operations EP).

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

4.5.6 Consultation Approach

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

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

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 proposed activities available on the Santos website at www.santos.com/offshoreconsultation, and providing hyperlinks to this website in consultation emails
- recognising WAFIC's published guidance that petroleum titleholders consult directly with those licence holders 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 Western Australia's estimated 1,500 fishing boat licence holders
- using WAFIC fee-for-service arrangements to circulate Santos' consultation information via email to 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 EMBAs that may have broader implications for recreational fishers; this approach acknowledges DPIRD's estimated 620,000 recreational fishers in Western Australia.

Santos also circulated information to subscribers of the WA Offshore Quarterly Update (July 2023) during the consultation period for this EP, including to some relevant persons identified in this EP. This Update provides subscribers with a regular update on proposed, planned, current and completed activities.

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

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

4.5.7 Reasonable Period for Consultation

Consultation for this revision to the EP has been undertaken in May 2023 to August 2024.

Santos directly contacted relevant persons notifying them of the consultation process and consultation period. Emails were sent to relevant persons to invite feedback for the EP, confirming the date by which feedback was sought.

Santos provided approximately 30 days from the date of initial consultation information being provided, to review and respond with feedback about the proposed activities. In some cases, more time was provided. Santos also sought to accommodate reasonable requests for additional time.

For most identified relevant persons, the consultation period followed a 30-day preliminary consultation period.

In addition, in August 2024 consultation was extended for 15 days, to provide relevant persons with the opportunity to provide any further feedback following the activity update.

This was considered to be a more than reasonable period given the activity update was mostly repeating information already provided in 2023 or included in the current in force EP, there are no new material impacts or risks for Relevant Persons to consider and, during all previous consultation carried out on the current in force EP and prior versions, Relevant Persons did not make any objections to the VI Hub operations activities or claims that those activities are unacceptable.

4.5.8 Consultation Opportunities

Santos offered multiple avenues and mediums for consultation, including:

- provision of a toll free 1800 number
- dedicated email address
- in-person or virtual meetings, as appropriate.

4.5.9 Ongoing Consultation

Santos carries out ongoing consultation during the life of an EP, including after an EP has been accepted by NOPSEMA.

Santos' post EP acceptance consultation implementation strategy is described in Section 8.13 and activity notifications are outlined in Table 8-4.

If, during the course of post acceptance consultation, Santos receives information demonstrating a new or increased environmental impact or risk that is not provided for in this EP, (as in force at the time) Santos will apply its Management of Change process outlined in Section 8.11.2.

Table 4-8: Summary of consultation activities

Activity	Purpose	Timing
Preliminary Consultation		
Website Website content and activity fact sheets developed and made available at https://www.santos.com/offshoreconsultation/	Provide relevant persons with: • information about Santos' consultation obligations and approach • descriptions of proposed activities, including potential activity impacts and risks, and proposed management measures • contact 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 privacy notice.	From 29 May 2023
Advertising Advertisements in the following publications: • The West Australian • Mid-West Times and Geraldton Guardian • Pilbara News • North West Telegraph	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 29 May 2023 (publication details are included in Table 4-9)
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 and establish consultation expectations.	From 29 May 2023
One-to-one meetings Meetings held with authorities, persons and organisations	Provide relevant persons with details on proposed Activities and establish consultation expectations.	From 29 May 2023
Consultation		
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 26 June 2023
Advertising Advertisement confirming commencement of consultation in the following publications:	Promote awareness of proposed Activities and seek feedback from relevant persons.	From 26 June 2023 (additional publication details

Activity	Purpose	Timing
• The West Australian • Mid West Times and Geraldton Guardian • Pilbara News • North West Telegraph		are included in Table 4-9**)**
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 19 July 2023
Community meetings *Exmouth Community Liaison Group meeting*	Information provided to the Group on Santos proposed Activities, including for this EP.	27 July 2023
Consultation materials Email to six additional relevant persons advising the commencement of consultation (as described in Section 4.5.2).	Provide relevant persons with details on proposed Activities and establish consultation expectations.	From 28 June 2024
Consultation materials Email to all identified relevant persons.	Provide details of the Halyard-2 commissioning and start up activity and the associated impacts and risks.	From 9 August 2024

Table 4-9: Additional consultation advertising (May–June 2023)

Publication date	Advertising type	Towns / Communities	Reach
Preliminary Consultation			
Tuesday, 29 May 2023	Press ad – The West Australian	WA State-wide	341,000
Wednesday, 31 May 2023	Press ad – Midwest Times and Geraldton Guardian	Carnamah, Carnarvon, Chapman Valley, Coorow, Coral Bay, Cue, Dongara, Eneabba, Geraldton, Greenough, Jurien, Kalbarri, Leeman, Meekatharra, Mingenew, Moonyoonooka, Morowa, Mount Magnet, Mullewa, Northampton, Perenjori, Port Denison, Shark Bay, Tardun, Tenindewa, Three Springs, Useless Loop, Walkaway, Wandina and Yalgoo	16,739
Wednesday, 31 May 2023	Press ad – Pilbara News	Dampier, Karratha, Onslow, Pannawonica, Paraburdoo, Point Samson, Port Hedland, Roebourne, South Hedland, Tom Price and Wickham	11,545
Wednesday, 31 May 2023	Press ad – North West Telegraph	Marble Bar, Newman, Nullagine, Port Hedland, South Hedland and Wedgefield	5,485
Tuesday, 6 June 2023	Press ad – The West Australian	As above	341,000
Wednesday, 7 June 2023	Press ad – Midwest Times	As above	16,739
Wednesday, 7 June 2023	Press ad – Pilbara News	As above	11,545
Wednesday, 7 June 2023	Press ad – North West Telegraph	As above	5,485
Consultation			
Monday, 26 June 2023	Press ad – The West Australian	As above	415,000

Publication date	Advertising type	Towns / Communities	Reach
Wednesday, 28 June 2023	Press ad – Midwest Times	As above	16,739
Wednesday, 28 June 2023	Press ad – Pilbara News	As above	11,545
Wednesday, 28 June 2023	Press ad – North West Telegraph	As above	5,485
Friday, 30 June 2023	Press ad – Geraldton Guardian	As above	10,012

4.6 Consultation Report

Santos has considered and responded to feedback from relevant persons, which is summarised in Table 4-10 Santos has also included in this table feedback that was received during the preliminary consultation phase.

Santos

Table 4-10: Summary of Consultation Activities

<table>
<tr><th colspan="4">Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant</th></tr>
<tr><th colspan="4">Australian Fisheries Management Authority (AFMA)</th></tr>
<tr><td colspan="4">

On 29 May 2023, Santos emailed Australian Fisheries Management Authority (AFMA) and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and included a link to an information fact sheet about proposed activities. [Con-2133]
On 31 May 2023, AFMA emailed Santos advising it would like to meet to discuss the proposed activities. [Con-2110]
On 7 June 2023, Santos met with AFMA regarding the proposed activities and discussed opportunities to adopt pragmatic and practical approaches for the consultation of licence holders entitled to fish in Commonwealth fisheries. [Con-2027]
On 12 June 2023, Santos responded to AFMA, in follow-up to the conversation the previous week. Santos noted its consultation principles and requested AFMA suggest a contact at DAFF. [Con-2134]
On 29 June 2023, Santos emailed AFMA seeking feedback on activities and advised it had directly consulted licence holders entitled to fish in the EMBA for this activity and had also provided information to organisations that represent these fisheries. [Con-1778]
On 30 June 2023, AFMA emailed Santos advising it had no feedback. [Con-1773]
On 9 August 2024, Santos emailed Australian Fisheries Management Authority (AFMA) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5367].
No additional correspondence or feedback has been received.

</td></tr>
<tr><th>Summary of Objection or Claim</th><th>Assessment of Merits</th><th>Santos' Response Statement</th><th>EP Reference</th></tr>
<tr><td>AFMA confirmed at the meeting of 7 June 2023 that it required pre-start and activity completion notifications.</td><td>Santos notes AFMA's feedback.

Note: consultation was undertaken for Halyard-2 and ongoing operations at the same time. This response was specific to Halyard-2 drilling & completion activities. As such, these notification commitments are outside the scope of this EP, however they appear in the Halyard-2 Drilling and Completion EP and do not appear in Section 8.10(Reporting and Notifications) of this EP.</td><td>Santos will send AFMA activity notifications.</td><td>Refer to Halyard-2 Drilling & Completion EP (9887-650-REP-0001) for notifications associated with this consultation.</td></tr>
<tr><th colspan="4">Australian Hydrographic Office (AHO)</th></tr>
<tr><td colspan="4">

On 26 June 2023, Santos emailed AHO seeking feedback on a number of proposed activities and included a link to an information fact sheet about proposed activities. [Con-1646]
On 27 June 2023, Santos received a standard response email from AHO stating that the data supplied will be registered, assessed, prioritised and validated in preparation for updating Santos' Navigational Charting products. [Con-1768]
On 9 August 2024, Santos emailed Australian Hydrographic Office (AHO) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5368]

</td></tr>
</table>

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 12 August 2024 Santos received an email response from the Australian Hydrographic Office acknowledging receipt of Santos' email. AHO informed Santos that the information supplied shall be registered, assessed, prioritised and validated. [Con-5549] • On 23 August 2024 Santos sent an email reminder to Australian Hydrographic Office (AHO) indicating that consultation relating to the activity update previously emailed on the 9 August 2024 on the commissioning and operation of the Halyard 2 well at the Varanus Island Hub in Western Australia closes on 23 August 2024. Santos reminded the AHO to provide any feedback on this activity update by Friday 23 August 2024 as Santos will be submitting a revised Environment Plan next week. [Con-5564] • No additional correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
AHO provided its standard response on activity notifications that is issued to an operator developing an EP.	*Santos noted AHO's advice.* *Note: consultation was undertaken for Halyard-2 and ongoing operations at the same time. This response was specific to Halyard-2 drilling & completion activities. As such, these notification commitments are outside the scope of this EP, however they appear in the Halyard-2 Drilling and Completion EP and do not appear in Section 8.10 (Reporting and Notifications) of this EP.*	*Santos will notify AHO on any changes to the intended operations.*	*Refer to Halyard-2 Drilling & Completion EP (9887-650-REP-0001) for notifications associated with this consultation.*
Australian Institute of Marine Science (AIMS)			
• On 12 June 2023, Santos emailed AIMS and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2135] • On 26 June 2023, Santos emailed AIMS seeking feedback on proposed activities. [Con-1657] • On 19 July 2023, Santos emailed AIMS by way of reminder on the timeframe for providing feedback. [Con-1666] • On 9 August 2024, Santos emailed Australian Institute of Marine Science (AIMS) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5369] • No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	*Santos considers it has provided sufficient time and opportunity for consultation.* *Santos considers Section 25 consultation complete for this EP.*	*NA*	*No additional EP controls required.*
Australian Maritime Safety Authority (AMSA) – maritime safety			
• On 30 May 2023, Santos emailed AMSA and provided information on a number of proposed activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2136] • On 29 June 2023, Santos emailed AMSA seeking feedback on proposed activities. [Con-1659]			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 19 July 2023, Santos emailed AMSA by way of reminder on the timeframe for providing feedback. [Con-1667] • On 9 August 2024, Santos emailed Australian Maritime Safety Authority (AMSA) – maritime safety to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5370] • No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
While no feedback has been received from AMSA, Santos notes feedback from previous regional consultation activities, including: *Contacting the AHO at datacentre@hydro.gov.au no less than four weeks before operations, with details relevant to the operations to promulgate the appropriate Notice to Mariners.* *Notify AMSA's Joint Rescue Coordination Centre (JRCC) by email rccaus@amsa.gov.au for promulgation of radio-navigation warnings at least 24-48 hours before operations commence.* *Provide updates to both the Australian Hydrographic Office and the JRCC on progress and, importantly, any changes to the intended operations.* *Exhibit appropriate lights and shapes to reflect the nature of operations.* *Set navigation status correctly in the ship's Automatic Identification System (AIS) unit.*	*Santos notes previous feedback provided by AMSA.* *Note: consultation was undertaken for Halyard-2 and ongoing operations at the same time. Previous feedback was more relevant to the drilling & completion activities. As such, these notification commitments are outside the scope of this EP, however they appear in the Halyard-2 Drilling and Completion EP and do not appear Section 8.10 (Reporting and Notifications) of this EP.* *As per previous revisions of the VI Hub Ops EP, Santos will continue to:* *- notify AHO and AMSA's JRCC prior to commencement of vessel-based activities.* *- notify AMSA of any marine pollution incidents as per Table 8-4*		*Refer to Halyard-2 Drilling & Completion EP (9887-650-REP-0001) for notifications associated with this consultation.* *Activity notifications are included in Section 8.10.1, as per previous revisions of the VI Hub Ops EP.*
Australian Maritime Safety Authority (AMSA) – marine pollution			
• On 29 June 2023, Santos emailed AMSA seeking feedback on proposed activities outlined in this revision. [Con-1658] • On 19 July 2023, Santos emailed AMSA by way of reminder on the timeframe for providing feedback. [Con-2461] • On 9 August 2024, Santos emailed Australian Maritime Safety Authority (AMSA) – marine pollution to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5272]. • No correspondence or feedback has been received.			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
• On 29 June 2023, Santos emailed AMSA seeking feedback on proposed activities outlined in this revision. [Con-1658] • On 19 July 2023, Santos emailed AMSA by way of reminder on the timeframe for providing feedback. [Con-2461] • On 9 August 2024, Santos emailed Australian Maritime Safety Authority (AMSA) – marine pollution to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5272]. • No correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
NA	AMSA's roles and responsibilities are defined in the National Plan for Maritime Environmental Emergencies.	NA	No additional EP controls required.
Department of Agriculture, Forestry and Fisheries (DAFF) – Fisheries			
• On 29 May 2023, Santos emailed DAFF and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2138] • On 15 June 2023, Santos met with DAFF (domestic fisheries branch) regarding the proposed activities and discussed opportunities to adopt pragmatic and practical approaches for the consultation of licence holders entitled to fish in Commonwealth fisheries. [Con-2032] • On 29 June 2023, Santos emailed DAFF seeking feedback on proposed activities. [Con-1671] • On 23 July 2023, Santos emailed DAFF by way of reminder on the timeframe for providing feedback. [Con-1672] • On 31 July 2023, DAFF emailed Santos and provided the following feedback: [Con-2121] – AFMA could provide information on fishing effort in areas likely to be directly impacted by proposed activities. • DAFF had no comment in relation to the activity location, further to Santos engaging AFMA on fishing effort and activity implications for licence holders. • DAFF noted more broadly that there were increasing activities occurring in the marine space with numerous consultation processes, with the fishing industry reporting significant consultation fatigue and a lack of capacity to adequately respond to all consultations. DAFF suggested keeping this in mind when Santos conducts its consultations with the fishing industry. • On 9 August 2023, Santos emailed DAFF to notify that Santos had engaged AFMA for activity consultation, reviewed AFMA fishing effort publications, and had provided consultation information to licence holders and representative organisations. Santos also confirmed it was working with a number of government authorities and representative organisations to develop consultation methods that met Regulatory requirements, while minimising fatigue to licence holders. [Con 2216] • On 9 August 2024, Santos emailed Department of Agriculture, Fisheries and Forestry (DAFF) - Fisheries to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5373] • On 9 August 2024, Santos received an auto-reply email from the Department of Agriculture, Fisheries and Forestry (DAFF) – Fisheries advising the respondent was out of the office and would reply the following business day. [Con-5547] • On 22 August 2024, Santos received an email response from the DAFF noting that Santos' planned activities are well away from areas of recent fishing effort in the Western Deepwater Trawl Fishery, and the North West Slope Trawl Fishery. As a result DAFF had no comments on Santos' proposal. DAFF assumed Santos has separately contacted the Australian Fisheries Management Authority (AFMA) for comment. [Con-5562]			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 22 August 2024, Santos emailed DAFF to acknowledge their response that the Halyard-2 Operations Varanus Island Hub Operations Environment Plan activity revision is well away from areas of recent fishing effort in the Western Deepwater Trawl Fishery, and the North West Slope Trawl Fishery. Santos also acknowledged that DAFF has no comments on Santos' proposal. Santos also confirmed that the Australian Fisheries Management Authority (AFMA) was contacted separately for comment on 09 August 2024. [Con-5563]			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
DAFF confirmed at the meeting of 29 May 2023 that it required pre-start and activity completion notifications	Santos notes DAFF's feedback. Note: consultation was undertaken for Halyard-2 and ongoing operations at the same time. This response was specific to Halyard-2 drilling & completion activities. As such, these notification commitments are outside the scope of this EP, however they appear in the Halyard-2 Drilling and Completion EP and do not appear in *Section 8.10* (Reporting and Notifications) of this EP.	Santos will notify DAFF's under the Halyard-2 Drilling & Completion EP.	Refer to Halyard-2 Drilling & Completion EP (9887-650-REP-0001) for notifications associated with this consultation.
DAFF advised that AFMA could provide fishing effort data on areas that were likely to be impacted by proposed activities.	Santos notes DAFF advice on sourcing fishing effort data.	Santos has reviewed ABARES fishery status reports in the development of this revision.	See Section 0
DAFF had no additional comments on proposed activities.	Santos notes DAFF feedback.	NA	NA
DAFF commented on consultation fatigue in the fishing industry.	Outside the consultation scope of this EP.	NA	NA
Department of Defence (DoD)			
• On 29 May 2023, Santos emailed DoD and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2238] • On 26 June 2023, Santos emailed DoD seeking feedback on proposed activities. [Con-1662] • On 7 July 2023, DoD emailed Santos with feedback regarding the proposed activities, noting the activity areas are located within the North Australian Exercise Area (NAXA) and restricted airspace. DoD advised Santos must inform itself as to the risks associated with conducting activities in the NAXA and restricted airspace. DoD requested continued liaison with Australian Hydrographic Service for Notices to Mariners (NOTMAR) and to ensure the AHS (AHO) is notified at least three weeks prior to the commencement of activities. [Con-1796] • On 24 July 2023, Santos emailed DoD to confirm Santos will notify DoD for any activities and also confirm the AHS (AHO) is being consulted. Santos acknowledged DoD's advice in regard to location, identification, removal or damage to equipment from UXOs. [Con-1798] • On 9 August 2024, Santos emailed Department of Defence (Defence) - Defence Infrastructure Division, Defence Support & Reform Group to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5374]			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• No additional correspondence or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
DoD advised Santos that the activities will occur within an area designated for military exercises and provided advice on the responsibilities of an Operator in the area.	Santos noted DoD's advice. Note: consultation was undertaken for Halyard-2 and ongoing operations at the same time. This response was specific to Halyard-2 drilling & completion activities. As such, these notification commitments are outside the scope of this EP, however they appear in the Halyard-2 Drilling and Completion EP and do not appear in *Section 8.10* (Reporting and Notifications) of this EP.	Santos will confirm restricted air space status with the Department as part of its commencement of activity notification).	Refer to Halyard-2 Drilling & Completion EP (9887-650-REP-0001) for notifications associated with this consultation.
DoD confirmed it required pre-start and activity completion notifications.	Note: consultation was undertaken for Halyard-2 and ongoing operations at the same time. This response was specific to Halyard-2 drilling & completion activities. As such, these notification commitments are outside the scope of this EP, however they appear in the Halyard-2 Drilling and Completion EP and do not appear in *Section 8.10* (Reporting and Notifications) of this EP.	Santos confirmed activity notifications, under the Halyard-2 Drilling & Completion EP.	.

Department of Foreign Affairs and Trade (DFAT)

- On 8 June 2023, Santos emailed DFAT to advise of preliminary consultation regarding proposed activities outlined in this revision. [Con-2368]
- On 14 June 2023, DFAT noted activities are proposed to be conducted in Australian waters and that environmental management is a matter for Australian regulators. DFAT provided contact details for DFAT personnel should there be a need to contact the governments of Timor-Leste or Indonesia. DFAT also stated that AMSA will normally inform DFAT when a maritime incident involves another country. However, DFAT provided contact details should Santos wish to contact DFAT direct in the event of an emergency - GlobalWatchOffice@dfat.gov.au. [Con-2111]
- On 20 June 2023, Santos emailed DFAT thanking them for their feedback and sought additional information about DFAT's role with respect to international engagements and sought a meeting with DFAT. [Con 2513]
- On 23 June 2023 Santos sent a follow up meeting request. [Con 2514]
- On 7 July 2023, Santos provided information to DFAT relating to proposed activities, including information about worst case spill scenarios and international implications, seeking confirmation that DFAT will undertake country-to-country discussions for oil spill response should a spill leave Australian waters where AMSA does not have authority for planning and response. [Con-1782]
- On 7 July 2023, DFAT emailed Santos confirming that AMSA should remain the primary contact point in an emergency. AMSA will inform DFAT as soon as the emergency becomes a matter for DFAT. DFAT again provided contact details for DFAT personnel should there be a need to discuss matters relating to Timor-Leste or Indonesia. [Con-1788]
- On 13 July 2023, Santos emailed DFAT and acknowledged the contact details provided and will include these in Santos' contacts directory. [Con-1791]]

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 9 August 2024, Santos emailed Department of Foreign Affairs and Trade (DFAT) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5375] • On 9 August 2024, Santos received an auto-reply email from the Department of Foreign Affairs and Trade advising the respondent was out of the office until 12 August 2024. [Con-5527] • On 23 August 2024 Santos telephoned Department of Foreign Affairs and Trade with an attempt to follow up on the auto-generated email response received on 9 August 2024. [Con-5565] • On 23 August 2024 Santos sent an email reminder to Department of Foreign Affairs and Trade (DFAT) indicating that consultation relating to the activity update previously emailed on the 9 August 2024 on the commissioning and operation of the Halyard 2 well at the Varanus Island Hub in Western Australia closes on 23 August 2024. Santos reminded the DFAT to provide any feedback on this activity update by Friday 23 August 2024 as Santos will be submitting a revised Environment Plan next week. [Con-5566] • No substantive response or feedback has been received.			
Summary of Objection or Claim	***Assessment of Merits***	***Santos' Response Statement***	***EP Reference***
DFAT advised that AMSA should be the primary contact in the event of an emergency and that AMSA would contact DFAT if the matter became a matter for DFAT. DFAT provided contact details for DFAT personnel should there be a need to contact the governments of Indonesia or Timor-Leste.	With the exception of hydrocarbon spill's, environmental risks and impacts from the EP are localized and remain within Australia's Exclusive Economic Zone. The likelihood of an unmitigated spill reaching the territorial lands and waters of other countries is low for this activity. In the unlikely event that a hydrocarbon spill enters international or neighbouring country waters, Santos will seek direction and assistance from the DFAT. Santos has established communications channels and protocols with DFAT in the event of an emergency that would require country-to-country engagements. Santos also notes that response planning and prioritisation of areas for protection outside of Australian territorial waters would be undertaken by the respective country under its respective spill response arrangements. Note: consultation was undertaken for Halyard-2 and ongoing operations at the same time. This response was specific to Halyard-2 drilling & completion activities. As such, these notification commitments are outside the scope of this EP, however they appear in the Halyard-2 Drilling and Completion EP and do not appear in	Santos will include contact details provided by DFAT in its contacts directory in the event that country-to-country engagement is required for emergency response planning. Santos acknowledges the role that DFAT would play more broadly in country-to-country discussions in the event that a marine pollution incident had implications for other nation interests.	No additional EP controls required. Refer to Halyard-2 Drilling & Completion EP (9887-650-REP-0001) Sections 7.6 to 7.9 for the risk assessment and controls for hydrocarbon spills in the event that a hydrocarbon spill enters international or neighbouring country waters.

Santos

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
	Section 8.10 (Reporting and Notifications) of this EP. The EMBA for the VI Hub Ops EP remains within Australia's Exclusive Economic Zone.		
Department of Industry, Science and Resources (DISR)			
• On 26 June 2023, Santos emailed DISR seeking feedback on proposed activities outlined in this revision. [Con-1665] • On 19 July 2023, Santos emailed DISR by way of reminder on the timeframe for providing feedback. [Con-1669] • On 9 August 2024, Santos emailed Department of Industry, Science and Resources (DISR) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5377]. • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA)			
• On 26 June 2023, Santos emailed DITRDCA seeking feedback on proposed activities outlined in this revision. [Con-1663] • On 18 July 2023, DITRDCA emailed Santos advising it has no specific comments at this stage. [Con-1799] • On 26 July 2023, Santos emailed DITRDCA acknowledging it had no comments. [Con-1800] • On 9 August 2024, Santos emailed Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5376]. • On 9 August 2024, Santos received an auto-generated email indicating that the mailbox is closed. [Con-5520] • On 13 August 2024, Santos submitted an online general request form requesting DITRDCA respond with a monitored mailbox to enable Santos to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. [Con-5521] • On 13 August 2024, Santos received an auto-generated email response from DITRDCA acknowledging receipt of Santos' email. [Con-5522] • No substantive response or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
Nil	NA	NA	NA
Director of National Parks (DNP)			
• On 30 May 2023, Santos emailed DNP and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2140]			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 26 June 2023, Santos emailed DNP seeking feedback on proposed activities. [Con-1664] • On 19 July 2023, Santos emailed DNP by way of reminder on the timeframe for providing feedback. [Con-1670] • On 9 August 2024, Santos emailed Director of National Parks (DNP) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5378]. • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
While no feedback has been received from DNP, Santos notes feedback from previous regional consultation activities, including: • consideration of activity overlap with Australian Marine Parks • consideration of Biologically Important Areas and Key Ecological Features • consideration of Australian marine parks and their representativeness • in the case of an emergency response, 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.	Santos notes previous feedback provided by DNP.	All previously advised considerations are included in the relevant sections of the EP.	Reporting requirements to DNP in the event of an emergency response are included in notification requirements in Table 8-4
Regulation 25(1)(b): 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)			
• On 30 May 2023, Santos emailed DBCA and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2144] • On 26 June 2023, Santos emailed DBCA seeking feedback on proposed activities. [Con-1647] • On 19 July 2023, Santos emailed DBCA by way of reminder on the timeframe for providing feedback. [Con-1723] • On 26 July 2023, DBCA emailed Santos with feedback regarding the proposed activities as per the table below. [Con-2147] • On 14 Aug 2023, Santos emailed DBCA with feedback to address their queries. [Con-2281] • On 9 August 2024, Santos emailed Department of Biodiversity, Conservation and Attractions (DBCA) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5380]. • On 22 August 2024, DBCA emailed Santos with feedback regarding the proposed activity revision. DBCA noted it had has previously provided comment to Santos in relation to petroleum production activities in proximity to ecologically sensitive receptors including marine parks and other reserves managed by DBCA under the CALM Act. DBCA noted its			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
comments relate to the need for comprehensive baseline monitoring of these receptors and oil spill response preparedness. DBCA noted it has received responses from Santos in relation to this advice, and in this communication DBCA reiterated its comments in relation to important reserves including but not limited to the Barrow Island Marine Management Area (M 11), Montebello Islands Marine Park (M 9) and Lowendal Islands Nature Reserve (R 33902) which are located in proximity to and within the EMBA by the proposed activities (as identified by Santos' modelling). DBCA noted that should Santos have any additional information in relation to its monitoring or oil spill response preparedness for these decommissioning activities for DBCA's information, this would be welcome. [Con-5588] • On 27 August 2024 Santos emailed DBCA to acknowledge their email response regarding the Halyard-2 Operations Varanus Island Hub Operations Environment Plan activity revision. Santos recognized DBCA has previously provided comment to Santos in relation to petroleum production activities in proximity to ecologically sensitive receptors including marine parks and other reserves managed by DBCA under the CALM Act, and those comments relate to the need for comprehensive baseline monitoring of these receptors and oil spill response preparedness. Santos advised it had previously responded to DBCA in relation to this advice and understands DBCA would like to reiterate its comments in this instance in relation to important reserves including but not limited to the Barrow Island Marine Management Area (M 11), Montebello Islands Marine Park (M 9) and Lowendal Islands Nature Reserve (R 33902) which are located in proximity to and within the area of the environment that may be affected by the proposed activities (as identified by Santos' modelling). Santos acknowledged it shall provide an update if there any changes to activity scope and modelling that would have implications for DBCA managed reserves. [Con-5592]			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
DBCA noted that the information provided indicated that Santos' proposed offshore activities were located in proximity to the Barrow Island Marine Management Area and other associated marine parks and island reserves. DBCA also noted that there were a number of ecologically important areas within the area of the EMBA by the proposed activities if there was a substantial hydrocarbon release. DBCA noted that baseline values of the EMBA should be understood and documented prior to any operations commencing that have the potential to lead to hydrocarbon releases.	Santos notes feedback provided by DBCA.	Santos acknowledges DBCA's comments in relation to baseline survey data. Our existing baseline data is reviewed every two years. In areas where limited baseline data is available, post spill pre-impact monitoring for the relevant receptors will be carried out in line with Santos' Operational and Scientific Monitoring Plan (OSMP). However, the ability to undertake this monitoring will depend on the arrival time for the oil to contact the sensitive receptors.	No additional EP controls required. The predicted arrival time for oil to contact key sensitive receptors is outlined in Sections 7.6 to 7.9.
DBCA noted that the potential impact to conservation significant species should also be assessed, accounting for the scale, location and biological significance of the proposed activities. DBCA recommended that vessel lighting should be designed to align with the standard of the National Light Pollution Guidelines for Wildlife (DCCEEW 2023) as far as practicable.	Santos notes feedback provided by DBCA. Note: consultation was undertaken for Halyard-2 and ongoing operations at the same time. Responses relating to MODU lighting are outside the scope of this EP, as they are specific to the Halyard-2 Drilling and Completion EP.	Santos acknowledges there are ecologically important areas located in the vicinity of the proposed operations and these values and sensitivities are documented in the EP. The management of potential risks and impacts to these sensitivities are documented in the EP.	No additional EP controls required. Refer to the following Sections of the EP: Sections 7.6 to 7.9 Hydrocarbon Releases Section 5 Environment Risk and Impact Assessment process. Section 6.2 Light Emissions Section 7.2 Marine Fauna Interactions.
DBCA recommended that Santos assess what baseline information was required	Santos notes feedback provided by DBCA.	Santos acknowledges DBCA's comments in relation to baseline survey data. Our existing	No additional EP controls required.

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
commensurate with the level of risk associated with the proposed activities and identify suitable sources/methods to attain that information such that Santos can ensure any impacts on ecological values and recovery of these values can be clearly identified, monitored and remediated.		baseline data is reviewed every two years. In areas where limited baseline data is available, post spill pre-impact monitoring for the relevant receptors will be carried out in line with Santos' Operational and Scientific Monitoring Plan (OSMP). However, the ability to undertake this monitoring will depend on the arrival time for the oil to contact the sensitive receptors. The EP describes: Predicted arrival time for oil to contact key sensitive receptors Environment Risk and Impact Assessment process Risk and impact assessment on High Environment Value areas The OPEP: Identifies Priority Protection Areas for response arrangements. Santos is confident that its risk and impact assessment process, baseline survey data review, and OSMP, addresses potential impacts on ecological values and recovery of these values.	Refer to the following Sections of the EP: Section 7 - predicted arrival time for oil to contact key sensitive receptors is outlined in of the EP and risk and impact assessment on High Environment Value areas. Section 5 - Environment Risk and Impact Assessment process Santos follows to determine the risk and impact of an activity. OPEP - Priority Protection Areas for response arrangements.
DBCA advised that published DBCA marine park monitoring may not be suitable to provide all baseline information required for oil spill risk assessment and management planning. DBCA encouraged Santos to acquire necessary information to implement a Before-After, Control-Impact (BACI) framework in planning and evaluating its management response.	Santos notes feedback provided by DBCA.	Santos acknowledges the monitoring reports available from the DBCA website. Santos notes DBCAs comments in relation to the BACI framework and advise the required responses to satisfy the BACI framework are contained within the Scientific Monitoring Plans attachment included in the OPEP.	No additional EP controls required.
DBCA provided contact details and communications expectations in the event of an actual or impending hydrocarbon release. DBCA also advised it would not implement an oiled wildlife management response on behalf of a petroleum operator except as part of a whole of government response mandated by regulatory decision makers,	Santos notes feedback provided by DBCA.	Santos confirms in the event of a hydrocarbon release, it will notify DBCA's Pilbara office as soon as practicable on telephone number 08 9182 2000. Santos will also work with the Department of Transport to ensure effective management, monitoring and clean-up of any DBCA interests if	Activity notifications are included in Table 8-4

Santos

<table>
<tr><th colspan="4">Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant</th></tr>
<tr><td>and any advice or assistance from DBCA would occur on a full cost recovery basis.
DBCA recommended Santos commit to the monitoring and clean-up of any DBCA interests affected by an oil spill in consultation with DBCA.</td><td></td><td>affected by an oil spill, in consultation with DBCA.
Santos also acknowledges DBCA's advice that it will not implement an oiled wildlife management response on behalf of a petroleum operator except as part of a whole of government response mandated by regulatory decision makers led by DoT (state's Hazard Management Agency) and any advice or assistance from DBCA, at any scale, will occur on a full cost recovery basis. Santos' also commits to consult with DBCA as required on monitoring and clean-up activity in the event of an oil spill and this commitment will be reflected in the OPEP.</td><td></td></tr>
<tr><th colspan="4">Department of Jobs, Tourism, Science and Innovation (JTSI)</th></tr>
<tr><td colspan="4">On 30 May 2023, Santos emailed JTSI and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2239]
On 26 June 2023, Santos emailed JTSI seeking feedback on proposed activities. [Con-1645]
On 19 July 2023, Santos emailed JTSI by way of reminder on the timeframe for providing feedback. [Con-1720]
On 9 August 2024, Santos emailed Department of Jobs, Tourism, Science and Innovation (JTSI) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5379].
No correspondence or feedback has been received.</td></tr>
<tr><th>Summary of Objection or Claim</th><th>Assessment of Merits</th><th>Santos' Response Statement</th><th>EP Reference</th></tr>
<tr><td>NA</td><td>Santos considers it has provided sufficient time and opportunity for consultation.
Santos considers Section 25 consultation complete for this EP.</td><td>NA</td><td>No additional EP controls required.</td></tr>
<tr><th colspan="4">Department of Planning, Lands and Heritage (DPLH)</th></tr>
<tr><td colspan="4">On 30 May 2023, Santos emailed DPLH and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2240]
On 26 June 2023, Santos emailed DPLH seeking feedback on proposed activities. [Con-1648]
On 28 July 2023, DPLH emailed Santos to notify that it had undertaken a review of the proposed project area against the Aboriginal Cultural Heritage Directory. It confirmed the project area does not intersect with any known Aboriginal Cultural Heritage. [Con-1765]
On 31 July 2023, Santos emailed DLPH acknowledging it had no feedback. [Con-1754]</td></tr>
</table>

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 9 August 2024, Santos emailed Department of Planning, Lands and Heritage (DPLH) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5383]. • No additional correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NIL	NA	NA	NA
Department of Primary Industries and Regional Development (DPIRD)			
• On 30 May 2023, Santos emailed DPIRD and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and included a link to an information fact sheet about proposed activities in this revision. [Con-2148] • On 9 June 2023, Santos met with DPIRD regarding the proposed activities and discussed opportunities to adopt pragmatic and practical approaches for the consultation of licence holders entitled to fish in Western Australian fisheries. [Con-2035] • On 29 June 2023, Santos emailed DPIRD seeking feedback on proposed activities. [Con-1710] • On 19 July 2023, Santos emailed DPIRD by way of reminder on the timeframe for providing feedback. [Con-1742] • On 20 July 2023, DPIRD emailed Santos and advised it noted Santos' advice that it was actively consulting with relevant commercial fishing sectors and had no further comments at this time regarding proposed activities. [Con-1759] • On 26 July 2023, Santos emailed DPIRD acknowledging DPIRD had no comments on proposed activities. [Con-1749] • On 9 August 2024, Santos emailed Department of Primary Industries and Regional Development (DPIRD) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5384]. • No additional correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
DPIRD confirmed at the meeting of 9 June 2023 that it required pre-start and activity completion notifications.	Santos notes DPIRD's feedback. Note: consultation was undertaken for Halyard-2 and ongoing operations at the same time. This response was specific to Halyard-2 drilling & completion activities. As such, these notification commitments are outside the scope of this EP, however they appear in the Halyard-2 Drilling and Completion EP and do not appear in Section 8.10(Reporting and Notifications) of this EP. As per previous revisions of the VI Hub Ops EP, Santos will continue to notify DPIRD if marine pests or disease are suspected.	Santos will send DPIRD activity notifications.	Refer Halyard-2 Drilling & Completion EP (9887-650-REP-0001) for pre-start notifications. Activity notifications are included in Section 8.10 as per previous revisions of the VI Hub Ops EP.

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant

Department of Transport (DoT)

- On 29 June 2023, Santos emailed DoT seeking feedback on proposed activities outlined in this revision. [Con-1711]
- On 5 July 2023, DoT emailed Santos advising if there is a risk of a spill impacting State waters from any of the proposed activities, please ensure the DoT is consulted as outlined in the Department of Transport Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (July 2020). [Con-1757]
- On 26 July 2023, Santos emailed DoT acknowledging its request via email on 5 July 2023. In accordance with this guidance, Santos will provide draft OPEPs for respective activities, noting that we have already received feedback for those Environment Plans currently under assessment by the Regulator. [Con-1750]
- On 14 August 2023, Santos emailed DoT confirming an update to the OPEP for the VI Hub Asset Removal Operations EP and sought further feedback from DoT [Con 2305]
- On 21 August 2023, DoT emailed Santos stating if there is no change in risk to State waters, then it does not need to see the updated draft OPEP. [Con-2309]
- On 30 October 2023, Santos emailed DoT regarding the Halyard-2 Drilling & Completion, advising some changes had been made to the VI Hub OPEP. Santos asked DoT if it would like to review the latest draft or would prefer to receive a copy of the accepted version of the OPEP. [Con-2574]
- On 3 November 2023, DoT emailed Santos advising based on the information provided, including confirmation that the addition of the Halyard-2 Drilling & Completion doesn't constitute an increased risk to State waters outside of what is already covered in the VI Hub OPEP. DoT does not need to review the Rev 15 version of the VI Hub OPEP at this stage. DoT would like a copy of the final OPEP. [Con-2616]
- On 3 November 2023, Santos emailed DoT acknowledging its reply and its request to see the accepted version of the OPEP. [Con-2618]
- On 9 August 2024, Santos emailed DoT – marine pollution to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5386]
- On 9 August 2024, Santos received an auto-generated email response from DoT - Marine Pollution advising it will be actioned as soon as possible by the relevant officer. [Con-5525]
- On 12 August 2024, Santos received an email requesting consultation in accordance with its published guidance note should a change to the risk of a spill impacting State waters from any of the proposed activities occur. [Con-5550]
- On 19 August 2024, Santos emailed the DoT responding to feedback for the Halyard-2 Operations Varanus Island Hub Operations Environment Plan activity revision. DoT requested consultation should a change to the risk of a spill impacting State waters from any of the proposed activities occur. Consultation is outlined in the DoT Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (July 2020). Santos notes no objection or claim to the activity update is raised and on that basis, Santos considers the consultation with DoT the Halyard-2 Operations Varanus Island Hub Operations Environment Plan is concluded. [Con-5551]

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
DoT requested to see the accepted version of the OPEP.	Santos accepts DoT's request for an accepted OPEP	Santos acknowledged DoT's request for an accepted OPEP.	Activity notifications committed to in previous revisions of the VI Hub Ops EP as well as the commitment to provide DoT with a copy of the OPEP are included in Table 8-4
DoT requested consultation in accordance with its published guidance note, should a change to the risk of a spill impacting State waters from any of the proposed activities.	DoT did not raise objections or claims		No Additional controls.

Department of Water and Environmental Regulation (DWER)

- On 30 June 2023, Santos emailed Department of Water and Environmental Regulation (DWER) regarding consultation for proposed Carnarvon Basin activities outlined in this revision. [Con-1673]

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 23 July 2023, Santos emailed DWER a reminder of proposed Carnarvon Basin activities for consultation. [Con-1716] • On 26 July 2023, DWER emailed Santos in response to an email on 24 July 2023. DWER requested an extension to 4 August 2023 in order to provide feedback regarding proposed Carnarvon Basin activities. [Con-1763] • On 31 July 2023, Santos emailed DWER and confirmed an extension had been provided. [Con-1753] • On 4 August 2023, DWER emailed Santos with feedback for this EP, requesting: [Con-2153] – Compliance with National Light Pollution Guidelines – considering recommendations within these guidelines and relevant actions committed to. – Notification in the event of a spill. • On 18 August 2023 Santos emailed DWER and provided a response to its feedback of 4 August 2023. [Con-2300] • On 9 August 2024, Santos emailed Department of Water and Environmental Regulation (DWER) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5381] • On 9 August 2024, Santos received an auto-generated email response from the Department of Water and Environmental Regulation acknowledging receipt of Santos' email. [Con-5523] • On 23 August 2024 Santos sent an email reminder to Department of Water and Environment Regulation (DWER) indicating that consultation relating to the activity update previously emailed on the 9 August 2024 on the commissioning and operation of the Halyard 2 well at the Varanus Island Hub in Western Australia closes on 23 August 2024. Santos reminded the DWER to provide any feedback on this activity update by Friday 23 August 2024 as Santos will be submitting a revised Environment Plan next week. [Con-5567] • On 23 August 2024, Santos received an auto-generated email response from the Department of Water and Environmental Regulation acknowledging receipt of Santos' email and stating it would aim to reply within 10 business days of receipt. [Con-5568] • No additional correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
DWER advised compliance with National Light Pollution Guidelines is not a control measure. The recommendations within these guidelines should be considered and relevant actions committed to.	Santos has considered DWER's feedback. Note: consultation was undertaken for Halyard-2 and ongoing operations at the same time. Responses relating to MODU lighting are specific to the Halyard-2 Drilling and Completion EP and therefore are outside the scope of this EP, however, all other commitments are relevant to both activities.	Santos has addressed the impacts of lighting from vessels and 24-hour operations within Section 6.2 of the EP. Santos has committed to reduce impacts to marine fauna from lighting on vessels and MODU through limiting lighting to that required by safety and navigational lighting requirements. Additionally, Santos has also committed to not displace marine turtles from habitat critical to the survival of the species or disrupt biologically important behaviours from occurring within biologically important areas. Implementation of the National Light Pollution Guidelines has been assessed in Section 6.2.4 of the EP.	No additional controls required.
DWER requested to be notified in the event of a spill.	Santos has considered DWER's feedback	Santos will notify DWER in the event of a reportable spill incident as soon as practicable. Santos will contact DWER on the 24-hour pollution watch hotline 1300 784	Activity notifications are included in Table 8-4.

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
		782 and email: pollutionwatch@dwer.wa.gov.au consistent with the requirements of the Environmental Protection Act 1986 (Section 72) and Environmental Protection (Unauthorised Discharge) Regulations 2004. Please advise if there have been any changes to the contact details you wish to be included in the EP.	

Gascoyne Development Commission (GDC)

- On 30 May 2023, Santos emailed Gascoyne Development Commission and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2278]
- On 27 June 2023, Santos emailed Gascoyne Development Commission seeking feedback on proposed activities. [Con-1655]
- On 19 July 2023, Santos emailed Gascoyne Development Commission by way of reminder on the timeframe for providing feedback. [Con-1734]
- On 9 August 2024, Santos emailed Gascoyne Development Commission (GDC) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5397].
- No correspondence or feedback has been received.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.

Mid-West Development Commission (MWDC)

- On 2 June 2023, Santos emailed MWDC and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2469]
- On 27 June 2023, Santos emailed MWDC seeking feedback on proposed activities. [Con-1654]
- On 19 July 2023, Santos emailed MWDC by way of reminder on the timeframe for providing feedback. [Con-1732]
- On 9 August 2024, Santos emailed Mid-West Development Commission (MWDC) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5400].
- On 9 August 2024, Santos emailed Ningaloo Coast World Heritage Advisory Committee (NCWHAC) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5388].
- No correspondence or feedback has been received.

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA.	No additional EP controls required.

Ningaloo Coast World Heritage Advisory Committee (NCWH AC)

- On 30 May 2023, Santos emailed NCWHAC and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and included a link to an information fact sheet about proposed activities in this revision. [Con-2277]
- On 27 June 2023, Santos emailed NCWHAC seeking feedback on proposed activities. [Con-1649]
- On 19 July 2023, Santos emailed NCWHAC by way of reminder on the timeframe for providing feedback. [Con-1725]
- On 9 August 2024, Santos emailed Pilbara Development Commission (PDC) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5398].
- No correspondence or feedback has been received.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA.	No additional EP controls required.

Pilbara Development Commission (PDC)

- On 30 May 2023, Santos emailed PDC and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and included a link to an information fact sheet about proposed activities in this revision. [Con-2150]
- On 27 June 2023, Santos emailed PDC seeking feedback on proposed activities. [Con-1656]
- On 19 July 2023, Santos emailed PDC by way of reminder on the timeframe for providing feedback. [Con-1736]
- On 9 August 2024, Santos emailed Pilbara Ports Authority (PPA) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5399].
- No correspondence or feedback has been received.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
Pilbara Ports Authority (PPA)			
• On 29 June 2023, Santos emailed PPA seeking feedback on proposed activities outlined in this revision. [Con-1714] • On 19 July 2023, Santos emailed PPA by way of reminder on the timeframe for providing feedback. [Con-1743] • On 20 July 2023, PPA emailed Santos advising all marine activities within port waters must be presented to their office for review. [Con-1760] • On 20 July 2023, Santos emailed PPA advising it would like to arrange a meeting to discuss planned activities and emergency response implications. [Con-1746] • On 9 August 2024, Santos emailed Pilbara Ports Authority (PPA) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5399]. • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NIL	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Shark Bay World Heritage Advisory Committee (SBWHAC)			
• On 30 May 2023, Santos emailed SBWHAC and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and included a link to an information fact sheet about proposed activities in this revision. [Con-2472] • On 27 June 2023, Santos emailed SBWHAC seeking feedback on proposed activities. [Con-1650] • On 19 July 2023, Santos emailed SBWHAC by way of reminder on the timeframe for providing feedback. [Con-1727] • On 9 August 2024, Santos emailed SBWHAC to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5401]. • On 9 August 2024, Santos received an auto-response email from SBWHAC acknowledging receipt of correspondence and advising Santos contact the Gascoyne District DBCA office directly. (See table entry for DBCA for consultation with DBCA [Con-5526]			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Western Australian Museum (WAM)			
• On 30 May 2023, Santos emailed the WA Museum and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2275] • On 27 June 2023, Santos emailed WA Museum seeking feedback on proposed activities. [Con-1651] • On 17 July 2023, WA Museum emailed Santos with feedback regarding the proposed Carnarvon Basin activities. [Con-2137] • On 18 August 2023, Santos emailed WA Museum with responses to their feedback on 17 July 2023. [Con-2302]			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 9 August 2024, Santos emailed Western Australian Museum (WAM) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5402]. • No additional correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
WA Museum requested Santos consult the Department of Climate Change, Energy, the Environment and Water (underwater heritage branch) with respect to matters concerning the Underwater Cultural Heritage Act 2018 (Cwth). Santos should then engage the WA Museum as its Delegate, if deemed necessary.	Santos notes WA Museum's guidance.	Santos confirms it has provided consultation information to the Department of Climate Change, Energy, the Environment and Water (underwater heritage branch) about proposed activities.	No additional EP controls required.
WA Museum stated that Santos should not undertake activities that will have, or are likely to have, direct or indirect adverse impact on protected underwater cultural heritage (UCH) without a permit.	Santos notes WA Museum's guidance.	Santos will comply with the Underwater Cultural Heritage Act 2018, and will not undertake activities that will have, or are likely to have, direct or indirect adverse impact on protected underwater cultural heritage (UCH) without an appropriate risk assessment and a permit.	Underwater Cultural Heritage Aspects are included in Section 3.2.6.7 of the EP. No additional EP controls required.
WA Museum stated that Santos should observe the requirements of protected zones and obtain a permit to enter or operate in a protected zone if it is required.	Santos notes WA Museum's guidance.	Santos will observe the requirements of protected zones and obtain a permit to enter or operate in a protected zone if it is required.	No additional EP controls required.
WA Museum stated that Santos should notify regulators of the discovery of any suspected UCH identified during the planning, development, operation, or decommissioning phases of a project within 21 days of the discovery.	Santos notes WA Museum's guidance.	Santos will comply with the Underwater Cultural Heritage Act 2018, and will not undertake activities that will have, or are likely to have, direct or indirect adverse impact on protected underwater cultural heritage (UCH) without an appropriate risk assessment and a permit. Santos will observe the requirements of protected zones and obtain a permit to enter or operate in a protected zone if it is required; and will also notify regulators of the discovery of any suspected UCH identified during the planning, development, operation, or decommissioning phases of a project within 21 days of the discovery.	Underwater Cultural Heritage Aspects are included in Section 3.2.6.7 of the EP . Activity notifications are included in Table 8-4 No additional EP controls required.
WA Museum stated that proponents should consider engaging a suitably qualified and	Santos notes WA Museum's guidance.	Santos has consulted the Department of Planning, Lands and Heritage for proposed	No additional EP controls required.

Santos

<table>
<tr><th colspan="4">Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant</th></tr>
<tr><td>experienced maritime archaeologist to undertake a UCH Desktop Assessment to identify Aboriginal and non-Aboriginal UCH within the project area.</td><td></td><td>activities, which has confirmed that the projects areas for proposed activities do not intersect with any known submerged Aboriginal Cultural Heritage.</td><td></td></tr>
<tr><td>WA Museum stated that proponents should consult with Traditional Owners where appropriate.</td><td>Santos notes WA Museum’s guidance.</td><td>Santos has provided consultation information to Traditional Owners, where appropriate, for proposed activities. Consultation with these groups is ongoing.</td><td>No additional EP controls required.

See this Section 4 and Section 8.13</td></tr>
<tr><th colspan="4">Wheatbelt Development Commission (WDC)</th></tr>
<tr><td colspan="4">
On 27 June 2023, Santos emailed WDC seeking feedback on proposed activities outlined in this revision. [Con-1708]
On 19 July 2023, Santos emailed WDC by way of reminder on the timeframe for providing feedback. [Con-1740]
On 9 August 2024, Santos emailed Wheatbelt Development Commission (WDC) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5403].
No correspondence or feedback has been received.
</td></tr>
<tr><th>Summary of Objection or Claim</th><th>Assessment of Merits</th><th>Santos’ Response Statement</th><th>EP Reference</th></tr>
<tr><td>NA</td><td>Santos considers it has provided sufficient time and opportunity for consultation.
Santos considers Section 25 consultation complete for this EP.</td><td>NA</td><td>No additional EP controls required.</td></tr>
<tr><th colspan="4">Regulation 25(1)(c): Department of the responsible Western Australian Minister</th></tr>
<tr><th colspan="4">Department of Energy, Mines, Industry Regulation and Safety (DEMIRS)</th></tr>
<tr><td colspan="4">
On 19 June 2023 Santos met with DEMIRS to discuss clarification on the notifications DEMIRS like to receive on our EPs. Feedback is:

DEMIRS advised that historically, DEMIRS has asked for us to notify them with a commencement and cessation notification (without specifying a timeframe).
Moving forwards Santos will provide DEMIRS a commencement and cessation notification on EPs in C’wlth waters that may impact state waters (but might be easier to run notifications as a default given size of EMBAs).
In terms of timing of notifications, alignment to the NOPSEMA ten day notification would be useful for all Santos' EPs (C’wlth and State (noting that the State regs dot specify a timeframe so the 10 day one provides consistency). [Con-2115]

On 29 June 2023 Santos emailed DEMIRS to advise it of proposed Carnarvon Basin activities for consultation. [Con-1712]
On 19 July 2023 Santos emailed DEMIRS a reminder of proposed Carnarvon Basin activities for consultation. [Con-1898]
On 9 August 2024, Santos emailed Department of Mines, Industry Regulation and Safety (DEMIRS) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5404].
No additional correspondence or feedback has been received.
</td></tr>
</table>

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
DEMIRS confirmed at that it required pre-start and activity completion notifications.	Santos notes DEMIRS feedback. Note: consultation was undertaken for Halyard-2 and ongoing operations at the same time. This response was specific to Halyard-2 drilling & completion activities. As such, these notification commitments are outside the scope of this EP, however they appear in the Halyard-2 Drilling and Completion EP and do not appear in Section 8.10(Reporting and Notifications) of this EP.	Santos will send DEMIRS activity notifications.	Refer to Halyard-2 Drilling & Completion EP (9887-650-REP-0001) for notifications associated with this consultation.
Regulation 25(1)(d): Persons or organisations whose functions, interests or activities may be affected by the activities to be carried out under the environment plan, or the revision of the environment plan			
Academic and research organisations			
Australian Marine Sciences Association (WA Branch)			
• On 12 June 2023, Santos emailed AMSA (WA Branch) and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of AMSA may be affected. [Con-2179] • On 27 June 2023, Santos emailed AMSA seeking feedback on proposed activities. [Con-1674] • On 19 July 2023, Santos emailed AMSA by way of reminder on the timeframe for providing feedback. [Con-1681] • On 9 August 2024, Santos emailed Australian Marine Sciences Association (AMSA - WA Branch) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5405]. • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Commonwealth Scientific and Industrial Research Organisation (CSIRO)			
• On 12 June 2023, Santos emailed CSIRO and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of CSIRO may be affected. [Con-2154] • On 27 June 2023, Santos emailed CSIRO seeking feedback on proposed activities. [Con-1675] • On 29 June 2023, CSIRO emailed Santos and advised it was not able to pursue a collaboration. [Con-1806]			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 9 August 2024, Santos emailed Commonwealth Scientific and Industrial Research Organisation (CSIRO) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5407]. • On 9 August 2024, Santos received an auto-generated email from Commonwealth Scientific and Industrial Research Organisation (CSIRO) acknowledging receipt of Santos' email. [Con-5529] • On 23 August 2024 Santos sent an email reminder to Commonwealth Scientific and Industrial Research Organisation (CSIRO) indicating that consultation relating to the activity update previously emailed on the 9 August 2024 on the commissioning and operation of the Halyard 2 well at the Varanus Island Hub in Western Australia closes on 23 August 2024. Santos reminded the CSIRO to provide any feedback on this activity update by Friday 23 August 2024 as Santos will be submitting a revised Environment Plan next week. [Con-5570]			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
Nil	NA	NA	NA
Geoscience Australia (GA)			
• On 12 June 2023, Santos emailed GA and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of GA may be affected. [Con-2155] • On 27 June 2023, Santos emailed GA seeking feedback on proposed activities. [Con-1676] • On 14 July 2023, Santos received a response email from GA, who advised it had no input or feedback. [Con-1808] • On 26 July 2023, Santos responded to the email from GA acknowledging it had no input or feedback for the proposed Carnarvon Basin activities. [Con-1797] • On 9 August 2024, Santos emailed Geoscience Australia (GA) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5408]. • On 9 August 2024, Santos received an auto-generated email from Geoscience Australia (GA) confirming receipt of Santos' email. [Con-5530] • On 23 August 2024 Santos sent an email reminder to Geoscience Australia (GA) indicating that consultation relating to the activity update previously emailed on the 9 August 2024 on the commissioning and operation of the Halyard 2 well at the Varanus Island Hub in Western Australia closes on 23 August 2024. Santos reminded the GA to provide any feedback on this activity update by Friday 23 August 2024 as Santos will be submitting a revised Environment Plan next week. [Con-5571] • On 23 August 2024, Santos received an auto-generated email from Geoscience Australia (GA) confirming receipt of Santos' email and it would aim to respond within 5 to 10 working days depending on the complexity of the enquiry. [Con-5572] • On 23 August 2024 Santos telephoned Geoscience Australia with an attempt to follow up on the auto-generated email response received on 23 August 2024. [Con-5573]			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
Nil	NA	NA	NA
Charles Darwin University (CDU)			
• On 27 June 2023, Santos emailed CDU seeking feedback on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of CDU may be affected. [Con-1680] • On 19 July 2023, Santos emailed CDU by way of reminder on the timeframe for providing feedback. [Con-1682] • On 9 August 2024, Santos emailed Charles Darwin University (CDU) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5406].			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 9 August 2024, Santos received an auto-generated email response from Charles Darwin University acknowledging receipt of Santos' email and it would aim to reply as soon as possible. [Con-5528] • On 23 August 2024 Santos telephoned Charles Darwin University with an attempt to follow up on the auto-generated email response received on 9 August 2024. [Con-5569] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
University of Tasmania - Marine Biodiversity Hub (UTAS)			
• On 12 June 2023, Santos emailed UTAS and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of UTAS may be affected. [Con-2156] • On 27 June 2023, Santos emailed UTAS seeking feedback on proposed activities. [Con-1677] • On 19 July 2023, Santos emailed UTAS by way of reminder on the timeframe for providing feedback. [Con-1683] • On 9 August 2024, Santos emailed University of Tasmania - Marine Biodiversity Hub (UTAS) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5409]. • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
University of Western Australia (UWA)			
• On 12 June 2023, Santos emailed UWA and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of UWA may be affected. [Con-2157] • On 27 June 2023, Santos emailed UWA seeking feedback on proposed activities. [Con-1678] • On 19 July 2023, Santos emailed UWA by way of reminder on the timeframe for providing feedback. [Con-1684] • On 9 August 2024, Santos emailed University of Western Australia (UWA) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5410] • On 9 August 2024, Santos received an auto-reply email from the University of Western Australia (UWA), informing they are in the field. [Con-5531] • On 23 August 2024 Santos sent an email reminder to University of Western Australia (UWA) indicating that consultation relating to the activity update previously emailed on the 9 August 2024 on the commissioning and operation of the Halyard 2 well at the Varanus Island Hub in Western Australia closes on 23 August 2024. Santos reminded the UWA to provide any feedback on this activity update by Friday 23 August 2024 as Santos will be submitting a revised Environment Plan next week. [Con-5574]			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 23 August 2024, Santos received an auto-reply email from the University of Western Australia (UWA), informing they are in the field with variable access to email. They would be back on campus on the 9 September 2024 and advised they would respond as soon as they could. [Con-5575] • No substantive response or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Western Australian Marine Science Institution (WAMSI)			
• On 12 June 2023, Santos emailed WAMSI and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of WAMSI may be affected. [Con-2158] • On 27 June 2023, Santos emailed WAMSI seeking feedback on proposed activities. [Con-1679] • On 19 July 2023, Santos emailed WAMSI by way of reminder on the timeframe for providing feedback. [Con-1685] • On 9 August 2024, Santos emailed Western Australian Marine Science Institution (WAMSI) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5412]. • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Commercial fishing – Commonwealth managed			
Australian Southern Bluefin Tuna Fishery			
• As part of preliminary consultation activities Santos sought to engage with AFMA, DAFF and representative organisations on pragmatic and practical approaches for the consultation of licence holders entitled to fish in Commonwealth fisheries. • On 29 June 2023, Santos emailed licence holders in the Australian Southern Bluefin Tuna Fishery and provided information on a number of proposed Carnarvon Basin activities. Santos provided a link to an information fact sheet about proposed activities in this revision and sought feedback on proposed activities. [Con-1900] • On 28 July 2023, Santos emailed licence holders in the Australian Southern Bluefin Tuna Fishery by way of reminder on the timeframe for providing feedback. [Con-1915] • On 29 June 2023, a licence holder advised Santos refer to the tuna industry association - Tuna Australia – on consultation matters. [Con-2161] • On 29 June 2023, Santos emailed the licence holder and advised it was consulting Tuna Australia as part of consultation activities. [Con-2166] • On 9 August 2024, Santos emailed Australian Southern Bluefin Tuna Fishery to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5417] • No other correspondence or feedback has been received.			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
Nil	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.

North West Slope Trawl Fishery

- As part of preliminary consultation activities Santos sought to engage with AFMA, DAFF and representative organisations on pragmatic and practical approaches for the consultation of licence holders entitled to fish in Commonwealth fisheries.
- On 29 June 2023, Santos emailed licence holders in the North West Slope Trawl Fishery and provided information on a number of proposed Carnarvon Basin activities. Santos provided a link to an information fact sheet about proposed activities in this revision and sought feedback on proposed activities. [Con-3057]
- On 28 July 2023, Santos emailed licence holders in the North West Slope Trawl Fishery by way of reminder on the timeframe for providing feedback. [Con-3058]
- On 9 August 2024, Santos emailed North West Slope Trawl Fishery to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5421].
- No correspondence or feedback has been received.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.

Small Pelagic Fishery

- As part of preliminary consultation activities Santos sought to engage with AFMA, DAFF and representative organisations on pragmatic and practical approaches for the consultation of licence holders entitled to fish in Commonwealth fisheries.
- On 29 June 2023, Santos emailed licence holders in the Small Pelagic Fishery and provided information on a number of proposed Carnarvon Basin activities. Santos provided a link to an information fact sheet about proposed activities in this revision and sought feedback on proposed activities. [Con-3059]
- On 9 August 2024, Santos emailed Small Pelagic Fishery to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5422]
- No correspondence or feedback has been received.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.

<table>
<tr><th colspan="4">Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant</th></tr>
<tr><th colspan="4">Western Deepwater Trawl Fishery</th></tr>
<tr><td colspan="4">

- As part of preliminary consultation activities Santos sought to engage with AFMA, DAFF and representative organisations on pragmatic and practical approaches for the consultation of licence holders entitled to fish in Commonwealth fisheries.
- On 29 June 2023, Santos emailed licence holders in the Western Deepwater Trawl Fishery and provided information on a number of proposed Carnarvon Basin activities. Santos provided a link to an information fact sheet about proposed activities in this revision and sought feedback on proposed activities. [Con-3060]
- On 28 July 2023, Santos emailed licence holders in the Western Deepwater Trawl Fishery by way of reminder on the timeframe for providing feedback. [Con-3061]
- On 9 August 2024, Santos emailed Western Deepwater Trawl Fishery to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5430]
- No correspondence or feedback has been received.

</td></tr>
<tr><th>Summary of Objection or Claim</th><th>Assessment of Merits</th><th>Santos’ Response Statement</th><th>EP Reference</th></tr>
<tr><td>NA</td><td>Santos considers it has provided sufficient time and opportunity for consultation.
Santos considers Section 25 consultation complete for this EP.</td><td>NA</td><td>No additional EP controls required.</td></tr>
<tr><th colspan="4">Western Skipjack Fishery</th></tr>
<tr><td colspan="4">

- As part of preliminary consultation activities Santos sought to engage with AFMA, DAFF and representative organisations on pragmatic and practical approaches for the consultation of licence holders entitled to fish in Commonwealth fisheries.
- On 29 June 2023, Santos emailed licence holders in the Western Skipjack Fishery and provided information on a number of proposed Carnarvon Basin activities. Santos provided a link to an information fact sheet about proposed activities in this revision and sought feedback on proposed activities. [Con-3062]
- On 28 July 2023, Santos emailed licence holders in the Western Skipjack Fishery by way of reminder on the timeframe for providing feedback. [Con-3063]
- On 9 August 2024, Santos emailed Western Skipjack Fishery to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5432]
- No correspondence or feedback has been received.

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<tr><th>Summary of Objection or Claim</th><th>Assessment of Merits</th><th>Santos’ Response Statement</th><th>EP Reference</th></tr>
<tr><td>NA</td><td>Santos considers it has provided sufficient time and opportunity for consultation.
Santos considers Section 25 consultation complete for this EP.</td><td>NA</td><td>No additional EP controls required.</td></tr>
<tr><th colspan="4">Western Tuna and Billfish Fishery</th></tr>
<tr><td colspan="4">

- As part of preliminary consultation activities Santos sought to engage with AFMA, DAFF and representative organisations on pragmatic and practical approaches for the consultation of licence holders entitled to fish in Commonwealth fisheries.
- On 29 June 2023, Santos emailed licence holders in the Western Tuna and Billfish Fishery and provided information on a number of proposed Carnarvon Basin activities. Santos provided a link to an information fact sheet about proposed activities in this revision and sought feedback on proposed activities. [Con-3065]

</td></tr>
</table>

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 28 July 2023, Santos emailed licence holders in the Western Tuna and Billfish Fishery by way of reminder on the timeframe for providing feedback. [Con-3066] • On 9 August 2024, Santos emailed Western Tuna and Billfish Fishery to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5436] • No other correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Commercial fishing – Western Australian managed			
Mackerel Managed Fishery (Area 2)			
• As part of preliminary consultation activities Santos sought to engage with DPIRD and WAFIC on pragmatic and practical approaches for the consultation of licence holders entitled to fish in Western Australian fisheries. Santos followed WAFIC guidance to consult licence holders who may be directly affected. Santos also used WAFIC fee-for-service arrangements to circulate consultation information to fishers. • On 29 June 2023, WAFIC emailed licence holders in the Mackerel Managed Fishery and provided information on a number of proposed Carnarvon Basin activities. WAFIC correspondence included a link to an information fact sheet about proposed activities in this revision and sought feedback on proposed activities. WAFIC also provided a summary of Santos consultation activities on a trial Consultation Hub on its website. [Con-1891] • On 24 July 2023, WAFIC emailed licence holders in the Mackerel Managed Fishery by way of reminder on the timeframe for providing feedback. [Con-2182] • On 9 August 2024, Santos emailed Mackerel Managed Fishery (Area 2) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5438]. • No correspondence or feedback has been received from licence holders.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Onslow Prawn Managed Fishery			
• As part of preliminary consultation activities Santos sought to engage with DPIRD and WAFIC on pragmatic and practical approaches for the consultation of licence holders entitled to fish in Western Australian fisheries. Santos followed WAFIC guidance to consult licence holders who may be directly affected. Santos also used WAFIC fee-for-service arrangements to circulate consultation information to fishers. • On 29 June 2023, WAFIC emailed licence holders in the Onslow Prawn Managed Fishery and provided information on a number of proposed Carnarvon Basin activities. WAFIC corresponded included a link to an information fact sheet about proposed activities in this revision and sought feedback on proposed activities. WAFIC also provided a summary of Santos consultation activities on a trial Consultation Hub on its website. [Con-1891] • On 24 July 2023, WAFIC emailed licence holders in the Onslow Prawn Managed Fishery by way of reminder on the timeframe for providing feedback. [Con-2182]			

Santos

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 9 August 2024, Santos emailed Onslow Prawn Managed Fishery to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5439]. • No correspondence or feedback has been received from licence holders.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Pilbara Line Fishery (Condition)			
• As part of preliminary consultation activities Santos sought to engage with DPIRD and WAFIC on pragmatic and practical approaches for the consultation of licence holders entitled to fish in Western Australian fisheries. Santos followed WAFIC guidance to consult licence holders who may be directly affected. Santos also used WAFIC fee-for-service arrangements to circulate consultation information to fishers. • On 29 June 2023, WAFIC emailed licence holders in the Pilbara Line Fishery and provided information on a number of proposed Carnarvon Basin activities. WAFIC correspondence included a link to an information fact sheet about proposed activities in this revision and sought feedback on proposed activities. WAFIC also provided a summary of Santos consultation activities on a trial Consultation Hub on its website. [Con-1891] • On 24 July 2023, WAFIC emailed licence holders in the Pilbara Line Fishery by way of reminder on the timeframe for providing feedback. [Con-2182] • On 9 August 2024, Santos emailed Pilbara Line Fishery to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5440]. • No correspondence or feedback has been received from licence holders.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Pilbara Trap Managed Fishery			
• As part of preliminary consultation activities Santos sought to engage with DPIRD and WAFIC on pragmatic and practical approaches for the consultation of licence holders entitled to fish in Western Australian fisheries. Santos followed WAFIC guidance to consult licence holders who may be directly affected. Santos also used WAFIC fee-for-service arrangements to circulate consultation information to fishers. • On 29 June 2023, WAFIC emailed licence holders in the Pilbara Trap Managed Fishery and provided information on a number of proposed Carnarvon Basin activities. WAFIC correspondence included a link to an information fact sheet about proposed activities in this revision and sought feedback on proposed activities. WAFIC also provided a summary of Santos consultation activities on a trial Consultation Hub on its web site. [Con-1891] • On 24 July 2023, WAFIC emailed licence holders in the Pilbara Trap Managed Fishery by way of reminder on the timeframe for providing feedback. [Con-2182] • On 9 August 2024, Santos emailed Pilbara Trap Managed Fishery to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5441].			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• No correspondence or feedback has been received from licence holders.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
West Coast Deep Sea Crustacean Managed Fishery			
• As part of preliminary consultation activities Santos sought to engage with DPIRD and WAFIC on pragmatic and practical approaches for the consultation of licence holders entitled to fish in Western Australian fisheries. Santos followed WAFIC guidance to consult licence holders who may be directly affected. Santos also used WAFIC fee-for-service arrangements to circulate consultation information to fishers. • On 29 June 2023, WAFIC emailed licence holders in the West Coast Deep Sea Crustacean Managed Fishery and provided information on a number of proposed Carnarvon Basin activities. WAFIC correspondence included a link to an information fact sheet about proposed activities in this revision and sought feedback on proposed activities. WAFIC also provided a summary of Santos consultation activities on a trial Consultation Hub on its website. [Con-1891] • On 24 July 2023, WAFIC emailed licence holders in the West Coast Deep Sea Crustacean Managed Fishery by way of reminder on the timeframe for providing feedback. [Con-2182] • On 9 August 2024, Santos emailed West Coast Deep Sea Crustacean Managed Fishery to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5443]. • No correspondence or feedback has been received from licence holders.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Energy industry – Petroleum titleholders and GHG permit holders			
3D Energi Ltd (previously known as 3D Oil Ltd)			
• On 2 June 2023, Santos emailed 3D Oil and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2274] • On 27 June 2023, Santos emailed 3D Oil seeking feedback on proposed activities. [Con-1686] • On 19 July 2023, Santos emailed 3D Oil by way of reminder on the timeframe for providing feedback. [Con-1713] • On 9 August 2024, Santos emailed 3D Energi to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5309]. • No correspondence or feedback has been received.			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.

Beagle No. 1			
• On 21 August 2023, Santos emailed Beagle No 1 and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2307] • On 14 September 2023 Beagle No 1 emailed Santos regarding its proposed Carnarvon Basin activities and advised Santos' activities are not going to impact its activities at WA-542-P and therefore though it acknowledges and thanks Santos for consultation procedure its does not feel it necessary to request further information or provide additional feedback at this time. [Con-2393] • On 9 August 2024, Santos emailed Beagle No. 1 to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5310]. • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
Nil	NA	NA	NA

BP Developments Australia			
• On 2 June 2023, Santos emailed BP and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2273] • On 27 June 2023, Santos emailed BP seeking feedback on proposed activities. [Con-1688] • On 19 July 2023, Santos emailed BP by way of reminder on the timeframe for providing feedback. [Con-1717] • On 25 July 2023, BP emailed Santos advising it had no comments or objection to the proposed activities. [Con-1762] • On 26 July 2023, Santos emailed BP acknowledging their feedback received via email on 25 July 2023. [Con-1767] • On 9 August 2024, Santos emailed BP Developments Australia to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5312]. • On 19 August 2024, Santos received an email from BP advising it had no further input to provide for the proposed EP. [Con-5557] • On 19 August 2024, Santos emailed BP acknowledging they have no further input in relation to the Halyard-2 Operations Varanus Island Hub Operations Environment Plan. [Con-5558]			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
Nil	NA	NA	NA

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
Carnarvon Energy			
• On 2 June 2023, Santos emailed Carnarvon Energy and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-1882] • On 12 June 2023, Carnarvon Energy emailed advising it had no further requests for information. [Con-1884] • On 9 August 2024, Santos emailed Carnarvon Energy Ltd to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5314]. • On 15 August 2024, Santos received an email from Carnarvon Energy Ltd advising it has no further comments or feedback to provide for the proposed EP. [Con-5553] • On 19 August 2024, Santos emailed Carnarvon Energy Ltd acknowledging they have no further comments or feedback in relation to the Halyard-2 Operations Varanus Island Hub Operations Environment Plan. [Con-5554]			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
Nil	NA	NA	NA
Chevron Australia			
• On 2 June 2023, Santos emailed Chevron and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-1879] • On 12 June 2023, Chevron emailed Santos advising all consultation emails are to go to ABUConsultation@chevron.com. Chevron requested Santos provide GIS shape files for the activities. [Con-1885] • On 26 July 2023, Santos emailed Chevron shape files and requested Chevron provide feedback by 10 August 2023. [Con-1887] • On 11 August 2023, Chevron emailed Santos regarding the proposed Carnarvon Basin activities. Chevron advised it had no issues with the proposed activities. Chevron requested should any work planned is executed during the cyclone season, please provide cyclone anchor configuration, as well as mooring design, site specific geophysical and geotechnical data, anchor analysis, risk mitigations to inform Chevron Australia of the potential risks to our assets within the affected leases. [Con-2280] • On 1 September 2023, Santos emailed Chevron with an assessment of potential risks to Chevron assets arising from cyclone conditions. [Con-2334] • On 9 August 2024, Santos emailed Chevron Australia P/L to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5316]. • No additional correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
While Chevron had no objections or claims about proposed activities, it requested additional information should activities be undertaken during cyclone season to inform potential risks to Chevron assets.	Santos has assessed Chevron's request and assessed that the Halyard-2 Drilling & Completion EP operational area is approximately 1.6 km from the nearest Chevron asset, the Wheatstone pipeline.	Santos provided information regarding anchoring/mooring analysis as requested by Chevron.	NA
Coastal Oil & Gas			
• On 21 August 2023, Santos emailed Coastal O&G and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2306]			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 9 August 2024, Santos emailed Coastal Oil & Gas P/L to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5317]. • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
Nil	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Eni Australia			
• On 2 June 2023, Santos emailed Eni Australia and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2272] • On 27 June 2023, Santos emailed Eni Australia seeking feedback on proposed activities. [Con-1689] • On 19 July 2023, Santos emailed Eni Australia by way of reminder on the timeframe for providing feedback. [Con-1718] • On 9 August 2024, Santos emailed Eni Australia Ltd to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5318]. • On 15 August 2024 ENI emailed Santos advising they have no concerns with the activity. ENI requested Santos keep them informed should any material changes occur. [Con-5555] • On 19 August 2024, Santos emailed ENI acknowledging it had no concerns with the activity and confirming Santos would keep ENI informed of any material changes. [Con-5556]			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Finder			
• On 2 June 2023, Santos emailed Finder and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2271] • On 27 June 2023, Santos emailed Finder seeking feedback on proposed activities. [Con-1690] • On 28 June 2023, Finder emailed notifying Santos that it has no objection or feedback on proposed activities in the Carnarvon Basin. [Con-1756] • On 14 July 2023, Santos emailed Finder acknowledging its email from 28 June 2023. [Con-1751] • On 9 August 2024, Santos emailed Finder to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024.[Con-5319] • On 14 August 2024 Finder emailed Santos expressing they had no objection or comment on the outlined activities. [Con-5532]			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 19 August 2024, Santos acknowledged that Finder has no objection or comment in regards to the revision activities for the Halyard-2 Operations Varanus Island Hub Operations Environment Plan. [Con-5533]			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
Nil	NA	NA	NA
INPEX			
• On 27 June 2023, Santos emailed INPEX and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-1691] • On 19 July 2023, Santos emailed INPEX by way of reminder on the timeframe for providing feedback. [Con-1719] • On 9 August 2024, Santos emailed INPEX to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5320]. • On 9 August 2024, Santos received an auto-generated email from INPEX in response to Santos' email listin g certain information that may help with Santos' enquiry. [Con-5534] • On 23 August 2024 Santos sent an email reminder to INPEX indicating that consultation relating to the activity update previously emailed on the 9 August 2024 on the commissioning and operation of the Halyard 2 well at the Varanus Island Hub in Western Australia closes on 23 August 2024. Santos reminded the INPEX to provide any feedback on this activity update by Friday 23 August 2024 as Santos will be submitting a revised Environment Plan next week. [Con-5576] • On 23 August 2024, Santos received an auto-generated email from INPEX in response to Santos' email listing certain information that may help with Santos' enquiry. [Con-5577] • On 27 August 2024, Santos telephoned INPEX with an attempt to follow up on the auto-generated email response received on the 23 August 2024. [Con-5604] • No substantive correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Jadestone Energy			
• On 2 June 2023, Santos emailed Jadestone and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2270] • On 27 June 2023, Santos emailed Jadestone seeking feedback on proposed activities. [Con-1693] • On 19 July 2023, Santos emailed Jadestone by way of reminder on the timeframe for providing feedback. [Con-1722] • On 9 August 2024, Santos emailed Jadestone Energy to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5321]. • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation.	NA	No additional EP controls required.

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
	Santos considers Section 25 consultation complete for this EP.		

Kato Energy

- On 2 June 2023, Santos emailed Kato Energy and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2269]
- On 27 June 2023, Santos emailed Kato Energy seeking feedback on proposed activities. [Con-1694]
- On 19 July 2023, Santos emailed Kato Energy by way of reminder on the timeframe for providing feedback. [Con-1724]
- On 9 August 2024, Santos emailed KATO Energy (WA) P/L to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024.[Con-5322].
- No correspondence or feedback has been received.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.

KUFPEC

- On 2 June 2023, Santos emailed KUFPEC and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2268]
- On 27 June 2023, Santos emailed KUFPEC seeking feedback on proposed activities. [Con-1695]
- On 19 July 2023, Santos emailed KUFPEC by way of reminder on the timeframe for providing feedback. [Con-1726]
- On 9 August 2024, Santos emailed KUFPEC (Perth) P/L to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5323].
- No correspondence or feedback has been received.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.

Mobil Australia

- On 2 June 2023, Santos emailed Mobil Australia and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2267]
- On 27 June 2023, Santos emailed Mobil Australia seeking feedback on proposed activities. [Con-1697]
- On 19 July 2023, Santos emailed Mobil Australia by way of reminder on the timeframe for providing feedback. [Con-1728]

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 9 August 2024, Santos emailed Mobil Australia Resources Company P/L to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5324]. • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Pathfinder Energy			
• On 2 June 2023, Santos emailed Pathfinder Energy and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2266] • On 27 June 2023, Santos emailed Pathfinder Energy seeking feedback on proposed activities. [Con-1698] • On 19 July 2023, Santos emailed Pathfinder Energy by way of reminder on the timeframe for providing feedback. [Con-1730] • On 9 August 2024, Santos emailed Pathfinder Energy to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5325] • On 9 August 2024 Santos, Santos received an auto-reply email from Pathfinder Energy advising the respondent out of office. [Con-5535] • On 23 August 2024 Santos telephoned Pathfinder Energy with an attempt to follow up on the auto-generated email response received on 9 August 2024. [Con-5578] • On 23 August 2024 Santos sent an email reminder to Pathfinder Energy indicating that consultation relating to the activity update previously emailed on the 9 August 2024 on the commissioning and operation of the Halyard 2 well at the Varanus Island Hub in Western Australia closes on 23 August 2024. Santos reminded the Pathfinder Energy to provide any feedback on this activity update by Friday 23 August 2024 as Santos will be submitting a revised Environment Plan next week. [Con-5579] • No substantive correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Skye Energy			
• On 21 August 2023, Santos emailed Skye Energy and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2308] • On 9 August 2024, Santos emailed Skye Energy to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5326]. • No correspondence or feedback has been received.			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Vermilion Oil & Gas Australia			
• On 2 June 2023, Santos emailed Vermilion Oil & Gas Australia and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2265] • On 27 June 2023, Santos emailed Vermilion Oil & Gas Australia seeking feedback on proposed activities. [Con-1703] • On 19 July 2023, Santos emailed Vermilion Oil & Gas Australia by way of reminder on the timeframe for providing feedback. [Con-1741] • On 9 August 2024, Santos emailed Vermilion Oil & Gas Australia to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024.[Con-5327] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Western Gas			
• On 2 June 2023, Santos emailed Western Gas and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2264] • On 27 June 2023, Santos emailed Western Gas seeking feedback on proposed activities. [Con-1704] • On 19 July 2023, Santos emailed Western Gas by way of reminder on the timeframe for providing feedback. [Con-1745] • On 8 August 2023, Western Gas emailed Santos and advised it will not be directly impacted by the proposed activities and had no feedback. [Con-2224] • On 9 August 2024, Santos emailed Western Gas to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5328] • No additional correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
Nil	NA	NA	NA
Woodside Energy Ltd			
• On 2 June 2023, Santos emailed Woodside Energy Ltd and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2263]			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 27 June 2023, Santos emailed Woodside Energy Ltd seeking feedback on proposed activities. [Con-1705] • On 19 July 2023, Santos emailed Woodside Energy Ltd by way of reminder on the timeframe for providing feedback. [Con-1747] • On 9 August 2024, Santos emailed Woodside Energy Ltd to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5329]. • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Environmental conservation organisations			
Australian Conservation Foundation (ACF)			
• On 2 June 2023 Santos emailed ACF and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of ACF may be affected. [Con-2159] • On 27 June 2023, Santos emailed ACF seeking feedback on proposed activities. [Con-1769] • On 19 July 2023, Santos emailed ACF by way of reminder on the timeframe for providing feedback. [Con-1783] • On 9 August 2024, Santos emailed Australian Conservation Foundation (ACF) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5446]. • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Cape Conservation Group (CCG)			
• On 2 June 2023, Santos emailed CCG and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2262] • On 27 June 2023, Santos emailed CCG seeking feedback on proposed activities. [Con-1770] • On 19 July 2023, Santos emailed CCG by way of reminder on the timeframe for providing feedback. [Con-1784] • On 9 August 2024, Santos emailed Cape Conservation Group to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5448] • No correspondence or feedback has been received.			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.

Care for Hedland

- On 2 June 2023, Santos emailed Care for Hedland and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2261]
- On 12 June 2023, Care for Hedland emailed Santos advising it would like to be involved in the preliminary consultation for proposed Carnarvon Basin activities. [Con-2104]
- On 6 July 2023, Santos met with Care for Hedland to provide an overview of the proposed Carnarvon Basin activities; learn more about Care for Hedland and their purpose and objectives; listen to any concerns Care for Hedland had with the proposed activities; and to discuss how it wanted to be consulted and if it wanted to receive activity notifications and emergency communications. Care for Hedland confirmed it required pre-start and activity completion notifications. [Con-2026]
- On 14 July 2023, Santos emailed Care for Hedland thanking it for the meeting and providing information including the AMSA National Emergency Response Plan and DoT Hazard Maritime Emergency Plan. Santos confirmed it would add Care for Hedland onto the emergency communication list for the Carnarvon Basin activities. [Con-1781]
- On 21 July 2023, Santos emailed Care for Hedland requesting additional feedback for the proposed Carnarvon Basin activities. [Con-1795]
- On 9 August 2024, Santos emailed Care For Hedland to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5449]
- No additional correspondence or feedback has been received.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
Care for Hedland confirmed at the meeting of 6 July 2023 that it required pre-start and activity completion notifications.	Santos notes Care for Hedland's feedback. Note: consultation was undertaken for Halyard-2 and ongoing operations at the same time. This response was specific to Halyard-2 drilling & completion activities. As such, these notification commitments are outside the scope of this EP, however they appear in the Halyard-2 Drilling and Completion EP and do not appear in Section 8.10 (Reporting and Notifications) of this EP.	Santos will send Care for Hedland activity notifications	Refer to Halyard-2 Drilling & Completion EP (9887-650-REP-0001) for notifications associated with this consultation.

Conservation Council of WA (CCWA)

- On 2 June 2023, Santos emailed CCWA and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of CCWA may be affected. [Con-2160]
- On 27 June 2023, Santos emailed CCWA seeking feedback on proposed activities. [Con-1771]

Santos

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 19 July 2023, Santos emailed CCWA by way of reminder on the timeframe for providing feedback. [Con-1785] • On 9 August 2024, Santos emailed Conservation Council of WA (CCWA) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5450] • No correspondence or feedback has been received			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Greenpeace Australia Pacific (GAP)			
• On 2 June 2023, Santos emailed GAP and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of GAP may be affected. [Con-2162] • On 27 June 2023, Santos emailed GAP seeking feedback on proposed activities. [Con-1774] • On 19 July 2023, Santos emailed GAP by way of reminder on the timeframe for providing feedback. [Con-1787] • On 9 August 2024, Santos emailed Greenpeace Australia Pacific to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5452] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
International Fund for Animal Welfare (IFAW)			
• On 2 June 2023, Santos emailed IFAW and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of IFAW may be affected. [Con-2163] • On 27 June 2023, Santos emailed IFAW seeking feedback on proposed activities. [Con-1775] • On 19 July 2023, Santos emailed IFAW by way of reminder on the timeframe for providing feedback. [Con-1789] • On 9 August 2024, Santos emailed International the Fund for Animal Welfare (IFAW) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5453] • On 9 August 2024, Santos received and auto-generated email response from IFAW advising the respondent was out of the office and requests Santos resend its email when they return to the office. [Con-5536] • On 19 August 2024, Santos resent the information regarding an activity update on the commissioning, start-up and operation of the Halyard 2 well at our Varanus Island Hub in Western Australia to IFAW. [Con-5537]			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• No substantive correspondence or feedback has been received			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Protect Ningaloo			
• On 2 June 2023, Santos emailed Protect Ningaloo and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2260] • On 27 June 2023, Santos emailed Protect Ningaloo seeking feedback on proposed activities. [Con-1780] • On 19 July 2023, Santos emailed Protect Ningaloo by way of reminder on the timeframe for providing feedback. [Con-1790] • On 9 August 2024, Santos emailed Project Ningaloo to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5455] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Wilderness Society (WS)			
• On 2 June 2023, Santos emailed WS and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of WS may be affected. [Con-2164] • On 27 June 2023, Santos emailed WS seeking feedback on proposed activities. [Con-1777] • On 19 July 2023, Santos emailed WS by way of reminder on the timeframe for providing feedback. [Con-1793] • On 9 August 2024, Santos emailed Wilderness Society to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5457]. • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
World Wildlife Fund (WWF)			
• On 2 June 2023, Santos emailed WWF and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of WWF may be affected. [Con-2165] • On 27 June 2023, Santos emailed WWF seeking feedback on proposed activities. [Con-1779] • On 19 July 2023, Santos emailed WWF by way of reminder on the timeframe for providing feedback. [Con-1794] • On 9 August 2024, Santos emailed World Wide Fund for Nature (WWF) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5458] • On 9 August 2024 Santos received an auto-generated email from the World Wide Fund for Nature (WWF) acknowledging receipt of Santos email and further advising it would respond shortly. [Con-5538] • On 13 August 2024 Santos received an auto-generated email from the World Wide Fund for Nature (WWF) indicating that Santos' request had been resolved. [Con-5539] • No substantive response or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
First Nations peoples and group: **Representative organisations – regional**			
Kimberley Land Council			
• On 9 July 2024, Santos emailed the KLC and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of KLC may be affected, specifically in relation to the Argo-Rowley Terrace, Ashmore Reef and Kimberley Marine Parks. [Con-5049] • On 9 July 2024 KLC responded to Santos' email, informing Santos that KLC have brought it to the attention of the relevant person and will advise accordingly. [Con-5082] • On 16 July 2024, Santos emailed Kimberley Land Council (KLC) by way of reminder on the timeframe for providing feedback by 22 July 2024. Santos also informed KLC that if they would like to provide input now, to please note that a summary of their feedback will be included in the environmental plan, including Santos' assessment of KLC's input and Santos' response. [Con-5088] • On 9 August 2024, Santos emailed Kimberley Land Council to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5454] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
Yamatji Marlpa Aboriginal Council (YMAC) – Please also refer to NTGAC entries which reference YMAC			
• On 29 May 2023, Santos emailed YMAC and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of YMAC may be affected. [Con-2181] • On 12 June 2023, Santos sent a follow up email to YMAC to discuss consultation expectations for proposed activities. [Con-2183] • On 19 June 2023, YMAC sent Santos an email with a proposed draft consultation framework in regard to oil and gas projects. YMAC also provided a letter to Santos stating it would contact Santos to discuss the framework and its administration. [Con-2106] • On 20 July 2023, Santos sent an email to YMAC acknowledging the provision of the draft consultation framework. Santos suggested an initial meeting to progress discussions in accordance with YMAC's expectations, including recognition and contribution for consultation of Rep Bodies and PBCs, as well as processes for the identification and protection of areas of cultural importance that may be affected by Santos' proposed activities. [Con-2075] • On 9 August 2024, Santos emailed YMAC to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5465] • No additional correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Murujuga Aboriginal Corporation (MAC)			
• On 29 May 2023, Santos emailed MAC and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of MAC and its members may be affected. [Con-2184] • On 30 May 2023, MAC emailed Santos and advised it didn't have the capacity to be involved in the consultation process. [Con-2105] • On 27 June 2023, Santos emailed MAC seeking feedback on proposed activities. [Con-2095] • On 20 July 2023, Santos emailed MAC by way of reminder on the timeframe for providing feedback. [Con-2067] • On 21 July 2023, MAC emailed Santos advising it did not consider itself a relevant person for consultation. [Con-2058] • On 21 July 2023, Santos emailed MAC thanking it for its response. [Con-2198] • On 9 August 2024, Santos emailed MAC to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5461].			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
Nil	NA	NA	NA
Native Title interests – Pilbara Region			
Buurabalayji Thalanyji Aboriginal Corporation (BTAC)			
• On 29 May 2023, Santos emailed BTAC and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of BTAC and its members may be affected. [Con-2185]			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant
• On 12 June 2023, Santos sent a follow up email to BTAC to discuss consultation expectations for proposed activities. [Con-2186] • On 21 June 2023, BTAC sent Santos a letter via email setting out its expectations for consultation, including entering into an engagement framework. [Con-2108] • On 20 July 2023, Santos emailed BTAC in response to their email on 21 June 2023 proposing a meeting to discuss how best to approach consultation for the proposed Carnarvon Basin activities. [Con-2074] • On 7 August 2023, Santos called BTAC's nominated representative to progress consultation discussions. Santos sent a follow-up email on 8 August 2023 to set up a preliminary meeting with BTAC. [Con-2218] • On 10 September 2023, Santos emailed BTAC a reminder of proposed Carnarvon Basin activities for consultation requesting feedback if it believed that its functions, interests, or activities may be affected by Santos' proposed activities, including consideration of potential impacts to or risks associated with: – traditional lands and waters – sea country interests – totemic species – other values or sensitivities of importance. [Con-2381] • On 11 September 2023, BTAC emailed Santos to confirm they wished to be consulted on this EP. BTAC indicated its preferred position was to enter into a framework agreement with Santos to ensure meaningful and appropriately resourced ongoing engagement for these and other activities and EPs that may require consultation in future. [Con-2382] • On 12 September 2023, BTAC emailed Santos advising it could meet with Santos on 21 September 2023, providing an estimated cost for the meeting [Con-2385] • On 18 September 2023, Santos emailed BTAC's nominated representative confirming it could meet on 21 September 2023. [Con-2434] • On 18 September 2023, BTAC's nominated representative confirmed the meeting date. [Con-2436] • On 18 September 2023, BTAC's nominated representative further advised that the meeting would need to be deferred due to community matters. [Con-2441] • On 18 September 2023, Santos emailed BTAC's nominated representative confirming BTAC's advice. [Con-2446] • On 29 September 2023, Santos emailed BTAC's nominated representative seeking an update on a potential meeting date. [Con-2445] • On 29 September 2023, BTAC's nominated representative advised that a meeting would not be likely until mid-October 2023 due to limited capacity. [Con-2447] • On 5 October 2023, Santos emailed BTAC's nominated representative a commitment to the codesign of a consultation agreement, as well as list of proposed Santos activities in the Carnarvon Basin, with planned EP and EP submission and activity commencement dates. [Con-2488] • On 25 October 2023, Santos emailed BTAC with a request for feedback on the proposed Carnarvon Basin activities by 30 October 2023 given pending EP submission to NOPSEMA. Santos included an engagement protocol to support the consultation. [Con-2561] • On 30 October 2023, BTAC emailed Santos advising it would like to be consulted on an ongoing basis and would like to enter into a holistic agreement with Santos. In the absence of any agreed resourcing by Santos, BTAC has not been able to meaningfully share information or undertake consultation with its members in relation to the above proposed activities and EPs. [Con-2575] • On 31 October 2023, Santos emailed BTAC thanking BTAC's correspondence in relation to our proposed consultation activities for activities offshore Western Australia. Santos advised it is still keen to meet to progress discussions on the development of a framework agreement, including support of meaningful ongoing engagement, information sharing, and capacity building. Santos requested BTAC advise if and when it can meet. [Con-2601] • On 23 November 2023, Santos emailed BTAC following up on the proposed resourcing protocol, general report, and to request a meeting before the end of 2023. Santos also asked for a list of the Board meetings were planned in 2024 so Santos could forward plan. [Con-2803] • On 23 November 2023, BTAC emailed Santos advising it would get to them as soon as possible. BTAC requested a Word doc version of the draft engagement protocol as BTAC was likely to have some edits to that document. [Con-2804] • On 22 January 2024, Santos emailed BTAC with minor edits to the engagement protocol [Con-3088] • On 8 February 2024, Santos emailed BTAC to confirm the engagement protocol was being finalised. [Con-3845]

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 9 February 2024 Santos emailed BTAC to advise the engagement protocol had been finalised. BTAC acknowledged the email from Santos regarding the finalising of the engagement protocol. [Con-3846] • On 9 August 2024, Santos emailed BTAC to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5459] • No additional correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
At the time of EP submission to NOPSEMA, BTAC had not provided any concerns in relation to proposed activities relating to this EP.	The consultation process for this revision has been running for over a year, since the first engagement on 29 May 2023. Santos has made considerable and significant efforts to date to try and engage and consult with BTAC and within a reasonable timeframe to obtain their feedback. Santos considers reg 25 consultation complete for this EP.	In response to BTAC's request to be consulted, Santos has provided BTAC with the following information for consultation: Santos' consultation materials specific to the activity. Follow up emails and calls as per the NOPSEMA sensitive information report to endeavour to close out EP consultation. A prioritised list of Carnarvon Basin activities and EP submission dates With respect to the development of a holistic agreement, this has now been finalised.	All information and communication with BTAC during this consultation has been included in the NOPSEMA sensitive information report for this EP.
Kariyarra Aboriginal Corporation (KAC)			
• On 29 May 2023, Santos emailed KAC and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of KAC may be affected. [Con-2187] • On 26 June 2023, Santos emailed KAC to discuss consultation expectations for proposed activities. [Con-2042] • On 20 July 2023, Santos emailed KAC by way of reminder on the timeframe for providing feedback. [Con-2077] • On 30 July 2023, KAC emailed Santos advising it requires full consultation for proposed Carnarvon Basin activities. [Con-2044] • On 31 July 2023, Santos emailed KAC advising it would like to meet to discuss the proposed activities. [Con-2062] • On 8 August 2023, Santos emailed KAC a reminder to discuss proposed activities. [Con-2180] • On 8 August 2023, KAC emailed Santos advising it would be in touch shortly. [Con-2236] • On 14 August 2023, Santos emailed KAC to advise it would be in Port Hedland on 16 August 2023 and would be available to meet. [Con-2478] • On 9 August 2024, Santos emailed KAC to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5460]. • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation.	NA	No additional EP controls required.

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
	Santos considers Section 25 consultation complete for this EP.		

Nganhurra Thanardi Garrbu Aboriginal Corporation (NTGAC)

- On 29 May 2023, Santos emailed YMAC on behalf of NTGAC and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of NTGAC may be affected. [Con-2188]
- On 19 June 2023, YMAC emailed Santos on behalf of NTGAC and referred Santos to YMAC's draft consultation framework. [Con-2107]
- On 20 July 2023, Santos emailed YMAC on behalf of NTGAC proposing a meeting to discuss how to approach consultation for proposed Carnarvon Basin activities [Con-2075]
- On 7 August 2023, Santos called YMAC by way of a follow-up to set a meeting date. YMAC confirmed that Santos would receive advice by email for a proposed meeting date with NTGAC in September 2023. [Con-2189]
- On 21 August 2023, YMAC on behalf of NTGAC sent Santos an email with a draft budget estimate for a proposed meeting with the NTGAC Board of Directors in September 2023. [Con-2313]
- On 22 August 2023, Santos emailed NTGAC advising it would consider the proposed meeting budget estimate. [Con-2397]
- On 4 September 2023, YMAC emailed Santos advising it would like to meet with Santos on 11/09/23 to discuss the agenda for the proposed meeting regarding future consultation. [Con-2335]
- On 7 September 2023, Santos emailed YMAC confirming attendance at the meeting. Santos requested if it would be online or in person. [Con-2371]
- On 8 September 2023, NTGAC emailed Santos following up on the proposed meeting budget. [Con-2379]
- On 11 September 2023, Santos responded to NTGACs email from 8 September 2023 confirming it accepts the proposed budget for the meeting on 28 September 2023. [Con-2383]
- On 28 September 2023, Santos met with NTGAC to discuss Santos activities and consultation expectations, including the development of a consultation agreement and supporting consultation materials. [Con-2645]
- On 5 October 2023, Santos emailed NTGAC a commitment to the codesign of a consultation agreement, as well as list of proposed Santos activities in the Carnarvon Basin, with planned EP submission and activity commencement dates. [Con-2487]
- On 25 October 2023 Santos emailed YMAC on behalf of NTGAC with a request for feedback on the proposed Carnarvon Basin activities by 30 October 2023 given pending EP submission to NOPSEMA. Santos included an engagement protocol to support the consultation. [Con-2560]
- On 1 November 2023 Santos emailed YMAC (NTGAC) to follow up on the opportunity to discuss a way forward on the Draft Agreement, Rates Schedule and the General Report, the latter of which Santos have in draft. Santos advised it would be pleased to meet. [Con-2604]
- On 3 November 2023 YMAC (on behalf of NTGAC) emailed Santos advising it has been a busy period. YMAC advised it would be in touch later in November to discuss and proposed the 20 November 2023 for a meeting. [Con-2613]
- On 10 November 2023 Santos emailed NTGAC to confirm a meeting the week of 20 November 2023 to progress consultation. Santos provided a draft general report for NTGAC to review and provide feedback to finalise a consultation agreement. [Con-2649]
- On 10 November 2023, Santos emailed NTGAC to advise of additional resources to support consultation and engagement with NTGAC, including an introduction from Santos' new team member. [Con-2656]
- On 27 November 2023, Santos emailed NTGAC to follow up on the General Report emailed through on 10/11/23, requesting feedback. Santos advised it was available to talk through the report with relevant stakeholders as required, as well as answer any questions. [Con-2784]
- On 29 January 2024 Santos emailed NTGAC to again follow up on the provision of the Santos NTGAC General Report final, seek feedback, and progress the consultation agreement, with a view to then organisation consultation meetings. [Con-3090]
- On the 20 February 2024, Santos again emailed NTGAC with a copy of the General Report (Final), to seek to progress meetings and consultation. [Con-3848]
- On 21 February 2024, NTGAC emailed Santos acknowledging receipt of the email of 20 February [Con-3849]

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 7 March 2024, Santos phoned NTGAC to seek progress on consultations and emailed NTGAC with a copy of the General Report (Final), to seek to progress meetings and consultation. [Con-3850] • On 9 August 2024, Santos emailed NTGAC to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5462] • No additional correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
At the time of EP submission to NOPSEMA, NTGAC had not provided any concerns in relation to proposed activities relating to this EP.	The consultation process for this EP has been running for more than a year, since the first engagement on 29 May 2023. Santos followed up NTGAC by email and provided a final opportunity for feedback before consultation was closed out. Santos has made considerable and significant efforts to date to try and engage and consult with NTGAC and within a reasonable timeframe to obtain their feedback. Santos considers reg 25 consultation complete for this EP. Santos will continue to engage with NTGAC to conclude a holistic agreement to support future engagement and consultation on future EPs.	In response to NTGAC's request to be consulted, Santos has provided NTGAC with the following information for consultation: Santos' consultation materials specific to the activity. Follow up emails and calls as per the NOPSEMA sensitive information report to endeavour to close out EP consultation. A prioritised list of Carnarvon Basin activities and EP submission dates With respect to the development of consultation framework Santos has: Attended relationship meeting on 28 September 2023 to discuss consultation expectations. Provided a draft consultation protocol and supporting schedule of rates. Provided a draft general report containing plain English descriptions of Santos' existing, planned and proposed activities that are regionally proximate to NTGAC's interests. Santos continues to engage with NTGAC to conclude a consultation framework.	All information and communication with NTGAC during this consultation has been included in the NOPSEMA sensitive information report for this EP.
Ngarluma Aboriginal Corporation (NAC)			
• On 29 May 2023, Santos emailed NAC and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of NAC and its members may be affected. [Con-2190] • On 30 May 2023, Santos emailed NAC to coordinate an in-person meeting as Santos was planning meetings in Karratha in early June. [Con-2191] • On 31 May 2023, NAC emailed Santos to advise that a Karratha-based meeting was not possible due to the availability of attendees. [Con-2192] • On 31 May 2023, Santos emailed NAC thanking NAC for its feedback. [Con-2193]			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant
• On 8 June 2023, Santos emailed NAC advising that its planning early June meetings did not proceed as planned and that Santos would be in Karratha later in June. Santos sought feedback if NAC me available at this time. [Con-2194] • On 26 June 2023, Santos emailed NAC to discuss consultation expectations for proposed activities. [Con-2103] • On 20 July 2023, Santos emailed NAC by way of reminder to set a meeting date. [Con-2079] • On 21 July 2023, NAC confirmed a meeting would be arranged for 28 August 2023. [Con-2066] • On 25 July 2023, Santos emailed NAC requesting a Teams meeting to discuss proposed activities. [Con-2064] • On 4 August 2023, Santos met with NAC to discuss proposed activities, which resulted in the following actions: • NAC to confirm in writing its consultation expectations for EP consultation. • Santos to provide feedback to NAC on its consultation expectations. • Meeting to be held in September 2023 to discuss next steps on consultation and potential presentation to the NAC Board of Directors. • On 18 September 2023, NAC emailed Santos and proposed for Santos' consideration the establishment of a joint working group to progress consultation for this EP and other Santos proposed activities. [Con-2495] • On 28 September 2023, NAC emailed Santos following up on its email of 18 September 2023. [Con-2435] • On 3 October 2023, Santos emailed NAC seeking clarification on proposed working group arrangements. [Con-2465] • On 4 October 2023, NAC emailed Santos and provided clarification on proposed working group arrangements, as well as proposing an initial working group meeting for mid-October 2023. [Con-2467] • On 5 October 2023, Santos emailed NAC's nominated representative a commitment to the codesign of a consultation agreement, as well as list of proposed Santos activities in the Carnarvon Basin, with planned EP submission and activity commencement dates. [Con-2490] • On 12 October 2023, Santos emailed Ngarluma Aboriginal Corporation information regarding proposed Carnarvon Basin activities for review as part of consultation, following a meeting earlier that day. [Con-2545] • On 25 October 2023, Santos emailed NAC with a request for feedback on the proposed Carnarvon Basin activities by 30 October 2023. Santos included an engagement protocol to support the consultation. [Con-2563] • On 30 October 2023, NAC emailed Santos advising Santos readdress the letter as the previous CEO is no longer at NAC. It also provided costings for meetings. [Con-2576] • On 9 November 2023, NAC emailed Santos advising in advance of next Thursday's meeting the protocol must be in place and NAC will need to invoice Santos. The NAC schedule of fees and process for paying is consistent across all of similar external engagements for the NAC working Group. NAC's lawyers have drafted the standard engagement agreement suited to the Santos consultations and consistent with your terms in your protocol document. NAC asked Santos to prioritise getting comments back and get the agreement closed out ASAP. [Con-2646] • On 13 November 2023, NAC emailed Santos advising it required feedback on the consultation protocol prior to the meeting on 16 November 2023. [Con-2663] • On 13 November 2023, Santos emailed NAC advising it had received the rates and protocol and was in the process of reviewing. Santos also provided a draft agenda for the meeting scheduled for 16 November 2023. [Con-2667] • On 22 November 2023, NAC emailed Santos requesting an update on the Santos review of the Consultation protocol, and request for confirmation if Santos would want to proceed with a December meeting. [Con-2817] • On 23 November 2023, Santos emailed NAC responding to the update request, advising that Santos is still reviewing the Consultation Protocol, and affirming that a meeting would be desirable if it can be held the week of the 18 to 21 December 2023. [Con-2819] • On 27 November 2023, Santos spoke to NAC on the phone. NAC advised no meeting is possible week of 18 December 2023; and that without a Consultation Protocol no meetings would go ahead. Santos advised NAC that Santos did need to respond to submission deadlines, but that this in no way reflects a cessation of engagement with NAC; simply that the ongoing relationship and external EP deadlines are two separate event streams. Discussion about the opportunity to meet early 2024 and affirmation that meeting was likely towards the end of Jan 2024, assuming the Consultation Protocol is in place. [Con-2824]

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 21 December 2023, Santos emailed NAC in regard to planned projects around Ngarluma country seeking consultation meetings with the groups and individuals that may be affected by such projects. [Con-3074] • On 22 December 2023 Santos emailed Ngarluma Aboriginal Corporation to affirm that a revised resourcing protocol will be arranged in early 2024 referencing NAC suggested draft. [Con-3080] • On 16 January 2024, Santos emailed NAC CEO suggesting late January for a possible meeting and indicating that having resourcing protocols in place before then would be desirable. [Con-3085] • On 22 January 2024, NAC emailed Santos regarding meeting costs and a draft schedule of rates. [Con-3087] • On 29 January 2024, Santos phoned NAC to discuss progression of consultation agreement, and to arrange first meeting for 2024 for the purpose of relationship building. [Con-5589] • On 9 August 2024, Santos emailed NAC to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5463] • No additional correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
At the time of EP submission to NOPSEMA, NAC had not provided any concerns in relation to proposed activities relating to this EP.	The consultation process for this EP has been running for more than a year, since the first engagement on 29 May 2023. Santos has made considerable and significant efforts to date to try and engage and consult with NAC and within a reasonable timeframe to obtain their feedback. Santos considers reg 25 consultation complete for this EP. Santos will continue to engage with NAC to conclude a holistic agreement to support future engagement and consultation on future EPs.	In response to NAC's request to be consulted, Santos has provided NAC with the following information for consultation: Santos' consultation materials specific to the activity. Follow up emails and calls as per the NOPSEMA sensitive information report to endeavour to close out EP consultation. A prioritised list of Carnarvon Basin activities and EP submission dates With respect to the development of a holistic agreement Santos has: Attended a NAC working group meeting on 12 October 2023 to discuss consultation expectations. Provided a draft consultation protocol and supporting schedule of rates. Santos continues to engage with NAC to conclude a holistic agreement.	All information and communication with NAC during this consultation has been included in the NOPSEMA sensitive information report for this EP.
South West Aboriginal and Sea Councils (SWALSC)			
• On 26 June 2023, Santos emailed SWALSC and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of SWALSC may be affected. [Con-2097] • On 20 July 2023, Santos sent a follow up email to SWALSC by way of reminder on the timeframe for providing feedback. [Con-2070] • On 8 September 2023, Santos emailed SWALSC a reminder of proposed Carnarvon Basin activities for consultation requesting feedback if it believed that its functions, interests, or activities may be affected by Santos' proposed activities, including consideration of potential impacts to or risks associated with:			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
– traditional lands and waters – sea country interests – totemic species – other values or sensitivities of importance. [Con-2377] • On 9 August 2024, Santos emailed South West Aboriginal Land And Sea Council (SWALSC) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5456] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
Nil	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Wanparta Aboriginal Corporation			
• On 29 May 2023, Santos emailed WAC and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of WAC and its members may be affected. [Con-2190] • On 29 February 2024, Santos emailed WAC contact person to seek a consultation meeting. [Con-4327] • On 8 March 2024, WAC was emailed by Santos, reiterating the request for a meeting and providing additional information on upcoming activities. [Con-4328] • On 28 March 2024, WAC confirmed by telephone that a meeting with the Board of Directors could be arranged for 8 May 2024. [Con-4330] • On 2 April 2024 WAC advised Santos that the meeting for 8 May would need to be rescheduled. [Con-4330] Santos acknowledged this email [Con-4331] • On 4 April 2024 WAC offered Santos a meeting on 17 May 2024. [Con-4332] • On 4 April 2024 Santos confirmed the meeting on 17 May 2024 [Con-4333] • On 8 April 2024 WAC advised it was waiting on another organisation to confirm the 17 May 2024 for a half day consultation meeting. [Con-4334] • On 17 April 2024 WAC advised Santos this meeting would need to be postponed. [Con-4335] • On 17 April 2024 Santos acknowledged the meeting postponement and requested the meeting be rescheduled with WAC. [Con-4345] • On 17 April 2024 WAC offered a date in August for a meeting [Con-4362] • On 17 April 2024 Santos emailed WAC advising that meeting in August would be too late for most activities of relevance to Wanparta as consultation would have closed by that time [Con-4384] • On 24 April 2024 Santos emailed WAC requesting the date of 17 May for a full day meeting. [Con-4336] • On 26 April 2024, WAC emailed Santos advising the 17 May was not available at all. [Con-4337] • On 29 May 2024 WAC emailed Santos offering a meeting on the 10 or 12 June 2024 [Con-4338] • On 30 May 2024 Santos emailed WAC confirming that the 10 June was acceptable for a meeting and forwarded details of the agenda. [Con-4339] • On 30 May 2024 WAC confirmed that the meeting would go ahead on 10 June 2024. [Con-4340] • On 4 June WAC emailed Santos confirming the agenda [Con-4341]			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 7 June 2024 Santos emailed WAC providing a full copy of the presentation prior to the meeting of the 10 June, including information that consultation on Halyard 2 would take place at the meeting. [Con-4385] • On 10 June 2024 Santos representatives met with Board Directors of WAC and Ngarla Elders. Directors and Elders requested information on implications to their functions, interests and activities in the event of a spill. WAC Directors and Ngarla Elders also requested to be notified in the event of a spill that had potential to impact WAC functions, interests and activities. [Con-4342] • On 17 June 2024 Santos responded via email to WAC, attaching a letter responding to information requests from the meeting of 10 June 2024 [Con-4343] • On 18 June 2024 Santos emailed WAC with the full minutes of the meeting from the 10 June. [Con-4386] • On 9 August 2024, Santos emailed WAC (Wanparta) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5467] • No additional correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
WAC Directors and Ngarla Elders requested information spill modelling predictions and potential impacts to Ngarla coastline, 80 Mile Beach Marine Park, Bedout and other islands within the Ngarla Native Title Determined Area.	Santos noted the request from WAC Directors and Ngarla Elders.	Santos confirmed that the EMBA for the Activity intersected the 80 Mile Beach Marine Park, but did not intersect mainland and island (Bedout, North Turtle, Little Turtle) coastlines. Santos also confirmed that the EMBA was an overly conservative representation of the potential extent of a spill and did not take into account implementation of spill response mitigation measures, which would reduce the size of the EMBA.	No additional EP controls required.
WAC Directors and Ngarla Elders requested to be notified in the event of a spill that had potential to impact WAC functions, interests and activities.	Santos noted the request from WAC Directors and Ngarla Elders.	Santos confirmed it will notify WAC in the event of a spill that has potential to impact the functions, interests, or activities of Ngarla people	Activity notifications are included in Table 8-4
A meeting attendee suggested that Ngarla Rangers could assist with spill response.	Santos noted the suggestion from the meeting attendee.	Santos confirmed at the meeting that the DoT has responsibility in WA waters for spill response, with planning and decision making undertaken in conjunction with other government agencies and liaison officers/advisors (where appropriate), including the identification of areas for protection. Santos confirmed it will, liaise with the DoT on opportunities for WAC to engage with DoT on spill response, including use of Ngarla Rangers in the event a spill could impact the functions, interests or activities of Ngarla people.	No additional EP controls required.

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.

Wirrawandi Aboriginal Corporation (WAC)

- In May 2023, Santos confirmed a meeting with WAC CEO and Directors in Karratha on 6 June 2023. The meeting did not proceed due to weather constraints for attendees travelling to the meeting.
- On 2 June 2023, Santos emailed the WAC CEO to coordinate a follow up meeting, with a focus on introducing Santos, its people and its activities ahead of formal consultation. [Con-3102]
- On 6 June 2023, WAC CEO emailed Santos to advise of a rescheduled date of 21 June 2023 for a meeting in Karratha. [Con-3102]
- On 21 June 2023, Santos met with WAC CEO and Directors. The purpose of the meeting was to introduce Santos and provide an overview of a number of proposed Carnarvon Basin activities [Con-4444]
- The meeting resulted in the following actions:
- WAC and Santos to develop a consultation framework to support ongoing consultation.
- On 17 August 2023, WAC emailed a subsequent acceptance letter for consideration to support a range of activities, including Environment Plan consultation. [Con-2314]
- On 20 August 2023, Santos responded to WAC and advised that the consultation letter was being considered. [Con-2315]
- On 23 August 2023, WAC emailed Santos advising it is open to modifying the letter to ensure costs are agreed by Santos in advance before being incurred by WAC. WAC outlined costs. [Con-2327]
- On 10 September 2023 Santos emailed WAC regarding consultation for the proposed offshore activities. [Con-2380]
- On 5 October 2023, Santos emailed WAC a commitment to the codesign of a consultation agreement, as well as list of proposed Santos activities in the Carnarvon Basin, with planned EP submission and activity commencement dates. [Con 2493]
- On 25 October 2023, Santos emailed WAC with a request for feedback on the proposed Carnarvon Basin activities by 30 October 2023. Santos included an engagement protocol to support the consultation. [Con-2562]
- On 4 November 2023, WAC emailed Santos providing an executed Cost Acceptance Letter and NOPSEMA activities engagement letter. [Con-2621]
- On 30 November 2023, Santos emailed WAC in response to their email from 4 November 2023. Santos advised it had provisionally accepted the costs outlined in the documentation provided by WAC, with Legal review pending. Santos also advised it was finalising a General Report. Santos provided a copy of the engagement protocol in Word format as requested. Santos requested a meeting. [Con-2808]
- On 30 November 2023, WAC emailed Santos advising it would be happy to meet in January 2024. [Con-2809]
- On 1 December 2023, Santos emailed WAC advising it would be happy to meet in January. Santos said it would be good to get the resourcing protocols in place before the new year to enable the structure and confidence to proceed. Santos advised it would provide the General Report to WAC in the next week. [Con-2810]
- On 3 December 2023, WAC emailed Santos requesting a Word version of the rates schedule for WAC to make amendment to, consistent with its earlier letter. [Con-2825]
- On 4 December 2023, Santos emailed WAC the Word version of the Resourcing Protocol rates as requested on 3 December 2023. [Con-2826]
- On 21 December 2023 Santos provided WAC a General Report to WAC in response to a request (within email dated 4 November 2023 [Con-2621], including maps and detail on project activities. [Con-3075]
- On 2 January 2024, WAC emailed Santos suggesting a meeting in Perth between 23/1 and 25/1 2024. [Con-3081]
- On 2 January 2024, Santos emailed WAC and agreed to meet during the proposed time period. [Con-3082]

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 15 January 2024, Santos emailed WAC and indicated that the purpose of the meeting was not for consultation but to informally meet (the new CEO). [Con-3084] • On 18 January 2024, WAC emailed Santos and agreed with proposed meeting objectives. [Con-3086] • On 29 January 2024, Santos emailed WAC to thank them for the meeting on 23 January 2024 with the WAC CEO where the project as described in the Santos WAC General Report v2 was reviewed and advised that final copies of engagement and resourcing protocols were almost complete. [Con-3092] • On 29 January WAC acknowledged the email from Santos sent on 29 January 2024. [Con-3487] • On 9 August 2024, Santos emailed WAC (Wirrawandi) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5464] • No additional correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
At the time of EP submission to NOPSEMA, WAC had not provided any concerns in relation to proposed activities relating to this EP.	The consultation process for this EP has been running for more than a year, since the first engagement on 21 June 2023. Santos has made considerable and significant efforts to date to try and engage and consult with WAC and within a reasonable timeframe to obtain their feedback. Santos considers reg 25 consultation complete for this EP. Santos will continue to engage with WAC to conclude a consultation agreement to support engagement and consultation on future EPs.	In response to WAC's request to be consulted, Santos has provided WAC with the following information for consultation: Santos' consultation materials specific to the activity. Follow up emails and calls as per the NOPSEMA sensitive information report to endeavour to close out EP consultation. A prioritised list of Carnarvon Basin activities and EP submission dates. With respect to the development of a consultation agreement Santos has: Attended a relationship meeting on 21 June 2023 to discuss consultation expectations. Provided a draft consultation protocol and supporting schedule of rates. Santos continues to engage with WAC to conclude a consultation agreement.	All information and communication with WAC has during this consultation been included in the NOPSEMA sensitive information report for this EP.
Yinggarda Aboriginal Corporation (YAC)			
• On 26 June 2023, Santos emailed YAC and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of YAC may be affected. [Con-2102] • On 20 July 2023, Santos emailed YAC by way of reminder to set a meeting date. [Con-2073] • On 8 September 2023, Santos emailed Yinggarda Aboriginal Corporation a reminder of proposed Carnarvon Basin activities for consultation requesting feedback if it believed that its functions, interests, or activities may be affected by Santos' proposed activities, including consideration of potential impacts to or risks associated with: – traditional lands and waters – sea country interests – totemic species			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
– other values or sensitivities of importance. [Con-2372] • On 9 August 2024, Santos emailed YAC to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5466] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers reg 25 consultation complete for this EP.	NA	No additional EP controls required.
Native Title interests – Gascoyne region			
Malgana Aboriginal Corporation (MAC)			
• On 26 June 2023, Santos emailed MAC and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of MAC may be affected. [Con-2100] • On 20 July 2023, Santos emailed MAC by way of reminder to set a meeting date. [Con-2072] • On 21 July 2023, Malgana emailed Santos advising it requests Santos attends the next Board meeting in Sept/Oct 2023. [Con-2055] • On 31 July 2023, Santos emailed Malgana advising it would be pleased to present at the next Board meeting. [Con-2061] • On 31 July 2023, Malgana emailed Santos advising it would lock a time in at the next meeting and would be in touch to confirm the timing and provide an invoice. [Con-2122] • On 9 August 2024, Santos emailed MAC to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5468] • No feedback on the activity has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
Nil	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Native Title interests – Mid West region			
Bundi Yamatji Aboriginal Corporation (BYAC)			
• On 27 June 2023, Santos emailed BYAC and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of BYAC may be affected. [Con-2096] • On 20 July 2023, Santos sent a follow up email to BYAC to discuss consultation expectations for proposed activities. [Con-2068] • On 08 September 2023, Santos emailed BYAC a reminder of proposed Carnarvon Basin activities for consultation requesting feedback if it believed that its functions, interests, or activities may be affected by Santos' proposed activities, including consideration of potential impacts to or risks associated with: – traditional lands and waters			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
– sea country interests – totemic species – other values or sensitivities of importance. [Con-2374] • On 20 July 2023, Santos emailed BYAC by way of reminder to set a meeting date. [Con-2068] • On 9 August 2024, Santos emailed BYAC to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5469]. • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA	No additional EP controls required.
Industry associations - Commercial fishing			
Australian Southern Bluefin Tuna Industry Association (ASBTIA)			
• On 30 May 2023, Santos emailed ASBTIA and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of ASBTIA may be affected, as well as consideration of ASBTIA's expectation for consultation of licence holders. [Con-2291] • On 8 June 2023, Santos emailed ASBTIA regarding consultation for proposed Carnarvon Basin activities. [Con-2292] • On 29 June 2023, Santos emailed ASBTIA seeking feedback on proposed activities. [Con-1900] • On 28 July 2023, Santos emailed ASBITA as a reminder its consultation for proposed Carnarvon Basin activities. [Con-1915] • On 9 August 2024, Santos emailed Australian Southern Bluefin Tuna Industry Association (ASBTIA) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5470]. • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation.		
Commonwealth Fisheries Association (CFA)			
• On 30 May 2023, Santos emailed CFA and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of CFA may be affected, as well as consideration of CFA's expectation for consultation of licence holders. [Con-2170] • On 29 June 2023, Santos emailed CFA seeking feedback on proposed activities. [Con-1899] • On 25 July 2023, Santos emailed CFA by way of reminder on the timeframe for providing feedback. [Con-1906]			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 9 August 2024, Santos emailed Commonwealth Fisheries Association (CFA) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5471] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers Section 25 consultation complete for this EP.	NA.	No additional EP controls required.
South East Trawl Fishing Industry Association (SETFIA)			
• On 7 June 2023, Santos emailed SETFIA and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of TA may be affected, as well as consideration of TA's expectation for consultation of licence holders. [Con-2345] • On 25 July 2023, Santos emailed CFA by way of reminder on the timeframe for providing feedback [Con-1864] • On 9 August 2024, Santos emailed South East Trawl Fishing Industry Association (SETFIA) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5472]. • On 10 August 2024, Santos received an email from SETFIA requesting removal from all updates relating to WA projects. [Con-5548]			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	*NA*	*NA.*	*No additional EP controls required.*
Tuna Australia (TA)			
• On 30 May 2023, Santos emailed TA and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of TA may be affected, as well as consideration of TA's expectation for consultation of licence holders. [Con-2172] • On 31 May 2023, TA emailed Santos advising it required a service agreement to enable it to effectively manage its member base for consultation. [Con-2117] • On 1 June 2023, Santos met with TA to provide information on proposed activities. [Con-2028] • On 29 June 2023, Santos emailed TA regarding consultation for proposed Carnarvon Basin activities. [Con-1896] • On 28 July 2023, Santos emailed TA and proposed an alternative approach to the service agreement and sought feedback on whether this approach would be acceptable to TA. [Con-1920] • On 31 July 2023, TA emailed Santos and advised a TA representative would respond. [Con-1923] • On 1 August 2023, Santos emailed TA and advised it would discuss proposed consultation approaches with the TA representative. [Con-1926] • On 1 August 2023, TA provided feedback to Santos advising it was disappointed that Santos was unable to enter a service agreement with Tuna Australia. [Con-2123] • On 1 August 2023, Santos called the TA representative to provide further context on the service agreement and the alternate consultation approach. Santos committed to further reviewing the matter and its intent for meaningful consultation of tuna fishery licence holders.			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 23 August 2023, Santos emailed Tuna Australia informing them that the Santos contracts team would like to discuss the potential amendments to the proposed T&Cs given Santos' particular needs. Santos will wait until it receives consent from Tuna Australia before passing contact details to the Contracting team. [Con-2316] • On 23 August 2023, Tuna Australia emailed Santos giving their consent to forward their details to the Santos Contracting team. [Con-2317] • On 24 August 2023, Santos emailed Tuna Australia with mark ups to their services agreement for their review. [Con-2323] • On 29 August 2023, Tuna Australia emailed Santos advising it does not agree with the proposed changes by Santos to its service agreement. [Con-2326] • On 13 September 2023, Santos emailed Tuna Australia to discuss the service agreement. [Con-2390] • On 13 September 2023, Tuna Australia emailed Santos to confirm a meeting via phone to discuss the service agreement. [Con-2391] • On 13 September 2023, Santos emailed Tuna Australia following a call with an updated service agreement for their review. [Con-2392] • On 18 September 2023, Tuna Australia emailed Santos, stating that Tuna Australia has discussed internally the rationale for the joint interest/joint venture and public indemnity insurance clauses Santos would like to keep included in the agreement. Tuna Australia have no concerns with agreeing to this latest draft and happy for Santos to take the lead of progressing the agreement to signing. [Con-2426] • On 19 September 2023, Santos emailed Tuna Australia, requesting that there is a minor addition to the Agreement, which is the inclusion of an agreement number (indicates that it is an negotiated Agreement); Santos asks if Tuna Australia is acceptable of this addition? Santos also requests for contact details of someone who can provide vendor details, so Santos can create a new vendor in the system. [Con-2450] • On 19 September 2023, Tuna Australia emailed Santos, confirming that they are happy for the Agreement number to be added to the document. Tuna Australia also provided contact details of whom Santos should contact to set-up Tuna Australia as a vendor in the system. [Con-2451] • On 5 October 2023, Tuna Australia emailed Santos the agreement executed by Tuna Australia. [Con-2473] • On 5 October 2023, Santos acknowledged receipt of the executed agreement from Tuna Australia. [Con-2474] • On 9 August 2024, Santos emailed Tuna Australia (TA) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5473]. • No additional correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
TA has requested Santos to support the development of a consultation agreement in order to undertake consultation activities.	Santos notes the intention of TA to consult is dependant on co-design of consultation arrangements. Santos and TA have finalised arrangements. Santos has not received any comments on the activities associated with this EP. Santos considers reg 25 consultation complete for this EP.	Santos is committed securing consultation arrangements with TA.	NA
Western Australian Fishing Industry Council (WAFIC)			
• On 7 June 2023, Santos met with WAFIC regarding the proposed activities and discussed opportunities to adopt pragmatic and practical approaches for the consultation of licence holders, noting WAFIC's published guidance on this matter. [Con-2037] • On 29 June 2023, Santos emailed WAFIC and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of WAFIC may be affected, as well as consideration of WAFIC's expectation for consultation of licence holders. [Con-1901]			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 27 July 2023, WAFIC emailed Santos with feedback regarding proposed activities and sought additional information on the following topics: [Con-2149] • General comments • Prohibition of recreational fishing within the operational area. • Halyard-2 Drilling & Completion comments • Physical presence and interaction with other marine users – there are no management measures in place to address fishing displacement. • Seabed disturbance – what assessment has Santos made to ensure all equipment can be fully removed in the future? • On 9 August 2023, Santos emailed WAFIC and provided a response as summarised below [Con-2212]. • On 24 August 2023, WAFIC emailed Santos with feedback in response to the email from Santos on 9 August 2023. [Con-2324] • On 6 October 2023, Santos emailed WAFIC with feedback to address their queries from 24 August 2023 regarding this EP. [Con-2517] • On 9 August 2024, Santos emailed Western Australian Fishing Industry Council (WAFIC) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5474]. • On 23 August 2024 Santos received an email from West Australian Fishing Industry Council (WAFIC) appreciating the activity update on the commissioning, start-up and operation of the Halyard 2 well at the Varanus Island Hub in Western Australia. WAFIC noted no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation. WAFIC has no further input and stands by its original feedback made on the 27 July 2023 and 24 August 2023. [Con-5580] • On 23 August 2023 Santos sent an email to Western Australian Fishing Industry Council (WAFIC) to acknowledge receipt of their email regarding the Halyard-2 Operations Varanus Island Hub Operations Environment Plan activity revision. Santos acknowledged that WAFIC observes no new material impacts from the activity revision and has no further input. Santos further acknowledges WAFIC stands by their original feedback on the 27 July 2024 and 24 August 2024 (correction email issued to WAFIC changing these dates to 27 July 2023 and 24 August 2023). [Con-5581]			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
WAFIC requested the prohibition of recreational fishing within the operational areas for proposed activities.	Santos has considered WAFIC's feedback. Note: consultation was undertaken for Halyard-2 and ongoing operations at the same time. This response was specific to the operational area defined for the Halyard-2 drilling and completion activity, therefore is outside the scope of this EP. A petroleum safety zone will continue to be applied around the John Brookes WHP and is shown on Australian nautical charts as per control measure VI-CW-CM-21.	Santos prohibits recreational fishing within the operational area and it is already included as a control in the EPs WAFIC listed, even if not listed as a 'key management measure' in the fact sheets.	Refer to Halyard-2 Drilling & Completion EP (9887-650-REP-0001) Section 6.5.3 for relevant control measure. Refer to Section 6.6.3 of this EP for control measure VI-CW-CM-21.
WAFIC noted that there are no management measures in place to address fishing displacement.	Santos has considered WAFIC's feedback. Note: consultation was undertaken for Halyard-2 and ongoing operations at the same time. This response was specific to potential fishing displacement during the	Santos has assessed the potential risks and impacts associated with physical presence and interactions with other marine users in Section (Interaction with other Marine Users) of the EP, and applied controls considered appropriate to manage the potential impacts	No additional EP controls required.

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
	Halyard-2, therefore outside the scope of this EP.	and risks of the activity to ALARP and acceptable levels.	
WAFIC asked that considering all decommissioning end states within this consultation package propose partial removal, what assessment has Santos made to ensure all equipment can be fully removed in the future?	Santos has considered WAFIC's feedback. Note: consultation was undertaken for Halyard-2 and ongoing operations at the same time. This response was specific to the additional equipment being installed on the seabed as part of the Halyard-2 drilling activity, and therefore is outside the scope of this EP.	Santos has assessed the potential risks and impacts associated with seabed disturbance in Section 6.5 of the Halyard-2 EP, and applied controls considered appropriate to manage the potential for impacts and risks to the seabed from the activity to ALARP and acceptable levels. Additionally, Santos has adopted an additional control in the EP whereby all equipment installed on the seabed is designed such that it can be fully removed during decommissioning. This will minimise ongoing impacts to the seabed beyond operations.	No additional EP controls required.

Western Rock Lobster (WRL)

- On 31 May 2023, Santos emailed Western Rock Lobster and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2259]
- On 19 June 2023, Santos met with Western Rock Lobster to provide information about the proposed Carnarvon Basin activities. Western Rock Lobster confirmed it required pre-start and activity completion notifications. [Con-2030]
- On 20 June 2023, Santos emailed information to Western Rock Lobster regarding proposed Carnarvon Basin activities and oil pollution management plans. [Con-2120]
- On 30 June 2023, Santos emailed Western Rock Lobster seeking feedback on proposed activities. [Con-1904]
- On 25 July 2023, Santos emailed Western Rock by way of reminder on the timeframe for providing feedback. [Con-1910]
- On 9 August 2024, Santos emailed Western Rock Lobster (WRL) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5475]
- No additional correspondence or feedback has been received.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
Western Rock Lobster confirmed at the meeting of 19 June 2023 that it required pre-start and activity completion notifications.	Santos notes Western Rock Lobster's feedback. Note: consultation was undertaken for Halyard-2 and ongoing operations at the same time. This response was specific to Halyard-2. As such, these notification commitments are outside the scope of this EP, however they appear in the Halyard-2 Drilling and Completion EP and do not	Santos will send Western Rock Lobster activity notifications.	Refer to Halyard-2 Drilling & Completion EP (9887-650-REP-0001) for notifications associated with this consultation.

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
	appear in Section 8.10 (Reporting and Notifications) of this EP.		
Industry associations – Energy industry			
Australian Energy Producers (AEP) (Previously known as Australian Petroleum Production and Exploration Association (APPEA))E			
• On 31 May 2023, Santos emailed APPEA and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2168] • On 29 June 2023, Santos emailed APPEA seeking feedback on proposed activities. [Con-1880] • On 21 July 2023, Santos emailed APPEA by way of reminder on the timeframe for providing feedback. [Con-1809] • On 9 August 2024, Santos emailed Australian Energy Producers (AEP) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5479] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Industry associations – Local government			
Western Australian Local Government Association (WALGA)			
• On 1 June 2023, Santos emailed WALGA and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2257] • On 30 June 2023, Santos emailed WALGA seeking feedback on proposed activities. [Con-1807] • On 21 July 2023, Santos emailed WALGA by way of reminder on the timeframe for providing feedback. [Con-1810] • On 9 August 2024, Santos emailed Western Australian Local Government Association (WALGA) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5477] • No correspondence or feedback has been received.			
Industry associations – Local industry			
Chamber of Commerce and Industry WA (CCIWA)			
• On 30 June 2023, Santos emailed CCIWAE and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-1829] • On 19 July 2023, Santos emailed CCIWA a reminder of proposed Carnarvon Basin activities for consultation. [Con-1847]			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 9 August 2024, Santos emailed Chamber of Commerce and Industry WA (CCIWA) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5482] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Mid-West Chamber of Commerce and Industry			
• On 07 June 2023, Santos emailed Mid West CCI and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2353] • On 27 June 2023, Santos emailed Mid West CCI seeking feedback on proposed activities. [Con-1816] • On 19 July 2023, Santos emailed Mid West CCI by way of reminder on the timeframe for providing feedback. [Con-1837] • On 9 August 2024, Santos emailed Mid West Chamber of Commerce and Industry to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5488] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Carnarvon Chamber of Commerce and Industry			
• On 31 May 2023, Santos emailed Carnarvon CCI and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2256] • On 27 June 2023, Santos emailed Carnarvon CCI seeking feedback on proposed activities. [Con-1814] • On 19 July 2023, Santos emailed Carnarvon CCI by way of reminder on the timeframe for providing feedback. [Con- 1835] • On 9 August 2024, Santos emailed Carnarvon Chamber of Commerce and Industry to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5481] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation.	NA	No additional EP controls required.

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
	Santos considers section 25 consultation complete for this EP.		
Exmouth Chamber of Commerce and Industry			
• On 31 May 2023, Santos emailed Exmouth CCI and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2255] • On 27 June 2023, Santos emailed Exmouth CCI seeking feedback on proposed activities. [Con-1813] • On 19 July 2023, Santos emailed Exmouth CCI by way of reminder on the timeframe for providing feedback. [Con-1834] • On 9 August 2024, Santos emailed Exmouth Chamber of Commerce and Industry to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5484] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Onslow Chamber of Commerce and Industry			
• On 31 May 2023, Santos emailed Onslow CCI and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2254] • On 27 June 2023, Santos emailed Onslow CCI seeking feedback on proposed activities. [Con-1812] • On 19 July 2023, Santos emailed Onslow CCI by way of reminder on the timeframe for providing feedback. [Con-1833] • On 9 August 2024, Santos emailed Onslow Chamber of Commerce and Industry to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5489]. • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Karratha and Districts Chamber of Commerce and Industry			
• On 31 May 2023, Santos emailed Karratha CCI and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2253] • On 27 June 2023, Santos emailed Karratha CCI seeking feedback on proposed activities. [Con-1811] • On 19 July 2023, Santos emailed Karratha CCI by way of reminder on the timeframe for providing feedback. [Con-1832]			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 9 August 2024, Santos emailed Karratha and Districts Chamber of Commerce and Industry to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5487] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Port Hedland Chamber of Commerce and Industry			
• On 9 July 2024, Santos emailed Port Hedland Chamber of Commerce and Industry seeking feedback on proposed activities. [Con-5048] • On 16July 2024, Santos emailed Port Hedland Chamber of Commerce and Industry by way of reminder on the timeframe for providing feedback. [Con-5080] • On 9 August 2024, Santos emailed Port Hedland Chamber of Commerce and Industry to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5490] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Industry associations – Recreational fishing			
Recfishwest			
• On 30 May 2023, Santos emailed Recfishwest and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of Recfishwest may be affected, as well as consideration of Recfishwest's expectation for consultation of regional fishing clubs for proposed activities. [Con-2211] • On 30 June 2023, Santos emailed Recfishwest regarding consultation for proposed Carnarvon Basin activities. [Con-1902] • On 25 July 2023, Santos emailed Recfishwest as a reminder its consultation for proposed Carnarvon Basin [Con-1913] • On 27 July 2023, a representative from Recfishwest called Santos asking for an extension of time to provide feedback. Santos confirmed that an extension was acceptable. • On 16 August 2023, Recfishwest emailed Santos with based on the information provided, Recfishwest has no objections to the proposed activities with feedback regarding the proposed Halyard-2 activities as per the table below. [Con-2298] • On 22 August 2023, Santos emailed Recfishwest acknowledging its feedback regarding the proposed Halyard-2 activities. [Con-2311] • On 9 August 2024, Santos emailed Recfishwest to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5491].			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 15 August 2024, Santos received an email from Recfishwest confirming the updated activity plan. Recfishwest acknowledged vessels would be in the area from September through to November. Recfishwest noted the Halyard-2 well will be managed at Varanus Island during commissioning, start-up and operation, and vessels may be intermittently present to undertake routine IMMR activities. Recfishwest has no concerns over the proposed activities. [Con-5559] • On 19 August 2024 Santos emailed Recfishwest acknowledging their email regarding confirmation of the Halyard-2 Operations Varanus Island Hub Operations Environment Plan activity revision. Santos confirmed that based on the information, Recfishwest has no concerns over the proposed activities. Santos acknowledged Recfishwest's request to be kept informed as work progresses. [Con-5560]			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
Recfishwest noted that the area was accessed by the charter industry and recreational fishers in larger vessels and requested to be kept informed on the progress of the proposal.	Santos has noted this information. Note: consultation was undertaken for Halyard-2 and ongoing operations at the same time. This response was specific to the commencement of the Halyard-2 drilling activity. As such, these notification commitments are outside the scope pf this EP, however they appear in the Halyard-2 Drilling and Completion EP and do not appear in Section 8.10 (Reporting and Notifications) of this EP.	Santos acknowledges the feedback provided and Santos will ensure Recfishwest is kept informed of the progress of the project through activity notifications and provision of the Santos WA Quarterly Update. Santos also acknowledges that Recfishwest has no objections to the proposed activities.	Refer to Halyard-2 Drilling & Completion EP (9887-650-REP-0001) for notifications associated with this consultation
Western Australian Game Fishing Association (WAGFA)			
• On 31 May 2023, Santos emailed WGFA and provided information on a number of proposed Carnarvon Basin activities. Santos included a link to an information fact sheet about proposed activities in this revision and sought feedback on whether the functions, interests or activities of WGFA may be affected, as well as consideration of WGFA 's expectation for consultation of regional fishing clubs for proposed activities. [Con-2294] • On 30 June 2023, Santos emailed WGFA regarding consultation for proposed Carnarvon Basin activities. [Con-1903] • On 25 July 2023, Santos emailed WGFA as a reminder its consultation for proposed Carnarvon Basin. [Con-1909] • On 9 August 2024, Santos emailed WA Game Fishing Association to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5492] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
Industry Associations-Commercial Shipping			
Maritime Industry Australia Ltd (MIAL)			
• On 1 June 2023, Santos emailed Maritime Industry Australia and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2251] • On 7 June 2023, Maritime Industry Australia advised it was sharing information about the proposed Carnarvon Basin activities with its members on 7 June 2023. [Con-2119] • On 27 June 2023, Santos emailed Maritime Industry Australia seeking feedback on proposed activities. [Con-1861] • On 21 July 2023, Santos emailed Maritime Industry Australia by way of reminder on the timeframe for providing feedback. [Con-1862] • On 9 August 2024, Santos emailed Maritime Industry Australia Ltd (MIAL) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5493] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Industry Associations-Tourism			
Australian Tourism Industry Council (ATIC)			
• On 1 June 2023, Santos emailed Australia Tourism Industry Council and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2250] • On 27 June 2023, Santos emailed Australia Tourism Industry Council seeking feedback on proposed activities. [Con-1865] • On 25 July 2023, Santos emailed Australia Tourism Industry Council by way of reminder on the timeframe for providing feedback. [Con-1868] • On 9 August 2024, Santos emailed Australian Tourism Industry Council (ATIC) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5494] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Tourism Council of Western Australia (TCWA)			
• On 1 June 2023, Santos emailed Tourism Council of Western Australia and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2249]			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 27 June 2023, Santos emailed Tourism Council of Western Australia seeking feedback on proposed activities. [Con-1866] • On 25 July 2023, Santos emailed Tourism Council of Western Australia by way of reminder on the timeframe for providing feedback. [Con-1869] • On 9 August 2024, Santos emailed Tourism Council of Western Australia (TCWA) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5496] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Marine Tourism WA (MTWA)			
• On 29 June 2023, Santos emailed Marine Tourism WA seeking feedback on proposed activities outlined in this revision. [Con-1878] • On 25 July 2023, Santos emailed Marine Tourism WA by way of reminder on the timeframe for providing feedback. [Con-1872] • On 9 August 2024, Santos emailed Marine Tourism WA to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5495] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Western Australian Indigenous Tourism Operators Council (WAITOC)			
• On 1 June 2023, Santos emailed WAITOC and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2248] • On 27 June 2023, Santos emailed WAITOC seeking feedback on proposed activities. [Con-1867] • On 25 July 2023, Santos emailed WAITOC by way of reminder on the timeframe for providing feedback. [Con-1870] • On 26 July 2023, WAITOC emailed Santos requesting it considers the newly endorsed Whadjuk climate change declaration. [Con-2139] • On 21 August 2023, Santos emailed WAITOC confirming it had considered the declaration. [Con-2310] • On 9 August 2024, Santos emailed Western Australian Indigenous Tourism Operators Council to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5497] • No additional correspondence or feedback has been received.			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	NA	NA	NA
Infrastructure Operators			
Vocus			

- On 1 June 2023, Santos emailed Vocus and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2247]
- On 27 June 2023, Santos emailed Vocus seeking feedback on proposed activities. [Con-1817]
- On 21 July 2023, Santos emailed Vocus by way of reminder on the timeframe for providing feedback. [Con-1821]
- On 9 August 2024, Santos emailed Vocus to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5498].
- On 12 August 2024, Santos received an email from Vocus requesting a change of email contact. [Con-5552]
- On 23 August 2024 Santos sent an email reminder to Vocus indicating that consultation relating to the activity update previously emailed on the 9 August 2024 on the commissioning and operation of the Halyard 2 well at the Varanus Island Hub in Western Australia closes on 23 August 2024. Santos reminded the Vocus to provide any feedback on this activity update by Friday 23 August 2024 as Santos will be submitting a revised Environment Plan next week. [Con-5582]
- No substantive response or feedback has been received.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Local Government Authorities			
City of Greater Geraldton			

- On 27 June 2023, Santos emailed City of Greater Geraldton and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-1918]
- On 19 July 2023, Santos emailed City of Greater Geraldton by way of reminder on the timeframe for providing feedback [Con-2017]
- On 9 August 2024, Santos emailed City of Greater Geraldton to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5499]
- On 9 August 2024 Santos received an auto-generated email from the City of Greater Geraldton (CGG) acknowledging receipt of Santos' email. [Con-5543]
- No substantive correspondence or feedback has been received.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
NA	Santos considers it has provided sufficient time and opportunity for consultation.	NA	No additional EP controls required.

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
	Santos considers section 25 consultation complete for this EP.		
Shire of Shark Bay			
• On 27 June 2023, Santos emailed Shire of Shark Bay and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-1916] • On 19 July 2023, Santos emailed Shire of Shark Bay by way of reminder on the timeframe for providing feedback [Con-2019] • On 19 July 2023, Shire of Shark Bay emailed Santos advising it has no feedback to the proposed Carnarvon Basin activities. [Con-1956] • On 26 July 2023, Santos emailed Shark Bay and acknowledged it had no feedback. [Con-1978] • On 9 August 2024, Santos emailed Shire of Shark Bay to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5507].			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	NA	NA	NA
Town of Port Hedland			
• On 9 July 2024, Santos emailed Town of Port Hedland seeking feedback on proposed activities. [Con-5047] • On 16 July 2024, Santos emailed Town of Port Hedland by way of reminder on the timeframe for providing feedback. [Con-5081] • On 9 August 2024, Santos emailed Town of Port Hedland to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5508] • On 9 August 2024 Santos received and auto-generated email from the Town of Port Hedland acknowledging receipt of Santos' email. [Con-5544] • On 23 August 2024 Santos sent an email reminder to Town of Port Hedland indicating that consultation relating to the activity update previously emailed on the 9 August 2024 on the commissioning and operation of the Halyard 2 well at the Varanus Island Hub in Western Australia closes on 23 August 2024. Santos reminded the Town of Port Hedland to provide any feedback on this activity update by Friday 23 August 2024 as Santos will be submitting a revised Environment Plan next week. [Con-5586] • On 23 August 2024 Santos received and auto-generated email from the Town of Port Hedland acknowledging receipt of Santos' email and confirming it would respond within 5-7 business days. [Con-5587] • No substantive correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	NA	NA	NA
Shire of Carnarvon			
• On 31 May 2023, Santos emailed Shire of Carnarvon and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2246] • On 27 June 2023, Santos emailed Shire of Carnarvon seeking feedback on proposed activities. [Con-1914] • On 19 July 2023, Santos emailed Shire of Carnarvon by way of reminder on the timeframe for providing feedback. [Con-2020]			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 19 July 2023, Shire of Carnarvon emailed Santos updating the contact list for future consultation. Shire of Carnarvon requested more information about the projects and potential impacts on Shire of Carnarvon. [Con-1954] • On 1 August 2023, Santos emailed Shire of Carnarvon with information regarding the project and potential impacts. [Con-1965] • On 9 August 2024, Santos emailed Shire of Carnarvon to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5503] • No feedback on the activity has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Shire of Carnamah			
• On 28 June 2024, Santos emailed Shire of Carnamah seeking feedback on proposed activities. [Con-5011] • On 11 July 2024, Santos emailed Shire of Carnamah by way of reminder on the timeframe for providing feedback. [Con-5067]No correspondence or feedback has been received. • On 9 August 2024, Santos emailed Shire of Carnamah to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5502]. • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Shire of Coorow			
• On 27 June 2024, Santos emailed Shire of Coorow seeking feedback on proposed activities. [Con-5009] • On 11 July 2024, Santos emailed Shire of Coorow by way of reminder on the timeframe for providing feedback. [Con-5065] • On 9 August 2024, Santos emailed Shire of Coorow to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5504] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation.	NA	No additional EP controls required.

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
	Santos considers section 25 consultation complete for this EP.		
Shire of Exmouth			
• On 31 May 2023, Santos emailed Shire of Exmouth and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2245] • On 27 June 2023, Santos emailed Shire of Exmouth seeking feedback on proposed activities. [Con-1912] • On 28 June 2023, Shire of Exmouth emailed Santos advising the email was received and forwarded to the relevant departments. [Con-2279] • On 19 July 2023, Santos emailed Shire of Exmouth by way of reminder on the timeframe for providing feedback. [Con-2021] • On 9 August 2024, Santos emailed Shire of Exmouth to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5506]. • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Shire of Ashburton			
• On 31 May 2023, Santos emailed Shire of Ashburton and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2244] • No correspondence or feedback has been received. • On 27 June 2023, Santos emailed Shire of Ashburton seeking feedback on proposed activities. [Con-1911] • On 12 July 2023, Shire of Ashburton provided feedback regarding the emergency response actions and queries to address. It did not raise any objectives to the planned activities. [Con-1958] • On 26 July 2023, Santos emailed Shire of Ashburton providing information requested and answering its queries. [Con-1981] • On 2 August 2023, Shire of Ashburton emailed Santos acknowledging response and requesting it receive activity notifications and other information as required. [Con-2151] • On 7 August 2023, Santos emailed Shire of Ashburton confirming it would add it to the activity notifications and emergency notifications lists for the proposed Carnarvon Basin activities. [Con-2152] • On 7 August 2023, Shire of Ashburton emailed Santos a list of names to add to the activity notifications and emergency notification lists. [Con-2235] • On 10 August 2023, Santos emailed Shire of Ashburton confirming it would add the emails to the activity notifications and emergency contacts list. [Con-2237] • On 9 August 2024, Santos emailed Shire of Ashburton to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5501] • No additional correspondence or feedback has been received.			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
Shire of Ashburton requested pre-start and activity completion notifications.	Santos notes Shire of Ashburton's feedback. Note: consultation was undertaken for Halyard-2 and ongoing operations at the same time. This response was specific to Halyard-2. As such, these notification commitments are outside the scope of this EP, however they appear in the Halyard-2 Drilling and Completion EP and do not appear in Section 8.10(Reporting and Notifications) of this EP.	Santos will send Shire of Ashburton activity notifications.	No additional EP controls required.

City of Karratha

- On 31 May 2023, Santos emailed City of Karratha and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-2243]
- On 27 June 2023, Santos emailed City of Karratha seeking feedback on proposed activities. [Con-1908]
- On 29 June 2023, City of Karratha emailed Santos stating that it had no comment for this activity, however if in event of an emergency that may impact on the City's functions, interests or activities to forward correspondence to CEO. [Con-1959]
- On 14 July 2023, Santos emailed City of Karratha acknowledging it's feedback. [Con-1945]
- On 27 June 2024, Santos emailed City of Karratha seeking feedback on proposed activities. [Con-5006]
- On 1 July 2024, email received from City of Karratha requesting an extension to consultation until Friday 26-July-2024. [Con-5012]
- On 11 Jul 2024 Santos emailed City of Karratha by way of reminder that consultation ends on 18 July 2024. Santos informs City of Karratha, that due to the Environmental Approvals timeline constraints, in this instance, an extension to the original request date for consultation cannot be granted at this time. [Con-5064]
- On 18 July 2024, City of Karratha responded seeking full details of the standards, policies and procedures that mitigate the impacts of the activity [Con-5161]
- On 22 July 2024 Santos emailed City of Karratha providing a link to the current Varanus Island Hub Operations Environment Plan for full details of the standards, policies and procedures that mitigate the impacts. Santos also informs City of Karratha that the attachment sent on 27 June 2024, was a high-level information consultation flyer, on the replacement of Halyard-1 with Halyard-2 well at the already operational Varanus Island Hub. Santos informs City of Karratha that given there will be no increase in impacts or risks associated with the replacement of Halyard-1 with Halyard-2 well at the Varanus Island Hub, the already accepted Environment Plan, provides all the current information. [Con-5162]
- On 9 August 2024, Santos emailed City of Karratha to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5500]
- No additional correspondence or feedback has been received.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
City of Karratha requested to be notified in the event of an emergency that may impact on the City's functions, interests or activities.	Santos has considered the City's feedback.	Santos will notify City of Karratha in the event of an emergency that may impact on the City's functions, interests or activities.	Activity notifications are included in 8.10

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
City of Karratha requested full details of the standards, policies and procedures that mitigate the impacts of the activity.	Santos has considered the City's feedback. Santos considers section 25 consultation complete for this EP.	Santos referred the City to the currently accepted Varanus Island Hub Operations Environment Plan for full details of the standards, policies and procedures that mitigate the impacts of the Varanus Island Hub, including operation of the Halyard field Industry environment plans (nopsema.gov.au). Santos noted the drilling and completion of the Halyard-2 well is addressed under a separate EP which is current with NOPSEMA and is available here: Industry environment plans (nopsema.gov.au). Santos noted the information provided on 27 June, was a consultation flyer, rather than an Environmental Management Plan. The purpose of the flyer was to provide high level information on replacement of Halyard-1 with Halyard-2 well at the already operational Varanus Island Hub in Commonwealth waters, including the associated impacts and risks and how Santos proposes to mitigate those risks. Given there will be no increase in impacts or risks associated with the replacement of Halyard-1 with Halyard-2 well at the Varanus Island Hub, the already accepted Environment Plan, provides all the current information.	

Exmouth Community Liaison Group (ECLG)

- On 12 June 2023, Santos emailed ECLG and provided information on a number of proposed Carnarvon Basin activities. [Con-4410]
- On 30 June 2023, Santos emailed ECLG and provided information on a number of proposed Carnarvon Basin activities, seeking to discuss opportunities for consultation and provided a link to an information fact sheet about proposed activities in this revision. [Con-4411]
- On 19 July 2023, Santos emailed ECLG by way of reminder on the timeframe for providing feedback. [Con-4413]
- On 27 July 2023, Santos met with the ECLG and provided an overview of the proposed Carnarvon Basin activities. No questions or feedback were raised in the meeting. [Con-4414]
- On 9 August 2024, Santos emailed ECLG to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5509]
- On 9 August 2024, Santos received an auto-response email from ECLG requesting that Santos contact an alternative respondent. [Con-5540]

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 19 August 2024, Santos emailed ECLG (alternate respondent) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5541] • No substantive response or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Recreational Fisheries			
Exmouth Game Fishing Club (EGFC)			
• On 29 June 2023, Santos emailed Exmouth Game Fishing Club feedback on proposed activities. [Con-1860] • On 19 July 2023, Santos emailed Exmouth Game Fishing Club by way of reminder on the timeframe for providing feedback. [Con-1843] • On 9 August 2024, Santos emailed Exmouth Game Fishing Club (EGFC) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5411] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Port Hedland Game Fishing Club			
• On 27 June 2024 Santos emailed Port Hedland Game Fishing Club (PHGFC) requesting consultation for Varanus Island Hub. [Con-5004] • On 11 July 2024 Santos emailed PHGFC by way of reminder that consultation ends on 18 July 2024. [Con-5063] • On 9 August 2024, Santos emailed Port Hedland Game Fishing Club to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5413] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
Ashburton Anglers			
• On 29 June 2023, Santos emailed Ashburton Anglers feedback on proposed activities. [Con-1863] • On 19 July 2023, Santos emailed Ashburton Anglers by way of reminder on the timeframe for providing feedback. [Con-1846] • On 9 August 2024, Santos emailed Ashburton Anglers to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5414]. • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
King Bay Game Fishing Club (KBFC)			
• On 29 June 2023, Santos emailed King Bay Game Fishing Club seeking feedback on proposed activities. [Con-1871] • On 19 July 2023, Santos emailed King Bay Game Fishing Club by way of reminder on the timeframe for providing feedback. [Con-1848] • On 9 August 2024, Santos emailed King Bay Game Fishing Club (KBFC) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5415]. • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Nickol Bay Sportsfishing Club (NBSC)			
• On 29 June 2023, Santos emailed Nickol Bay Sportsfishing Club seeking feedback on proposed activities. [Con-1874] • On 19 July 2023, Santos emailed Nickol Bay Sportsfishing Club by way of reminder on the timeframe for providing feedback. [Con-1851] • On 9 August 2024, Santos emailed Nickol Bay Sportsfishing Club (NBSC) to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5419]. • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation.	NA	No additional EP controls required.

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
	Santos considers section 25 consultation complete for this EP.		

Tourism operators- Exmouth-based operators

Evolution Charters Exmouth

- On 24 July 2023, Santos emailed Tourism Operators based in Exmouth and Dampier/Karratha seeking feedback on proposed activities. [Con -XXXX]
- On 9 August 2024, Santos emailed Evolution Charters Exmouth to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5361]
- No correspondence or feedback has been received.

Blue Horizon Charters

- On 24 July 2023, Santos emailed Tourism Operators based in Exmouth and Dampier/Karratha seeking feedback on proposed activities.
- 9 August 2024, Santos emailed Blue HorizinHorizon Charters to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5362]
- No correspondence or feedback has been received.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.

Fawesome Expeditions Exmouth

- On 24 July 2023, Santos emailed Tourism Operators based in Exmouth and Dampier/Karratha seeking feedback on proposed activities.
- On 9 August 2024, Santos emailed Fawesome Expeditions Exmouth to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5363]
- No correspondence or feedback has been received.

Summary of Objection or Claim	Assessment of Merits	Santos' Response Statement	EP Reference
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.

Innkeeper Sport Fishing Charters Exmouth

- On 24 July 2023, Santos emailed Tourism Operators based in Exmouth and Dampier/Karratha seeking feedback on proposed activities.

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 9 August 2024, Santos emailed Innkeeper Sport Fishing Charters Exmouth to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5364] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Onstrike Charters Exmouth			
• On 24 July 2023, Santos emailed Tourism Operators based in Exmouth and Dampier/Karratha seeking feedback on proposed activities. • On 9 August 2024, Santos emailed Onstrike Charters Exmouth to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5357] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Elite charters			
• On 24 July 2023, Santos emailed Tourism Operators based in Exmouth and Dampier/Karratha seeking feedback on proposed activities. • On 9 August 2024, Santos emailed Elite Charters to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5355] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Ningaloo Sportfishing Charters			
• On 24 July 2023, Santos emailed Tourism Operators based in Exmouth and Dampier/Karratha seeking feedback on proposed activities.			

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
• On 9 August 2024, Santos emailed Ningaloo Sportfishing Charters to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5354]] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Peak Sportfishing Adventures			
• On 24 July 2023, Santos emailed Tourism Operators based in Exmouth and Dampier/Karratha seeking feedback on proposed activities. • On 9 August 2024, Santos emailed Peak Sportfishing Adventures to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5350] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Top Gun Charters			
• On 24 July 2023, Santos emailed Tourism Operators based in Exmouth and Dampier/Karratha seeking feedback on proposed activities. • On 9 August 2024, Santos emailed Top Gun Charters to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5348] • On 10 August 2024. Top Gun Charters informed Santos that should it need any other vessel's for this type of work, Santos could pass on Top Gun Charters details to that department. Top Gun Charters could hire out its vessel that has the capability of operating offshore for weeks on end and for crew transfers. [Con-5545] • On 19 August 2024, Santos emailed Top Gun Charters in relation to the Halyard-2 Operations Varanus Island Hub Operations Environment Plan activity revision. Santos informs Top Gun Charters it has forwarded their request to its Marine Manager – Logistics who can give some guidance on Santos' requirements regarding vessel charter services. On that basis Santos considers the consultation with Top Gun Charters on the Halyard-2 Operations Varanus Island Hub Operations Environment Plan is concluded. [Con-5546]			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NATop Gun Charters requested their details be passed on to relevant department who any require vessel charter services with the capability for long term offshore operations.	Santos has noted the information and request made by Top Gun Charters. Santos assesses this does not raise an objection or claim and is outside the scope of this EP.	Santos has passed on Top Gun Charters request to its Logistics Marine Manager and informed Top Gun Charters of this action.NA	No additional EP controls required.

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
	considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.		
Fishing Charter Base			
• On 24 July 2023, Santos emailed Tourism Operators based in Exmouth and Dampier/Karratha seeking feedback on proposed activities. • On 9 August 2024, Santos emailed Fishing CharterBase to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5347] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Exmouth Boat Hire			
• On 24 July 2023, Santos emailed Tourism Operators based in Exmouth and Dampier/Karratha seeking feedback on proposed activities. • On 9 August 2024, Santos emailed Exmouth Boat Hire to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5346] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Exmouth Fishing Adventures			
• On 24 July 2023, Santos emailed Tourism Operators based in Exmouth and Dampier/Karratha seeking feedback on proposed activities. • On 9 August 2024, Santos emailed Exmouth Fishing Adventures to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5344] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation.	NA	No additional EP controls required.

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
	Santos considers section 25 consultation complete for this EP.		
Aquatic Adventures			
• On 24 July 2023, Santos emailed Tourism Operators based in Exmouth and Dampier/Karratha seeking feedback on proposed activities. • On 9 August 2024, Santos emailed Aquatic Adventures to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5340] • No correspondence or feedback has been received			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Seaestar Boat Charters			
• On 24 July 2023, Santos emailed Tourism Operators based in Exmouth and Dampier/Karratha seeking feedback on proposed activities. • On 9 August 2024, Santos emailed Seaestar Boat Charters to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5339] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Tourism Operators- Dampier/Karratha operators			
• On 24 July 2023, Santos emailed Tourism Operators based in Exmouth and Dampier/Karratha seeking feedback on proposed activities. • On 9 August 2024, Santos emailed Onslow Bay Boatworks to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5338] • No correspondence or feedback has been received			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
Mackerel Islands Fishing Charters			
• On 24 July 2023, Santos emailed Tourism Operators based in Exmouth and Dampier/Karratha seeking feedback on proposed activities. • On 9 August 2024, Santos emailed Mackerel Islands Fishing Charters to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5337] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Blue Juice Charters			
• On 24 July 2023, Santos emailed Tourism Operators based in Exmouth and Dampier/Karratha seeking feedback on proposed activities. • On 9 August 2024, Santos emailed Blue Juice Charters to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5334] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.
Monte Bells Safaries			
• On 24 July 2023, Santos emailed Tourism Operators based in Exmouth and Dampier/Karratha seeking feedback on proposed activities. • On 9 August 2024, Santos emailed Monte Bells Safaris to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5333] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.

Regulation 25(1)(a): Departments or agencies of the Commonwealth to which the activities to be carried out under the environment plan may be relevant			
Apache Charters			
• On 24 July 2023, Santos emailed Tourism Operators based in Exmouth and Dampier/Karratha seeking feedback on proposed activities. • On 9 August 2024, Santos emailed Apache Charters to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5331] • No correspondence or feedback has been received.			
Pelican Charters			
• On 24 July 2023, Santos emailed Tourism Operators based in Exmouth and Dampier/Karratha seeking feedback on proposed activities. • On 9 August 2024, Santos emailed Pelican Charter to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well located at the Varanus Island Hub in Western Australia. Santos advised there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, (live link provided). Santos requested further input by 23 August 2024. [Con-5330] • No correspondence or feedback has been received.			
Summary of Objection or Claim	**Assessment of Merits**	**Santos' Response Statement**	**EP Reference**
NA	Santos considers it has provided sufficient time and opportunity for consultation. Santos considers section 25 consultation complete for this EP.	NA	No additional EP controls required.

5. Environmental Impact and Risk Assessment

OPGGS(E)R 2023 Requirements
Regulation 21. Environmental assessment
Evaluation of environmental impacts and risks 21(5) 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, appropriate to the nature and scale of each impact or risk; and c. details of the control measures that will be used to reduce the impacts and risks of the activity to as low as reasonably practicable and an acceptable level. 21(6) To avoid doubt, the evaluation mentioned in paragraph (5)(b) must evaluate all the environmental impacts and risks arising directly or indirectly from: a. all operations of the activity; and b. potential emergency conditions, whether resulting from accident or any other reason.

Environmental impact and risk assessment refers to a process whereby planned and unplanned events that will or may 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 on the basis of their likelihood of occurrence which contributes to their level of risk.

Santos has undertaken environmental impact and risk assessments for the operational activity's planned events (including any routine, non-routine and contingency events) and unplanned events in accordance with the OPGGS(E)R 2023.

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

- 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 Santos' Offshore Division Offshore Division Environmental Hazard Identification and Assessment Guideline.

5.1 Impact and Risk Assessment Terminology

Common terms applied during the impact and risk assessment process, and used in this EP, are defined Table 5-1. For a more comprehensive listing of the terms and definitions used in environmental impact and risk assessment, refer to Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline.

Table 5-1: Impact and Risk Assessment Terms

Name	Definition
Acceptability	Determined for both impacts and risks. Acceptability of events is in part determined by the consequence of the impact following management controls. Acceptability of unplanned events is in part determined from its risk ranking following management controls. For both impacts and risks, acceptability is also determined from a demonstration of the ALARP principle, consistency with Santos Policies, consistency with all applicable legislation and consideration of relevant stakeholder consultation when determining management controls.
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.

Name	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.
DMIRS	Department of Mines, Industry Regulation and Safety
Environment	Includes the natural and socio-economic values and sensitivities which will or may be affected by the activity. Is defined by NOPSEMA and DMIRS as: a. ecosystems and their constituent parts, including people and communities; b. natural and physical resources; c. the qualities and characteristics of locations, places and areas; d. the heritage value of places; and includes 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 Section 5 of the OPGGS(E)R to mean any change to the environment, whether adverse or beneficial, that wholly or partially results from the activity. Defined by regulation 4 of the Petroleum (Submerged Lands)(Environment) Regulations 2012 as any change to the environment, whether adverse or beneficial, that wholly or partly results from a petroleum activity of an operator.
ENVID	Environmental hazard identification workshop
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.
Hazard	A situation with the potential to cause harm
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.
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.
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority, the regulator with jurisdiction over the petroleum activity.
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 environmental, social and/or economic 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.

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 Management, Investigation and Assurance operating standard) 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.

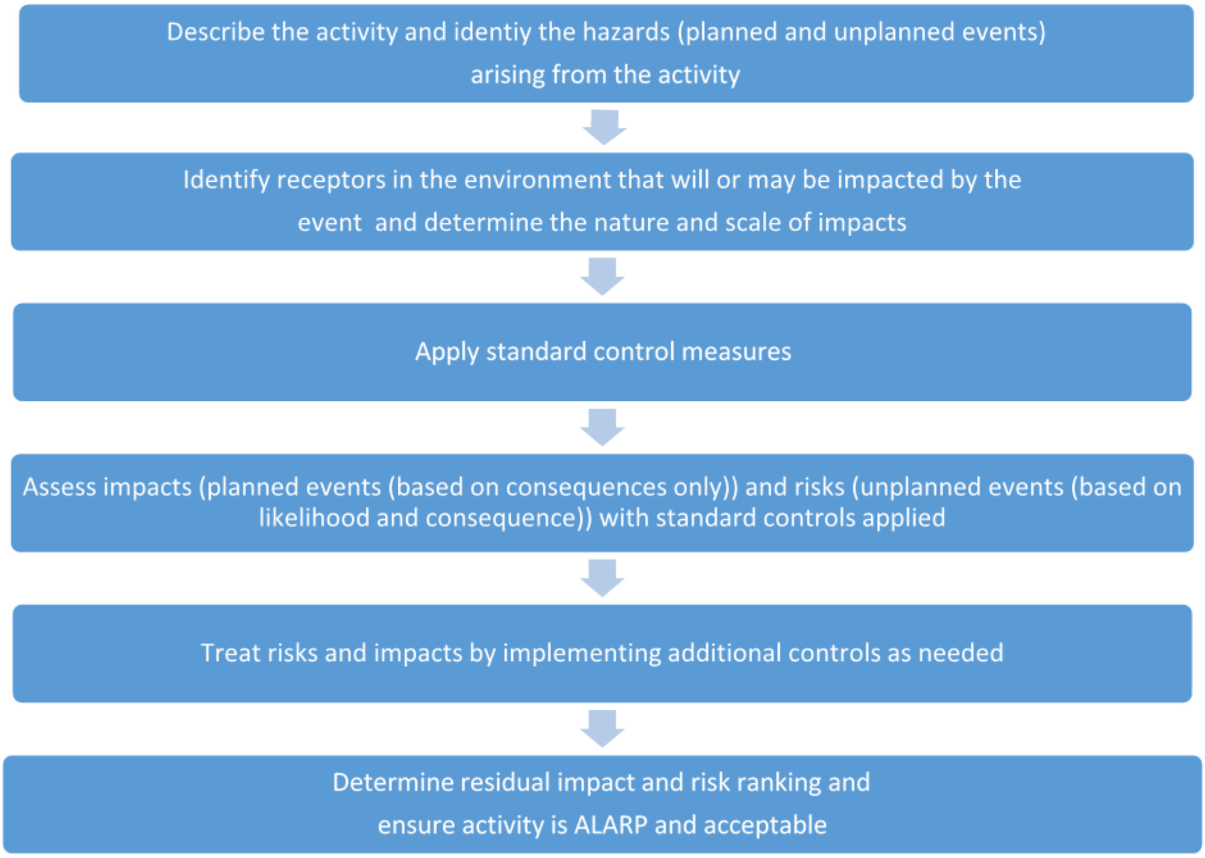

Figure 5-1: Environmental impact and risk assessment process

Santos' Offshore Division Environmental Hazard Identification and Assessment Guideline 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' Environmental Management Policy and Standards
- principles of Ecologically Sustainable Development (ESD)
- Santos acceptable levels of impact and risk.

These factors were considered in environmental impact and risk assessment workshops held on 23 April 2018, 18 May 2018, 28 June 2018, 9 August 2018 and 12 August 2024 in which environmental impact identifications (ENVIDs) were made. The risk workshop involved participants from Santos' Health, Safety and Environment (HSE) and Operations departments and specialist environmental consultants.

ENVIDs are regularly reviewed for currency during the course of operations and were validated as a part of this five-yearly EP revision on 4 April 2019, the revision to include the Spartan Development on 28 July 2021, and again for this revision on 12 August 2024 to replace Halyard-1 with Halyard-2

5.2.2 Describe the Activity and Hazards (Planned and Unplanned Events)

The petroleum activity is described in Section 2 of this plan. An assessment against the activity was undertaken, and the environmental hazards and aspects were identified. The outcome of this assessment is detailed in the relevant subsections of Sections 6 and 7. A summary of the environmental hazards identified for the activity are:

- noise emissions
- light emissions
- greenhouse gas emissions
- atmospheric emissions
- seabed and benthic habitat disturbance
- interaction with other marine users
- planned operational discharges (surface and subsea)
- spill response operations
- introduction of invasive marine species
- marine fauna interaction
- non-hydrocarbon release of solid objects
- hazardous liquids releases (surface)
- surface release of condensate from wellheads at the John Brookes WHP
- subsea release of condensate from a subsea pipeline
- subsea release of condensate of condensate from wellheads
- surface release of diesel (vessel collision/bunkering).

5.2.3 Determine the Nature and Scale of Impacts and Identify Receptors that Will or May be Impacted

The extent of actual or potential impacts from each planned or unplanned event is 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 in impacted areas are detailed in Section 3.

5.2.4 Describe the Environmental Performance Outcomes and Control Measures

For each planned and unplanned event, a set of Environmental Performance Outcome(s), Control Measures, Environmental Performance Standards and Measurement Criteria are identified. The definitions of the performance outcomes, control measures, standards and measurement criteria must be consistent with the OPGGS(E)R 2023, and the NOPSEMA Environment Plan Content Requirements Guidance Note (NOPSEMA, 2020).

Additional controls must also be considered and either accepted for use or not adopted based on whether the standard controls reduce impacts and risks to levels that are ALARP and acceptable (refer Section 5.2.6 and Section 5.2.7).

Controls are allocated in order of preference according to the hierarchy of controls as shown in Figure 5-2

Control	Effectiveness	Example
Eliminate		*Removal of the risk.* Refueling of vessels at port eliminates the risks of an offshore refueling.
Substitute		*Change the risk for a lower one.* The use of low-toxicity chemicals that perform the same task as a more toxic additive.
Engineering		*Engineer out the risk.* The use of oil-in-water separator to minimise the volume of oil discharged.
Isolation		*Isolate people or the environment from the risk.* The use of bunding for containment of bulk liquid materials.
Administrative		*Provide instructions or training to people to lower the risk.* The use of Job Hazard Analysis to assess and minimise the environmental risks of an activity.
Protective		*Use of protective equipment.* Containment and recovery of spilt hydrocarbons.

Figure 5-2: Hierarchy of Controls

5.2.5 Determine the Impact Consequence and Risk Rankings (on the Basis that All Control Measures have been Implemented)

This step looks at the causal effect between the aspect or hazard 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. Refer to Section 3 for the impact thresholds applied for surface hydrocarbons, entrained hydrocarbons and dissolved aromatic hydrocarbons used in the hydrocarbon spill modelling study for this EP.

The consequence level of the impact is then determined for each planned and unplanned event based on the severity of the impact to relevant receptors in the categories of:

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

The level of information required to determine the impact or risk assessment depends on nature and scale. 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, it is evident the social and economic values in the region are of interest.

A description of the consequence level is provided in Table 5-2**.**

Table 5-2: Summary Environmental Consequence Descriptors

Consequence Level		Consequence Level Description
I	Negligible	No impact or negligible impact.
II	Minor	Detectable but insignificant change to local population, industry or ecosystem factors.

Consequence Level		Consequence Level Description
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.

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 in accordance with Santos' Environmental Severity Descriptors and Consequence Levels. 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.

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 in almost all circumstances OR could occur *within days to weeks*
e	Likely	Occurs in most circumstances OR could occur *within weeks to months*
d	Occasional	Has occurred before in Santos OR could occur *within months to years*
c	Possible	Has occurred before in the industry OR could occur *within the next few years*
b	Unlikely	Has occurred elsewhere OR could occur *within decades*
a	Remote	Requires exceptional circumstances and is unlikely even in the long term

Table 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

The process and definitions supporting the consequence and severity rankings and the likelihood and residual risk ranking determination are included in the Environmental Risk Identification and Analysis Procedure.

5.2.6 Evaluate if Impacts and Risks are As Low as Reasonably Practicable

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 or effort to reduce the level of impact or risk. If this cannot be demonstrated, then further control measures are adopted. The level of detail included in the ALARP assessment is based on 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.

5.2.7 Evaluate Impacts 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.
- Assessment and management of risks has addressed the principles of ecologically sustainable development.
- 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 the EHS Policy.
- Performance standards are consistent with industry standards and best practice guidance (e.g., National Biofouling Management Guidance Guidelines for the Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee, 2018) and the Australian Biofouling Management Requirements (Department of Agriculture, Water and the Environment, 2022).
- Performance outcomes 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.

Table 5-5: Activity Relevant Principles of Ecological Sustainable Development (EA-91-IG-00004)

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. For unplanned events, if the residual risk is ranked between Medium and Very High, an assessment against this principle is required. 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). For an unplanned event, if the residual risk is ranked between Medium and Very High, an assessment against this principle is required. 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.

No.	ESD Principle	Relevance
		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 and services, especially those that are derived from natural or social capital or from ecological services. This principle is not relevant to the proposed activity as the proposed activity does not involve the production, delivery, distribution or consumption of goods and services.

6. Planned Activities Risk and Impact Assessment

OPGGS(E)R 2023 Requirements
Regulation 21. Environmental assessment.
Environmental performance outcomes and standards 21(7) The environment plan must: a. set environmental performance standards for the control measures identified under paragraph (5)(c); and b. set out the environmental performance outcomes against which the performance of the titleholder in protecting the environment is to be measured; and c. include measurement criteria that the titleholder will use to determine whether each environmental performance outcome and environmental performance standard is being met.

Santos' environmental assessment identified seven potential sources of environmental impact associated with the planned activities to be undertaken in the operational area. The results of the impact assessments are summarised in Table 6-1. Given that the risk of a planned event occurring is 100% likelihood (i.e., it will occur), the residual risk ranking is not assessed (as explained in Section 5.2(e)). The potential impact assessment for each planned event and the subsequent control and management measures proposed by Santos to reduce the extent of the impacts are detailed in the following subsections.

Table 6-1: Summary of the Consequence Level Rankings for Hazards Associated with Planned Events

EP Section Reference	Hazard	Residual Consequence Level
6.1	Noise Emissions	I - Negligible
6.2	Light Emissions	I - Negligible
6.3	Greenhouse gas emissions	I - Negligible
6.4	Atmospheric emissions	I - Negligible
6.5	Seabed and benthic habitat disturbance	I - Negligible
6.6	Interaction with other marine users	I - Negligible
6.7	Planned Operational discharges	I - Negligible
6.8	Spill Response Operations	I - Minor

6.1 Acoustic Disturbance to Marine Fauna

6.1.1 Description of Event

Event	During the operational life of the activity, anthropogenic noise emissions will be generated by the operation of the John Brookes WHP and associated subsea infrastructure in the operational area. There is little noise generating equipment on John Brookes WHP since processing of hydrocarbons occurs on VI and the WHP is unmanned. The main sources of underwater noise during operational activities are noise from: • the operation of the John Brookes WHP (low-level noise from gas-driven microturbine generator, pumps for chemical injection and hydraulics on the WHP) • operation of a diesel generator (only used as emergency power supply) • IMMR activities of the WHP and other subsea infrastructure (e.g., use of ROV, geophysical equipment, marine growth cleaning, pigging, modification and replacement of components) • support vessel activities (e.g., vessel engines, thrusters and other machinery) • operation of the acoustic bird deterrent system to deter birds • helicopter activities in the operational area. Noise originating from these sources could potentially have a negative physiological or behavioural effect on marine fauna.
Extent	• Localised: A support vessel using main engines and bow thrusters to maintain position will become inaudible above background noise within an approximately 20-km radius. • Localised: A conservative estimate for the use of geophysical equipment (SBESs, MBESs and SSS) is within a 1.5-km radius depending on the activity characteristics. • Localised: Helicopter and unmanned aerial vehicle noise will be highly localised as the majority of the noise will not transfer into the water. • Localised: Production equipment noise will be inaudible within 1 to 2 km of the WHP. • Localised: ROV, AUV and diving operations will occur in the area of the activity and adjacent to subsea infrastructure. • Localised: Bird deterrent emits a maximum noise level of 110 db at 10 m from the WHP.
Duration	Intermittently around the subsea infrastructure and John Brookes WHP in the operational area.

6.1.1.1 Noise generated by Support Vessels

Vessel operational noise consists of machinery noise (e.g., engine noise) and hydrodynamic noise (e.g., water flowing past the hull and propeller singing). All machinery on a ship radiates sound through the hull into the water.

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 from a support vessel holding station in the Timor Sea. The thruster noise dropped below 120 dB re 1 µPa within 3 to 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., pipeline inspection and maintenance activities will typically require the vessel to be moving slowly at approximately four knots. McCauley (1998) recorded the noise of a support vessel underway audible up to 10 km away, with the intensity dropping below 120 dB re 1 µPa at around 0.5 to 1 km away from the vessel.

6.1.1.2 Single-beam and Multi-beam Echo Sounders, Side Scan Sonar

SBESs, MBESs and SSS are used to develop a high-resolution image of the seafloor and of objects on the seafloor such as the pipeline and 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 (JASCO, 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.

6.1.1.3 Noise generated from a Helicopter and Unmanned Aerial Vehicle

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 generally of a low frequency below 500 Hz (Richardson et al., 1995). Sound pressure in the water directly below a helicopter is greatest at the surface and diminishes with increasing receiver depth. Noise also reduces with increasing helicopter altitude, but the duration of audibility often increases with increasing altitude. The noise from the flyover of a Bell 214 helicopter (stated to be one of the noisiest) has been recorded underwater (Richardson et al., 1995). The sound source was 162 dB re 1 µPa @ 1 m at its peak and had a frequency of 155 Hz.

6.1.1.4 Noise generated from Machinery Equipment on the Wellhead Platform

Noise is also generated by equipment such as generators and pumps on the topsides infrastructure. Noise from WHP operations, maintenance or well intervention or suspension activities, such as plant modifications, is expected to be low as all operating equipment, including generators, engines and machinery, is above sea level. The frequency and level of noise received underwater from the WHP topsides will depend on a number of variables, including the type of infrastructure; the types and sizes of engines, and the local hydroacoustic and geoacoustic environment (Erbe, 2011).

An estimate of underwater noise from a wellhead platform's machinery has been drawn from a study by McCauley (1998) of noise from a drilling rig when it is working but not drilling, with the rig tender at anchor. The comparison is considered conservative, thus overestimating the sound being produced from a wellhead platform. The highest level encountered by McCauley (1998) was recorded at the wellhead, with 117 dB re 1 µPa at 125 m. This noise was audible up to 1 to 2 km away.

6.1.1.5 Noise generated from bird deterrent devices

Impacts to marine fauna from noise generated by bird deterrent devices, will depend on the frequency range and intensity of the noise produced. As sounds increase in wavelength with distance from the source, higher frequencies experience rapid loss. The noise generated by bird deterrent devices is high frequency which is outside the sensitive range for marine fauna such as cetaceans. The bird deterrent system will be operated in a band width of approximately 118 to 137 MHz. The acoustic footprint of the audio device is estimated to be 1,500 m above water based on a maximum potential noise level at source of 148 dB. As the system will be installed on the helideck well above the waterline, the level of noise penetrating underwater will be significantly lower. As described in Section 2.8.3, the bird deterrent system has a 148 dB spl peak acoustic output at 1 m, and in accordance with the permit conditions, the acoustic system emits a maximum volume output of no more than 110 dB at 10 metres horizontal distance from the WHP. The system is designed not to impair the hearing of birds.

6.1.2 Nature and Scale of Environmental Impacts

Potential Receptors include:

- Threatened or migratory fauna (marine mammals, marine turtles, birds, sharks, fish and rays).

Noise generated from vessels, subsea and WHP IMMR activities, and helicopters may result in physiological or behavioural impacts to fauna, including marine mammals, marine turtles, fish and sharks, and birds. The generated noise is short in duration and is expected to be reduced to background levels within kilometres to tens of kilometres; therefore, any impact to fauna is expected to be temporary and short-ranged.

Noise may impact on fauna through:

- attraction to the noise source
- increased stress levels
- localised avoidance of the area
- disturbance, leading to behavioural changes or displacement from areas
- physical injury to hearing or other organs
- indirectly by inducing behavioural and physiological changes in predator or prey species.

The use of sound in the underwater environment is important for marine animals, particularly cetaceans, to navigate, communicate and forage effectively. The following additional impacts to marine fauna may result from underwater noise:

- disruption to underwater acoustic cues
- masking or interference with other biologically important sounds, such as communication or echolocation (used by certain cetaceans for location of prey and other objects).

Impacts to marine fauna will depend on the frequency range and intensity of the noise produced, distance from the noise source, and species sensitivity. As noise propagates away from the source, it reduces in intensity, which is caused by the spreading of sound into an ever-increasing space, known as spherical spreading loss (Swan et al., 1994). The rate of noise attenuation, however, depends on the frequency of the sound source, as well as such environmental factors as temperature, water depth and composition of the sea floor. As sounds increase in wavelength with distance from the source, higher frequencies experience rapid loss (e.g., SBES, MBES, and SSS dissipate within approximately 1.5 km), while low frequencies continue to propagate over longer distances (e.g., vessels dissipate within approximately 20 km) (Swan et al., 1994; MCC, 2007) as described above.

Direct studies of underwater noise effects on marine animals are difficult to undertake, and comprehensive studies concentrate on the species that are known to be sensitive to sound. These are mainly marine mammals, fish and some invertebrates, as well as sea turtles and potentially aquatic birds (OSPAR Commission, 2009).

6.1.2.1 Marine Mammals

Marine mammals, such as cetaceans, use sound for navigation and communication and are particularly susceptible to noise impacts. As described in Table 3-6, BIAs for humpback whales (migration) overlap the operational area, and these mammals are likely to be present in the operational area in increased numbers during migration windows. The migration and reproduction BIAs for the southern right whale are distant from the operational area (> 150 km away) and are not expected to be impact by underwater noise associated with the activities. Conservation advice for the pygmy blue whale provides guidance on threat abatement activities relevant to noise interference. Santos marine fauna records have previously reported the presence of humpback whales in proximity to the operational area.

Sound levels sufficient to cause physical injury (defined as the onset of permanent threshold shift, PTS) and sublethal responses (such as temporary threshold shift, TTS) have been the subject of many studies. Southall et al. (2007), Finneran and Jenkins (2012) Wood et al. (2012), Finneran (2015) and more recently NMFS (2018) reviewed available literature to determine noise exposure criteria, which they determined based on the onset levels of non-recoverable permanent hearing loss (PTS) and temporary hearing threshold shift (TTS) in cetaceans. The NMFS (2018) criteria incorporate the best available science to inform assessment of PTS and TTS. Thresholds for PTS (for impulsive sounds) are between 202 and 230 dB (depending on the species), and thresholds for TTS are between 196 and 224 dB. As discussed above, sources of noise may reach these levels during vessel and helicopter activities.

PTS and TTS in marine mammals has the potential to occur in close range to operations activities. However, marine mammals potentially affected by underwater noise are expected to exhibit avoidance behaviour prior to PTS or TTS occurring. Behavioural responses, such as avoidance, are typically expected at 160 dB (NMFS, 2018). Migration patterns for pygmy blue whales primarily take place in deeper offshore waters, as shown by satellite tracking data, with whales predominantly utilizing the slope and shelf break habitats far from the operational area. The operational area is about 8 km away from the pygmy blue whale migration BIA, and with noise from vessels using dynamic positioning (DP) expected to be below 120 dB within 4 km, pygmy blue whales are unlikely to be exposed to sound levels triggering behavioural responses (160 dB) or physiological harm (PTS, TTS thresholds) (Ferreira et al., 2024). Avoidance behaviour is likely to be localised within the operational area and for the duration of the helicopter or vessel presence only. Acoustic disturbances to marine fauna due to IMMR activities are expected to be minimal, as the activities are temporary and intermittent in an open-ocean environment.

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. Observations by Richardson and Malme (1993) indicate that, for bowhead whales, most individuals are unlikely to react significantly to occasional single-pass low-flying helicopters transporting personnel and equipment at altitudes above 150 m. Leatherwood et al. (1982) observed that minke whales responded to helicopters at an altitude of 230 m by changing course or slowly diving.

The Conservation Management Plan for the Blue Whale (Commonwealth of Australia, 2015), a recovery plan made under the EPBC Act, defines BIAs for pygmy blue whales, with particular emphasis placed on foraging areas and migration corridors. Foraging in pygmy blue whales occurs primarily along the slope and shelf break, with the highest habitat suitability in regions such as the Bonney Coast and Southern Australia. Given that these foraging areas are far from the operational area, there is limited potential for interaction during feeding behaviours. The operational area’s distance from key foraging sites significantly reduces the risk of noise disturbance during foraging (Ferreira et al., 2024). Migrating pygmy blue whales are unlikely to occur in the operational area, with observed and modelled distributions of pygmy blue whales occurring further offshore in deeper water (Thums et al., 2022). The noise source with the greatest potential for impacts to pygmy blue whales is vessels holding station using DP. As described above, noise from vessels using DP is expected to be below 120 dB re 1 µPa within 4 km of the source. Given the operational area is approximately 8 km from the pygmy blue whale migration BIA at the closest point, activities will not credibly result in noise levels in the pygmy blue whale migration corridor above the PTS, TTS or behavioural response thresholds. When considering the Conservation Management Plan for the Blue Whale (Commonwealth of Australia, 2015) and Guidance on key terms within the Blue Whale Conservation Management Plan (DAWE, 2021), underwater noise emissions from the petroleum activities are consistent with the requirements of the plans.

6.1.2.2 Marine Turtles

As described in Table 3-6, BIAs for marine turtles, including the loggerhead turtle (reproduction) and the green, flatback and hawksbill turtles (reproduction and critical nesting habitat), occur within the operational area. A study that investigated flatback turtle internesting behaviour found that the 30-m depth contour encompassed the vast majority of internesting activities (i.e., resting on the seabed) (Pendoley, 2017). Another study by Whittock et al. (2016) identified suitable internesting habitat for flatbacks to be between 0 and 16 m deep and within 5 to 10 km off the coastline. These studies demonstrate that, while marine turtles may be present in offshore waters during the internesting period, they are typically freely moving through these areas before they return to shallow waters to rest in the days leading up to re-nesting activity. Therefore, it is likely that marine turtles will occur in increased numbers as they traverse through the operational area during the peak internesting period. Santos marine fauna records have previously reported the presence of marine turtles in proximity to the operational area.

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.

Marine turtle hearing is thought to be most sensitive in the frequency range of 100 to 700 Hz (Bartol & Musick, 2003), with studies showing that behavioural responses occur to received sound levels of approximately 166 dB re 1 µPa and that avoidance responses occur at around 175 dB re 1 µPa (McCauley et al., 2000). These levels overlap with the sound frequencies produced by vessels and helicopters.

Temporary impairment from operational sounds to marine turtles due to TTS is expected to only occur at close ranges (within tens of metres) (JASCO, 2016). Behavioural impacts may occur at close to intermediate ranges (within hundreds of metres). Considering the open-ocean location of the operational area, only individual turtles may be affected as they transit the area. No impacts at a population level are anticipated.

6.1.2.3 Sharks, Fish and Rays

All fish species can detect noise sources, although hearing ranges and sensitivities vary substantially between species (Dale et al., 2015). 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 & Popper, 2004; Braun & 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 peak sound pressure level (PK) and 213 dB PK (depending on the presence or absence of a swim bladder), and the threshold for TTS is 186 dB cumulative sound exposure level (SELcum) (Popper et al., 2014). Given that there is no exposure criteria for sharks and rays, the same criteria are adopted, although typically sharks and rays do not possess a swim bladder. As discussed above, sources of noise have the potential to reach these levels during vessel activities; however, this is an upper limit that is expected to be temporary and localised.

Whale sharks could potentially be impacted from operational noise, especially around the time of aggregating events off the Ningaloo coast since whale sharks could potentially migrate through the operational area while transiting to these aggregations. As described in Table 3-6, a BIA for whale shark foraging occurs within the operational area.

Whale sharks would be expected to show avoidance to vessel noise, although they are likely to tolerate low level noise, because whale sharks have been observed swimming close to oil and gas platforms on the Northwest Shelf. Santos marine fauna records have previously reported the presence of whale sharks in proximity to the operational area.

6.1.2.4 Birds

Birds are known to aggregate around offshore platforms as they provide a safe place to roost (CoA 2020). As outlined in Section 3.2.4 and 3.2.5, numerous birds are common in the region and may interact with the WHP.

Four reproduction BIAs overlap the operational area (Australian fairy tern, roseate tern, wedge-tailed shearwater and lesser crested tern). Noise emitted by the bird-deterrent device aims to have a behavioural impact on birds to prevent them breeding and nesting on the WHP. Encouraging them to stay away protects birds from helicopter strike and makes the WHP safe for helicopters to land on and take-off from. If the regular but intermittent use of the acoustic bird-deterrent system does not deter birds from using the WHP, then it will also be used prior to helicopter take-off and landing to minimise the risk of bird strike and provide safe conditions for take-off and landing manoeuvres.

No physical impacts from the acoustic devices are expected. Detrimental impacts to birds from bird-deterrent devices are not expected at an individual or population level.

The inherent design of the bird deterrent system mitigates significant potential impacts to the hearing of individual birds. Avian hearing encompasses a narrower range of frequencies than human hearing; within that range, avian hearing is less sensitive than human hearing (Beason 2004). Controls include a variable volume control managed to a level to illicit a dispersion/deterrent response rather than to impair hearing, and variation in dispersion tracks. This operating philosophy aligns with a principle of applying lowest effective volume range and short intermittent noise events.

The bird deterrent device has shown that when operated the bird behaviour is to disperse from the top level of the WHP immediately, which further reduces the risk of prolonged exposure to noise. The sound level decreases and deteriorates with distance which further reduces the potential impact area and risk of hearing damage.

Any impacts to birds will be short term intermittent local avoidance only to a small proportion of local populations. Assessments on the potential impacts of bird deterrent strategies are included in Section 6.6.

6.1.2.5 Plankton and Invertebrates

Benthic invertebrates are unlikely to be negatively impacted from noise generated from operational activities due to their distance from the WHP and other vessels (i.e., water depth is greater than 50 m). Plankton, including fish eggs and larvae, and pelagic invertebrates could drift into close proximity to high-energy noise sources (e.g., bow thrusters). 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.

6.1.3 Environmental performance outcomes

Environmental performance outcomes (EPOs) relating to this event include:

- No injury or mortality to EPBC Act and WA Biodiversity Conservation Act 2016 listed marine fauna during operational activities.
- No injury or death to EPBC Act and WA Biodiversity Conservation Act 2016 listed threatened, migratory or marine species as a result of the operation of the John Brookes WHP bird deterrent system.

The control measures considered for this event are outlined in Table 6-2, and the environmental performance standards and measurement criteria for the EPOs are described in Table 8-2.

Table 6-2: Control Measure Evaluation for Acoustic Disturbance

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls				
VI-CW-CM-01	Procedure for interacting with marine fauna.	Reduces risk of physical and behavioural impacts to marine fauna from vessels and helicopters because if marine fauna are sighted, then vessels can slow down or move away.	Operational costs to adhere to marine fauna interaction restrictions, such as vessel 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.
VI-CW-CM-02	Bird deterrent system CCTV footage retrieved	Reduces the potential for adverse impacts to birds by reviewing the	Minor cost, standard practice	**Adopted-** environmental benefit

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
	opportunistically from the John Brookes WHP.	CCTV footage, confirming the effectiveness and performance of the deterrent system and recording bird species, numbers and response to the deterrent system.		outweighs the minor cost.
VI-CW-CM-60	The acoustic bird deterrent system is maintained in accordance with the device specifications and Santos maintenance system.	Ensures the acoustic system is operating in line with specifications and does not cause physical harm to birds.	Minor cost, standard practice	**Adopted**- environmental benefit outweighs the minor cost.
Additional Controls				
N/A	Dedicated Marine Fauna Observer on vessels.	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.	**Not Adopted** – Cost disproportionate to increase in environmental benefit.
N/A	Structure operational activities to avoid coinciding with sensitive periods for marine fauna present in the operational area.	Potential reduction in impact of noise to some sensitive receptors.	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.	**Not Adopted** – Cost and residual safety risk are disproportionate to increase in environmental benefit.
N/A	Elimination or reduction of number or size of vessels.	Potential reduction in impact of noise to some sensitive receptors.	Elimination of support vessels from the field would not achieve Santos' legal requirements for petroleum production or work-plan objectives for oil and gas production and may compromise safety standards to other marine users.	**Not Adopted** – Cost disproportionate to increase in environmental benefit.
N/A	Elimination of bird deterrent usage.	Would eliminate potential impacts associated with this intermittent noise source.	Limits the type of bird-deterrent devices able to be used and potentially prohibits landings because the helideck integrity may be affected by bird guano and the risk of bird strike would create safety issues. Would also require	**Not Adopted** – Given the intermittent use and minimal risk of impacts to birds occurring, safety risk associated with personnel and helicopter use outweigh the environmental benefit.

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
			mobilisation of personnel via vessel to the WHP to clean the decks, introducing safety risks to personnel due to climbing the WHP and inhalation of guano.	
N/A	View bird deterrent system CCTV footage directly from the VI Control Room	Would allow real time viewing of the effectiveness of the system and interaction with birds.	Not feasible. Due to restrictions with bandwidth between the John Brookes WHP and the VI control room, live CCTV monitoring cannot be adopted. Alternatively, the John Brookes bird deterrent system will store weekly CCTV footage which will be downloaded opportunistically by personnel visiting the normally unmanned facility (VI-CW-CM-02).	**Not Adopted** – It is not feasible to implement live monitoring of the bird deterrent CCTV footage from the VI Control Room.

6.1.4 Environmental Impact Assessment

Table 6-3: Impacts and Consequence Ranking- Acoustic Disturbance

Receptor	Consequence Level
Acoustic Disturbance	
Threatened or local fauna	While the level of noise expected from temporary and intermittent operational activities has the potential to cause physical injury to marine fauna, most species that may transit through the area are expected to demonstrate avoidance behaviour if noise levels approach those that could cause pathological effects. The potential for physical injuries and behavioural impacts to marine fauna will be managed through the procedure for interacting with marine fauna. Any unavoidable behavioural impacts to fauna are expected to be temporary and short-ranged and are not expected to lead to long-term changes in individual behaviour (e.g., migration or internesting) or lead to changes at the population level. Bird-deterrent devices aim to produce avoidance behaviour in birds and are not expected to result in detrimental impacts to birds at an individual or population level. The consequence level for fauna is considered to be I - Negligible.
Physical environment or habitat	Not applicable – Habitats within the operational area consist of non-coral invertebrates (such as sea fans and gorgonians), which are not impacted by noise emissions. No decrease in local population size or in the area of occupancy of species and no loss or disruption to habitat critical to the survival of a species, disruption to the breeding cycle or introduction of disease is expected.
Threatened ecological communities	Not applicable – No threatened ecological communities identified in the area over which noise emissions are expected.
Protected areas	Not applicable – Noise levels are not expected to impact on habitats or species at a population or community level. Therefore, no significant impacts to Protected Areas, such as the Montebello Marine Park (Multiple Use Zone – IUCN Category VI), are expected.
Socio-economic receptors	Not applicable –Noise levels are not expected to impact on fish communities; therefore, indirect impacts to fisheries are not considered. There are no recreation zones within the area expected to be impacted by noise. The nearest recreation zones are sheltered within the islands of the Montebello Islands State Marine Park (7.5 km from the operational area).

Receptor	Consequence Level
Overall worst-case consequence	I – Negligible

6.1.5 Demonstration of As Low as Reasonably Practicable

The use of support vessels is unavoidable if the operational activities are to proceed as required on 24 hours a day, 365 days a year basis. Equipment maintenance will keep the vessel noise levels to within normal operating limits, which will also aid in reducing the likelihood of noise impacts to sensitive receptors. A bird deterrent device for John Brookes WHP is needed for critical safety reasons as outlined in Section 2.8.3. The deterrent device is required to be used regularly (such as daily) but intermittently and for a short duration to deter birds from nesting and/or roosting on the WHP.

The use of helicopters as an alternative means to transfer personnel to and from the John Brookes WHP is necessary to allow operational activities to occur safely and effectively, with the ability to maximise the daylight hours, and to provide for a rapid method of transferring to and from the WHP in the case of an emergency situation. Allowing birds to nest in or on the WHP and create guano contamination on the helideck because there is no deterrent or the introduction of a performance standard prohibiting helicopters from landing or taking-off in the presence of marine megafauna would introduce an unacceptable risk to human life.

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 which 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.

Thus, noise emitted during operational activities is not expected to significantly impact on marine fauna within the receiving environment. There are no additional controls that would further reduce the impact from noise associated with the operational activities without gross disproportionality; therefore, it is considered ALARP.

6.1.6 Acceptability Evaluation

Is the consequence ranked as I (Negligible) or II (Minor)	Yes – maximum consequence from acoustic 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 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 – IUCN principles of nearby reserves are met. Management consistent with EPBC Regulations Part 8. Controls implemented will minimise the potential impacts from the activity to species identified in recovery plans and conservation advice as having the potential to be impacted by noise emissions. Relevant species recovery plans, conservation management plans and management actions, including but not limited to the Recovery Plan for Marine Turtles in Australia (DoEE, 2017), Blue Whale Conservation Management Plan 2015–2025 (DoE, 2015c), National Recovery Plan for the Southern Right Whale (DCCEEW, 2024), Approved Conservation Advice for Rhincodon typus (whale shark) (TSSC, 2015a), and relevant management plans, recovery plans and conservation advices for birds. Consistent with EPBC Act Part 13 Permit (Permit E2020 0173).
Are risks and impacts consistent with Santos' Environmental, 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

Minimal behavioural changes are expected from operational 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, which requires compliance with Part 8 of the EPBC regulations (specifically vessels and aircraft), and the conditions of EPBC Act Part 13 Permit E2020-0173 (Section 2.8.32.8.3) 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 operational activities will have any unacceptable impacts to socio-economic receptors. The activity is managed in accordance with the relevant actions described in the recovery plans and conservation advices listed above, and no impacts to other Marine Park values are expected. The impacts of noise in the receiving environment are ALARP and considered environmentally acceptable.

Recovery Plan for Marine Turtles

The Recovery Plan for Marine Turtles in Australia: 2017 to 2027 (Commonwealth of Australia, 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 priority actions related to noise for all marine turtle stock, being to:

- manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to the survival; and
- manage anthropogenic activities in BIAs to ensure that BIB can continue.

Underwater noise emitted from vessels when the vessel is idling or moving between sites would be detectable over a short distance. Higher noise levels occur when the vessel is using the dynamic position system to hold station. Overall, underwater noise levels generated during the activity are expected to be localised, and below the thresholds for PTS and TTS.

Transiting marine turtles may occur within the operational area during the internesting period. Thums et al. (2017) studied flatback turtles during their post-nesting migration from the Lacepede Islands and during foraging. The study found that flatback turtles migrated along the coast in water depths of 63 ± 5 m, passing near Adele Island on the way to foraging grounds on the Sahul Shelf in the Timor Sea. It is unlikely that these turtles will travel greater than 66 km from the coast.

Given the intermittent and short-term duration of vessel noise and the proposed management measures, it is reasonable to conclude that noise emissions will not displace turtles from habitat critical to their survival, affect the conservation status of marine turtles or compromise the objectives of the marine turtle recovery plan and therefore impacts are acceptable.

Management Plans and Conservation Advice for Cetaceans

The operational area intercepts a BIA for humpback whales (migration), whilst the migration BIA for pygmy blue whales is approximately 8 km from the operational area at its closest point..

This activity is consistent with the Conservation Management Plan for Blue Whales (DoE, 2015a) because:

- The activity includes the implementation of procedures for interacting with marine fauna as a control to ensure the petroleum activity complies with Part 8 of Environment Protection and Biodiversity Regulations 2000. These regulations include adaptive management controls which provides opportunity for the petroleum activity to take action if blue whales are observed.
- There will be no injury due to noise emissions to blue whales that may be encountered during the activity. As defined by the Department’s guidance on key terms in the conservation management plan (DAWE, 2021), injury is considered to be either PTS or TTS from underwater noise. The received levels from vessels will decline rapidly from the source and be below thresholds for PTS and TTS within approximately 12 to 266 m of the source. The operational area is approximately 8 km from the pygmy blue whale migration corridor BIA, exceeding the noise threshold distance.

On this basis, impacts are considered acceptable.

6.2 Light Emissions

6.2.1 Description of Event

Event	During the operational life of the activity, the physical presence of the John Brookes WHP and the supporting vessel and helicopter use will generate light emissions that may impact marine fauna and seabirds. A minimum level of lighting is required for safety and navigational purposes on the John Brookes WHP and on support vessels (as is the intermittent use of a bird-deterrent device with a light-emitting component to provide safe landing conditions on the WHP). Routine operational activities using support vessels (i.e., transfer of personnel to and from the John Brookes WHP) is the most frequent vessel activity. Crew transfers to and from the WHP on support vessels are typically conducted weekly to fortnightly and only during daylight hours for safety reasons. However, lighting will be required for operational, safety and navigational purposes during planned but not routine night operations. Operational lighting may include spot lighting on an as-needed basis (e.g., in-sea ROV inspection, deployment and retrieval). Lighting will typically consist of bright white (i.e., metal halide, halogen, or fluorescent) lights.
Extent	Localised: No lighting directed onto water. Limited light ‘spill’ or ‘glow’ onto waters surrounding facilities from John Brookes WHP or support vessels.
Duration	Artificial lighting is required 24 hours a day on the John Brookes WHP. Lighting may also be required 24 hours a day on support vessels if undertaking non-routine operational activities during nighttime periods.

6.2.2 Nature and Scale of Environmental Impacts

Potential Receptors include:

- threatened or migratory fauna (marine mammals, marine turtles, sharks, fish and rays, and seabirds).

This section assesses the potential for impacts from artificial light on listed species and other marine fauna for which artificial light is known to affect, this includes impacts to behaviour, survivorship and/all reproduction, in accordance with the National Light Pollution Guidelines for Wildlife (Commonwealth of Australia, 2023). In accordance with the National Light Pollution Guidelines for Wildlife, this addendum has assessed the potential for light impacts to occur within 20 km of the operational area (Commonwealth of Australia, 2023). This is considered conservative considering the level of lighting required for the petroleum activities and the duration that the petroleum activities are expected to take place.

Light is a form of energy that is emitted over a particular band of frequencies and wavelengths of the electromagnetic spectrum. The visible range (for humans) is typically 400 to 700 nm, with ultraviolet below this wavelength range, and infra-red above it. Fauna perceives light differently to humans, and their visible spectrum can vary between about 300 nm and more than 700 nm depending on the species (Commonwealth of Australia, 2020a); i.e. it can extend into the ultraviolet and infra-red spectra. Therefore, the potential impact from artificial light emissions can vary depending on the specific characteristics of the source (e.g. light intensity, wavelength) and the sensitivities of the receptor.

Artificial lighting can alter critical behaviours in wildlife. For some species, artificial lighting may extend diurnal or crepuscular behaviours by improving an animal’s ability to forage (e.g., Hill, 1992). For nocturnal species, artificial light can result in detrimental changes in behaviour.

The severity to which artificial light negatively impacts individuals depends upon the vulnerability, which varies between and within species, depending upon their behaviour, and on the spectral output of the light emissions. The sensitivity of different species to different wavelengths is summarised in Figure 6-1, which shows that most species are sensitive to short wavelength light (ultraviolet/violet/blue).

The characteristics of light emissions will differ depending upon the number, intensity, spectral output and type of light. Historically, vessels and facilities use a combination of high-pressure sodium, fluorescent, metal halide and mercury vapour lights. Recent advances in light emitting diode technology have seen some offshore lighting applications switch to this more efficient and cost-effective technology.

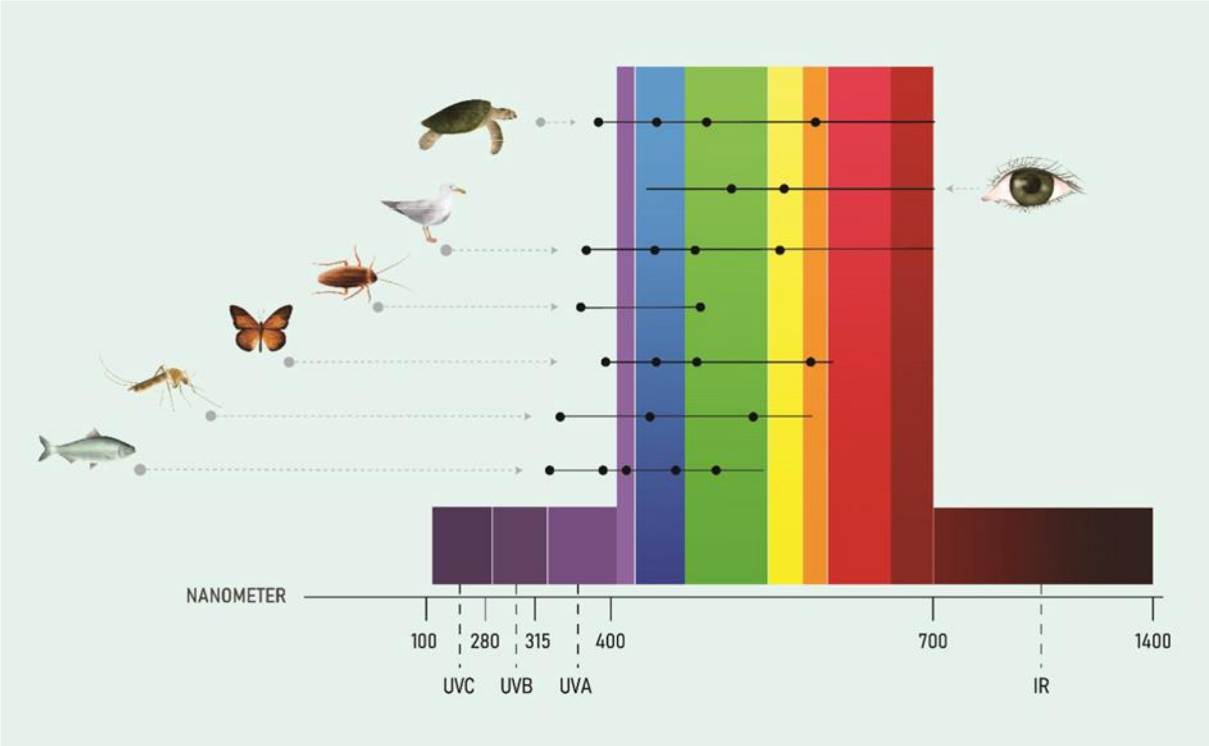

Figure 6-1: Visibility of different wavelengths of light in humans and wildlife is shown by horizontal lines. Black dots represent reported peak sensitivity (Commonwealth of Australia, 2020a)

Continuous lighting in the same location for an extended period of time may result in alterations to fauna behaviour, as discussed below for each fauna group. The combinations of colour, intensity, closeness, direction and persistence of a light source are key factors in determining the magnitude of environmental impact (EPA, 2010).

6.2.2.1 Marine Mammals

Research on the effects of artificial lighting on marine mammals is limited, and no direct impacts on cetaceans have been documented. Many dolphin species are believed to be diurnal, or at least more active during the day, likely due to prey availability (Sekiguchi and Kohshima, 2003). Because fish species may gather in areas with light spill, dolphins might be indirectly drawn to lit structures or illuminated marine environments for foraging.

Mammals use variations in day length to anticipate environmental changes and time their reproduction. Marine mammals in the area affected by light will be transient, so impacts to biologically important behaviours are unlikely. There is potential for opportunistic foraging by odontocetes if prey abundance increases around light sources. As shown in Figure 3-8, BIAs overlap the operational area including the 20 km buffer for humpback whales (migration) and blue whales (migration, approximately 8 km from the operational area), likely increasing their presence during migration windows. However, cetaceans and other marine mammals are not significantly attracted to light sources at sea. Cetaceans primarily use acoustic senses to monitor their environment rather than visual cues (Simmonds et al., 2004), making significant impacts unlikely.

6.2.2.2 Marine Turtles

Marine turtles are highly sensitive to artificial lighting, which can interfere with nesting females, newly emerged hatchlings, and those dispersing in nearshore waters (Salmon, 2003; Salmon et al., 1995a, 1995b; Salmon and Wyneken, 1987; Wilson et al., 2018). The potential impact on foraging turtles is primarily due to their secondary response to changes in prey distribution caused by light (Kebodeaux, 1994). Since marine turtles do not feed during the breeding season (Limpus et al., 2013) and light does not influence their inter-nesting behaviours, they are less likely to be affected. Typically, inter-nesting turtles are found in waters less than 30 meters deep (Whittock et al., 2016), whereas the operational area has depths ranging from approximately 95 to 125 meters (Thums et al., 2013), making their presence in the operational area unlikely.

Adult female marine turtles primarily nest on sandy beaches at night, relying on visual cues to select and navigate to nesting sites and return to the ocean. Excessive artificial lighting from urban areas, roads, and piers can disorient these turtles, leading to fewer nesting females on brightly lit beaches (Salmon, 2003; Hu et al., 2018). However, nesting females are generally less impacted by artificial lighting than hatchlings (Witherington, 1991a).

Hatchlings emerge at night and use topographic and brightness cues to find the ocean, moving toward the brighter horizon and away from dark silhouettes of dunes or vegetation (Pendoley & Kamrowski, 2015; Lohmann et al., 1997; Limpus & Kamrowski, 2013). Artificial lights from platforms and vessels can trap and disorient hatchlings, causing increased energy expenditure, higher predation risk, and lower survival rates (Witherington & Martin, 2003; Commonwealth of Australia, 2023). Disoriented hatchlings may delay reaching the sea or fail to reach it, resulting in dehydration, exhaustion, and higher mortality (Salmon & Witherington, 1995).

Offshore, hatchlings rely less on light and more on wave motion, currents, and the earth's magnetic field to navigate (Lohmann & Lohmann, 1992). Their internal compass, set during their crawl down the beach, and wave cues guide them offshore (Stapput & Wiltschko, 2005; Wilson et al., 2021). In the absence of wave cues, hatchlings may orient towards light cues while swimming (Harewood & Horrocks, 2008), sometimes overriding wave cues (Thums et al., 2013, 2016; Wilson et al., 2018).

Currents influence hatchlings' dispersal speed and direction in the ocean (Wilson et al., 2018, 2021). However, in the presence of artificial light, hatchlings may swim against the currents toward the light source, increasing energy expenditure and predation risk (Wilson et al., 2018). As shown in Figure 3-11 to Figure 3-14, BIAs for marine turtles occur within the 20 km buffer, including BIAs for the loggerhead turtle (reproduction) and the green, flatback and hawksbill turtles (reproduction and critical nesting habitat). These internesting areas are an area around Barrow Island, located approximately 5 km from the operational area.

The WA Environmental Protection Authority (EPA) conservatively estimates there is only a light influence on marine turtles if the light source is within 1.5 km of the nesting beach (EPA, 2010).

Additionally, considering the water depths at the location, internesting females are not expected in the operational area.

The Recovery Plan for Marine Turtles in Australia: 2017-2027 (Commonwealth of Australia, 2017) specifies the following priority action for the Pilbara genetic stock of flatback turtles in relation to artificial light:

- manage artificial light from onshore and offshore sources to ensure biologically important behaviours of nesting adults and emerging/dispersing hatchlings can continue.

Based on the justifications above, impacts from light emissions on individual turtles in the area that may be affected by light emissions during the activity are expected to be restricted to localised attraction and temporary disorientation. These impacts are short-term (i.e., during the activity), will not result in population-scale impacts or long-term threats to the survival of marine turtles, and are considered to be negligible. Light emissions from the activity will not compromise the objectives as set out in the marine turtle recovery plan and impact of lighting associated with the activities to turtles is negligible.

6.2.2.3 Sharks, Fish and rays

Fish responses to light emissions differ based on species and habitat. Experiments with light traps have shown that certain fish and zooplankton species are attracted to light (Meekan et al., 2001), with traps capturing specimens from distances up to 90 meters (Milicich, 1992). A study by Lindquist et al. (2005) found that artificial lighting from offshore oil and gas activities increased the abundance of clupeids (herring and sardines) and engraulids (anchovies), species known to be highly photopositive. The artificial light concentrates marine plankton, improving foraging success for planktivorous fishes and potentially increasing predation rates on them.

The operational area including the 20 km buffer overlaps the whale shark foraging BIA (Figure 3-15), so artificial light could attract foraging whale sharks within 90 meters of the operations, affecting their vertical migration. However, these impacts are expected to be minimal due to the short duration of the activity. Additionally, the light from the activity will not reach the whale shark foraging BIA, where a higher density of prey and more whale sharks are expected.

6.2.2.4 Seabirds

Artificial lighting can attract and disorient seabird species, leading to behavioral changes such as circling light sources or disrupted foraging, and can result in injury or death near the light source (Gaston et al., 2014; Longcore and Rich, 2004). Research conducted between 1992 and 2002 in the North Sea confirmed that artificial lights attracted birds to illuminated offshore structures (Marquenie et al., 2008). Birds may be drawn directly to the light source or indirectly to the structures in deep water, which attract marine life at all trophic levels, creating food sources and shelter for seabirds. The most vulnerable life stages for seabirds and migratory shorebirds are nesting adults and fledglings.

The operational area including 20 km buffer overlaps reproduction BIAs for the wedge-tailed shearwater, fairy tern, lesser crested tern and roseate tern (Figure 3-16).

Tagging studies by Cannell et al. (2019) showed that most chick-rearing foraging activity for wedge-tailed shearwaters was concentrated around nesting islands, although tagged birds were observed foraging widely in the Indian Ocean, often near seamounts.

Artificial light can impact seabird behaviour, adult nest attendance, or confuse birds, resulting in injury or death from collisions with structures (Cianchetti-Benedetti et al., 2018; Rodríguez et al., 2017). Shearwater fledglings are particularly affected by onshore lighting, which can override their sea-finding cues and draw them inland, preventing them from reaching the sea (Mitkus et al., 2018).

Adult birds are vulnerable to artificial lighting during the breeding cycle when returning to and leaving the nesting colony to maintain nesting sites or forage. Foraging adults may be drawn to light sources to feed on fish attracted to the light or may be drawn to vessel lights during low visibility, although they primarily feed during the day (Catry et al., 2009; Whittow, 2020). Resting periods on the sea surface are greater at night than during the day, which aligns with primarily daytime foraging (Weimerskirch et al., 2020).

Adult wedge-tailed shearwaters and other seabirds may be temporarily attracted to light from the vessels, or to fauna aggregated by the light. This behavioural disturbance is expected to be localised around the vessels within the operational area.

Support vessels will not be stationary or in the operational area for long periods of time and so are unlikely to attract large numbers of seabirds to one fixed location. While the bird-deterrent acoustic device (Section 2.8) may also include a light component, this is only used intermittently to ensure safe landing and take-off conditions on the WHP by deterring birds from nesting or depositing guano on the WHP surface. Any impacts to birds from lighting on the bird deterrent system will be short term and intermittent (during hours of darkness only) and result in local avoidance only to a small proportion of local populations. Detrimental impacts to seabirds from bird-deterrent devices are not expected at an individual or population level.

Impacts to transient seabirds from vessels will therefore be limited to short-term behavioural effects with no decrease in local population size or in the area of occupancy of species and no loss or disruption of habitat critical to the survival of a species or disruption to the breeding cycle.

Migratory shorebirds may be present or fly through the region between July and December, and again between March and April, as they migrate between Australia and offshore locations (Commonwealth of Australia, 2015c). The risk of collision for shorebirds attracted to the light is considered low, based on the short-term duration and localised nature of activities in the operational area. Impacts are expected to be limited to temporary behavioural disturbances for isolated individuals and are not expected to disrupt the migration of seabirds.

6.2.3 Environmental Performance Outcomes and Control Measures

The EPOs relating to this event are:

- Reduce impacts to marine fauna from lighting on the WHP and support vessels through limiting lighting to that required by safety and navigational lighting requirements [EPO-VI-CW-02].
- No injury or death to EPBC Act and WA Biodiversity Conservation Act 2016 listed 2016 listed threatened, migratory or marine species as a result of the operation of the John Brookes WHP bird deterrent system (EPO-VI-CW-11).

The control measures considered for this event are outlined in Table 6-4and the environmental performance standards and measurement criteria for the EPOs are described in Table 8-2.

Table 6-4: Control measures evaluation – Light Emissions

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls				
VI-CW-CM-02	Bird deterrent system CCTV footage retrieved opportunistically from the John Brookes WHP.	Reduces the potential for adverse impacts to seabirds by reviewing the CCTV footage, confirming the effectiveness of the deterrent system and recording bird species, numbers and response to the deterrent system.	Minor cost, standard practice	**Accepted** – environmental benefit outweighs the minor cost.
VI-CW-CM-03	Lighting will be used only as required for safe work conditions and navigational purposes.	Light spill from unnecessary lighting reduced, even further lowering likelihood of impacts to the environment.	Additional costs associated with implementing control.	**Accepted** – Cost is considered acceptable for the benefit that may be realised from this control.

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
VI-CW-CM-04	Premobilisation review and planning of lighting on support vessels and the WHP is undertaken prior to activities commencing.	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.	Additional costs associated with implementing control.	**Accepted** – Cost is considered appropriate for the benefit that may be realised from this control.
Additional Controls				
N/A	Review lighting to a type (colour) that has less impact.	Could reduce potential impacts of artificial light on certain fauna	High cost to complete lighting change out on all vessels in area of low sensitivity. Navigational lighting colours are stipulated by law.	**Not Adopted –** Cost outweighs the benefit.
N/A	Limit or exclude night-time operations.	Would eliminate potential impacts of artificial light during hours of darkness when light sources are more apparent and potential impacts are greatest.	Would double duration of activity; increase impacts or potential impacts in other areas, including increase in waste, air emissions, risk of 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.	**Not Adopted** – Given the minimal risk of impacts to EPBC Act listed marine species (e.g., turtles) occurring due to lighting, the financial and environmental costs incurred by requiring all works to be undertaken during daylight hours only (therefore disrupting operational activities) is unfeasible. Delay to IMMR works to daylight hours only could also pose a safety risk for any safety critical work which is unacceptable. Although the operational area overlaps with the turtle reproduction BIAs, impacts are not expected on a population level or on turtle habitat.
N/A	Select a bird-deterrent device that doesn't include a light-emitting component.	Would eliminate potential impacts associated with this intermittent light source during hours of darkness.	Limits the type of bird-deterrent devices able to be used and potentially prohibits landings because the helideck integrity may be affected by bird guano, which creates safety issues.	**Not Adopted** – Given the intermittent use and minimal risk of impacts to birds occurring, the financial and environmental costs of restricting helicopter use to only daylight hours (thereby disrupting emergency response abilities) is unfeasible.
N/A	View bird deterrent system CCTV footage directly from the VI Control Room.	Would allow real time viewing of the effectiveness of the system and interaction with seabirds.	Not feasible. Due to restrictions with bandwidth between the John Brookes WHP and the VI control room, live CCTV monitoring	**Not Adopted** – It is not feasible to implement live monitoring of the bird deterrent CCTV footage from the VI Control Room.

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
			cannot be adopted. Alternatively, the John Brookes bird deterrent system will store weekly CCTV footage which will be downloaded opportunistically by personnel visiting the normally unmanned facility (VI-CW-CM-02).	
N/A	Use of shrouding on external lights	Reduces 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.	**Not Adopted** - The financial and environmental costs of extending the activity duration are deemed grossly disproportionate to low environmental benefits.
N/A	Use of dark matt surfaces to reduce sky glow across all activities.	Reduces potential for impacts on turtles from light emissions during hours of darkness when light sources are more apparent and potential impacts are greatest.	Additional cost to repaint vessel surfaces.	**Not Adopted** - Given the minimal risk of impacts to listed marine species (e.g., turtles) occurring due to lighting, the financial and environmental costs of extending the activity duration are deemed grossly disproportionate to low environmental benefits.

6.2.4 Environmental Impact Assessment

The impacts and consequence ranking of planned light emissions are outlined in Table 6-5.

Table 6-5: Impacts and Consequence Ranking- Light Emissions

Receptor	Consequence Level
Threatened or migratory fauna	Continuous lighting in the same location for an extended period of time may result in alterations to normal marine fauna behaviour. Sensitive receptors that may be impacted include fish at surface, sea snakes, marine turtles, and seabirds. A localised increase in fish activity as a result of vessel lighting is expected to occur as a result of the activity within the operational area. Light pollution is recognised as potential threat to marine turtles in recovery plan for marine turtles in Australia. Light emissions may be visible to turtles transiting, foraging or internesting in surrounding areas, but they are unlikely to affect nesting or hatchling sea finding and dispersal activity. It is considered that the activity will not compromise the objectives as set out in the marine turtle recovery plan, and therefore, the impact of lighting associated with the activity to turtles is negligible. The operational area including the 20 km buffer overlaps the reproduction BIAs for the wedge-tailed shearwater, fairy tern, lesser crested tern and roseate tern. Individuals may forage in the waters surrounding the islands during nesting seasons. Adult birds are vulnerable to artificial lighting during the breeding cycle when returning to and leaving the nesting colony to maintain nesting sites or forage. Therefore, adult birds may be temporarily attracted to light from the vessels and John Brookes WHP in the operational area. This behavioural disturbance is expected to be localised around vessels and the WHP within the operational area. Since the light source from these vessels is temporary, any impacts are predicted to affect individual birds rather than entire populations. The temporary behavioural

Receptor	Consequence Level
	disturbance will be localised around the light sources and is not expected to have a significant adverse effect on a population or its lifecycle and therefore assessed as negligible (I).
Physical environment or habitat	Not applicable – No physical environments or habitats identified in the area over which light emissions are expected other than open water.
Threatened ecological communities	Not applicable – No threatened ecological communities identified in the area over which light emissions are expected.
Protected areas	Not applicable – The operational area intersects the Montebello Marine Park (Multiple Use Zone – IUCN Category VI). The values of the marine park, with respect to the presence of light-sensitive marine fauna, are described against threatened or migratory fauna.
Socio-economic receptors	Not applicable – Lighting is not expected to cause an impact to socio- economic receptors other than to act as a visual cue for avoidance of the area by other marine users for safety purposes.
Overall worst-case consequence	I – Negligible

6.2.5 Demonstration of as Low as Reasonably Practicable

There are no safe alternatives to the use of artificial lighting on the John Brookes WHP and support vessels. Artificial lighting is required 24 hours a day for navigational safety in the area, and additional light is required to allow operational activities to proceed safely 24 hours a day for occupational health and safety reasons.

A lighting-emitting bird-deterrent device for John Brookes WHP is also required for critical safety reasons as outlined in Section 2.8.3. The deterrent device is required to be used regularly (such as daily) but intermittently and for a short duration to deter birds from nesting on the WHP. If the system doesn't deter birds from using the WHP, then it will also be used prior to helicopter take-off and landing to minimise the risk of bird strike and to provide safe conditions for take-off and landing manoeuvres.

The use of helicopters as an alternative means to transfer personnel to and from the John Brookes WHP is necessary to allow operational activities to occur safely and effectively, with the ability to maximise the daylight hours, and to provide a rapid method of transferring to and from the WHP in the case of an emergency situation. Allowing birds to nest in or on the WHP and create guano contamination on the helideck because there is no deterrent or introducing a performance standard prohibiting helicopters from landing or taking-off in the presence of birds on the WHP would introduce an unacceptable risk to human life.

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, 2020b) or the National Light Pollution Guidelines for Wildlife (Commonwealth of Australia, 2023), as biologically important behaviours of nesting adults, foraging individuals and emerging/ dispersing hatchlings can continue given the short duration of the activity and the controls implemented. Additional control measures were considered but not adopted since the associated cost or effort was grossly disproportionate to any environmental benefit, as detailed in Section 6.2.3. Therefore, the use of 24-hour per day artificial lighting at an intensity to allow work to proceed is considered ALARP.

6.2.6 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 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 – management consistent with the Navigation Act 2012, Recovery Plan for Marine Turtles in Australia (DoEE, 2017) and relevant recovery plans and conservation advices for birds. Consistent with EPBC Act Part 13 Permit (Permit E2020-0173) Permit to install and operate bird deterrence equipment on unmanned wellhead platform 'John Brookes' 100 km offshore WA. Consistent with relevant species recovery plans, conservation management plans and management actions, including but not limited to the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017), Blue Whale Conservation Management Plan 2015 to 2025 (Department of Agriculture, Water and the Environment, 2021, National Light Pollution

	Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (2020) and the Wildlife Conservation Plan for Seabirds (Commonwealth of Australia, 2020b).
Are risks and impacts consistent with Santos' Environmental, 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.

Lighting on the WHP and vessels is industry standard and required to meet relevant maritime and safety regulations.

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 nesting beaches is consistent with the relevant actions described in the Recovery Plan for Marine Turtles in Australia (DoEE, 2017).

Constant navigational lighting at the WHP is not likely to impact transient turtles. Turtles are more sensitive to light when feeding, mating or nesting or as hatchlings when transitioning from nest to ocean. Given the distance of the operational area from the shoreline, little to no effect is expected.

The event is consistent with the relevant actions described in the recovery plans listed above. No impacts to marine park values are expected, and no stakeholder concerns have been raised regarding lighting for the activity.

Operation of the bird deterrent system is consistent with the conditions of EPBC Act Part 13 Permit E2020-0173 (Section 2.8.3).

The impacts of lighting to the receiving environment are ALARP and considered environmentally acceptable.

6.3 Greenhouse Gas Emissions

6.3.1 Description of Event

Event	The VI Hub is the base of Santos' Western Australian energy portfolio and has been in operation since 1986. The VI Hub operations consist of production from facilities located in both Commonwealth and State waters. Processing and export is undertaken on VI, located in State waters. Gaseous greenhouse gas (GHG) emissions are discharged to the atmosphere from the VI Hub operations. GHG emissions refers to gases that trap heat within the atmosphere through the absorption of longwave radiation reflected from the Earth's surface. GHG emissions generated at the VI Hub in Commonwealth and State waters are predominantly CO_2, CH_4 and N_2O emitted to the atmosphere when hydrocarbons are burned, flared, vented or released as fugitive emissions through extraction, transmission and processing. The GHG Protocol defines direct emissions as GHG emission from sources that are owned or controlled by the company. Scope 1 GHG emissions are emissions released into the atmosphere as a direct result of the activities at a facility. Scope 1 GHG emissions from the VI Hub operations (inclusive of production from wells, the John Brookes WHP, GES and John Brookes Pipelines through to the processing plant on VI) are considered direct emissions for this activity and include: • flaring; a vital safety feature in which hydrocarbons are combusted intermittently (in emergency or planned shutdown or maintenance circumstances) to prevent overpressure and/ or the creation of an explosive atmosphere. Note there is no flare on the John Brookes WHP. • venting; reservoir CO_2 extracted from the gas is vented during some routine and non-routine maintenance activities. • fuel gas use for power generation; hydrocarbon-based fuels (primarily gas, with diesel used intermittently) are combusted to generate heat and power. • fugitive emissions from onshore and offshore facilities; may occur from pressurised equipment, and are inherent in design, emitted by infrequent operational activities, or unplanned equipment leaks. A periodic leak detection and repair program (LDAR) is in place to detect and manage these emissions. • onshore processing of gas at VI Hub facility. The GHG Protocol defines indirect GHG emissions as emissions that are a consequence of the activity but occur at sources owned or controlled by another entity. Scope 2 emissions for a facility represent the 'indirect' emissions that are released outside the facility boundary to produce the electricity that is imported into the facility and used. The VI Hub facilities in both Commonwealth and State waters generate their own power, heating and cooling requirements (captured in direct emissions) therefore there are no Scope 2 emissions associated with this activity. Scope 3 emissions are broader indirect emissions other than scope 2 emissions that occur outside a facility boundary as a result of the activities. Scope 3 emission sources associated with the VI Hub include: • Upstream: the operation of contracted support vessels (for example supply, campaign and IMMR vessels), helicopters (business travel), • Downstream: transport and distribution (via tankers and carriers from VI),processing of Santos products and end-user consumption of the condensate and gas. Environmental impacts associated with atmospheric emissions other than GHGs are assessed in Section 6.4 Notes: *Leakages of synthetic substances resulting in GHG emissions e.g., SF6 has been accounted in fugitive emissions.* *The emissions boundary is drawn based on the EP lifecycle, e.g., for Halyard-2, it is expected that production from this well will occur; however, decommissioning will not occur within this timeframe and therefore is excluded.* While GHG emissions from VI Hub Commonwealth Operations products are directly proportional to the production volumes, the production volumes vary annually and are dependent on shutdown and maintenance activities as well as gradual reservoir decline. There is no increase to the annual operational emissions of the VI Hub Operations as a result of operating the Halyard-2 well, which will replace the Halyard-1 well (this will be disconnected and shut-in before operation of Halyard-2 commences).
Extent	Direct and indirect GHG emissions will be generated at the VI Hub Commonwealth operations and at the VI State operations (including the processing plant). Indirect GHG emissions will also be generated outside the area authorised under this EP (as described above).
Duration	Generation of direct and indirect GHG emissions will occur during the operational life of the field.

6.3.2 Nature and Scale of Environmental Impacts

6.3.2.1 Greenhouse gas emission estimates

To quantify potential GHG emissions, the metric CO_2-e is used to standardise the different GHG emissions, as in, CO_2, CH_4, N_2O, based on their global warming potential, by converting amounts of GHG emitted to the equivalent amount of CO_2 with the same global warming potential.

The calculation methodology models GHG emissions based on activity input data and industry standard data. The methods used in this modelling align with the relevant Australian and international legislation, regulations, standards and guidelines, being:

- National Greenhouse and Energy Reporting (NGER) (Measurement) Determination 2008
- International Organisation for Standardisation (ISO) 14064 Greenhouse gases – Part 1: Specification with guidance at the organisation level for quantification and reporting of greenhouse gas emissions and removals
- ISO 14040: 2006 Environmental management – Life Cycle Assessment – Principles and Framework.

Under the NGER regime, emissions are described as either Scope 1, 2 or 3, which relate to where the emissions occur (Clean Energy Regulator (CER), 2024) as described in Section 6.3.1.

6.3.2.2 Direct - scope 1 emissions

6.3.2.2.1 GHG emissions from VI Hub Commonwealth Operations

During the operations phase authorised under this EP, Santos controls the following activities that result in Scope 1 (direct) emissions:

- extraction of well fluids and gasses from the reservoir using multiple subsea wells
- transport of the well fluids and gasses from the wells via subsea flowlines and John Brookes WHP to Varanus Island.

6.3.2.2.2 GHG emissions from VI Hub Operations

While the emissions associated with the operation of the VI Hub, located in State waters, are outside the operations authorised under this EP, they are controlled by Santos and have been included as Scope 1 (direct) emissions in Table 6-6.

The VI Hub processes natural gas and condensate from several fields. The condensate is loaded ‘free on-board’ to the customer owned tanker at the VI load out terminal for international markets, and processed natural gas is transmitted via the Dampier to Bunbury Gas Pipeline (DBGP) to domestic customers.

6.3.2.3 Indirect - scope 2 emissions

The VI Hub generates its own power, heating and cooling requirements (captured in direct emissions) therefore there are no Scope 2 emissions associated with the activity.

6.3.2.4 Indirect - scope 3 emissions

Australian and International carbon accounting rules mean each country and each emitter is responsible for reporting their own Scope 1 and Scope 2 emissions. The NGER Act does not require reporting of indirect (scope 3) emissions.

Notwithstanding this, in order to support Santos' evaluation of potential risks and impacts of the activity, an estimate of the indirect (scope 3) emissions is provided in Table 6-6. It is worth noting that these are forecast emissions, and as our understanding of our upstream and downstream Scope 3 emissions matures these values may change.

6.3.2.5 Total emissions summary-all scopes

A GHG emissions forecast has been prepared by Santos to determine the GHG emissions for VI Hub Operations. The forecast identifies that relevant GHG emission scope for each activity.

Table 6-6 summarises the GHG emissions calculated for VI Hub Operations, regardless of jurisdiction boundaries for the remaining period of the Environment Plan; 2024-2027.

Table 6-6: Forecast of greenhouse gas emissions (Scope 1 and Scope 3) for Varanus Island Hub Operations

Scope	Activity/Source	CO_2-e (tonnes)			
		2024	2025	2026	2027
1 (Direct emissions)	**Offshore**				
	Cold venting	9,421	9,421	9,421	9,421
	Fugitive emissions	1,000	1,000	1,000	1,000
	Fuel gas	887	887	887	887
	Subtotal	11,308	11,308	11,308	11,308
	Total Scope 1 (ex onshore)	**0.0452 Mt CO2e**			
	Onshore				
	Flaring and venting incl. reservoir CO_2	144,282	143,418	142,228	116,254
	Fugitive emissions	8,292	8,269	8,269	8,269
	Fuel use (power generation – fuel gas)	18,950	18,896	18,896	18,896
	Fuel use (compression – fuel gas)	75,558	84,098	83,531	67,286
	Fuel use (VICP – fuel gas)	39,857	59,786	79,497	79,497
	Fuel use (all others)	1,226	1,366	1,510	1,654
	Subtotal	288,165	315,833	333,931	291,856
	Total Scope 1 (onshore)	**1.230 Mt CO2e**			
	Total Scope 1 (2024 to 2027)	**1.275 Mt CO2e**			
3 (Indirect emissions)	Vessels	625	625	625	625
	Helicopters and flights	1,569	1,569	1,569	1,569
	Road transport	3,838	3,838	3,838	3,838
	Purchased goods	-	-	-	-
	Product use (gas)	3,818,580	3,976,717	3,921,273	2,645,791
	Product use (condensate)	266,878	343,707	316,348	179,386
	Subtotal (ex condensate)	3,820,774	3,978,911	3,923,467	2,647,985
Total emissions	Total Scope 1 & 3 ex. Product (2024-2027)	**1.275Mt CO2e**			
	Total Scope 1 & 3 in. Product (2024-2027)	**16.768 Mt CO2e**			

Note: GHG emissions associated with product use assumes 100% combustion. Losses of natural gas post sales gate in the form of methane emissions has the potential to increase GHG emissions; sales gate for condensate is "free-on-board" to customer tankers at VI Hub Load Out Terminal, and sales gate for natural gas is the onshore connection to the DBNGP.

6.3.2.6 Analysis of VI Hub operations GHG contributions

In the context of evaluating potential impacts and risks that may be associated with GHG emissions, Santos has considered these emissions in the context of broader climate change scenarios. Santos' portfolio has been tested to assess resilience through the energy transition, under both current policy settings and in accelerated transition scenarios, being:

- IEA 2023 World Energy Outlook Stated Policies Scenario (IEA STEPS) (IEA, 2023)

- IEA 2023 Net Zero by 2050 Scenario (IEA NZE) (IEA, 2023)
- S&P Global Commodity Insights (previously IHS Markit) Accelerated Carbon Capture and Storage Scenario (S&P ACCS) (S&P Global, 2023).

Scenarios do not represent forecasts or likely outcomes, but rather a range of potential future outcomes based on sets of assumptions around changes in global behaviour, including energy supply and demand.

Santos notes that both the IEA and S&P Global acknowledge that their scenarios represent potential pathways, not definitive pathways, and based on assumed changes in consumer behaviour and global energy demand – to limiting global temperature increase to 1.5 degrees Celsius, and that globally the world is not currently tracking to these pathways. Santos therefore also references a broader range of scenarios as published by the Intergovernmental Panel on Climate Change (IPCC) which are aligned with a global temperature increase of less than 1.5 degrees Celsius with low or no overshoot. Additionally, Santos has analysed the above three agency median outlooks for gas demand that fall within the range of the almost 100 IPCC AR-6 1.5 degrees Celsius scenarios (IPCC, 2022) in both the global and Asia-Pacific context.

6.3.2.7 The role of natural gas in energy transition

Natural gas plays a critical role in meeting ever growing global energy demand as a versatile and abundant energy source. The world needs gas for electricity generation, manufacturing, agriculture, and many other everyday products. Importantly, gas has many more uses than simply generating electricity. This includes heating and feedstock for making things like fertilisers, pharmaceuticals, polymers and chemicals, steel, bricks and cement (IEA, 2019). Energy transition is expected to vary in different countries given the different starting points, the development requirements as well as resources and capability.

Gas plays a critical role in the transition to a lower carbon future, able to flexibly fill market supply gaps as alternative energy sources emerge. As the world looks to decarbonise and builds additional renewable energy sources, natural gas power plants will play a critical role in responding to fluctuations in supply, by providing on-demand supplementary power generation (IEA, 2019). In countries such as Australia where decentralised power generation such as rooftop solar is increasingly dominating renewable supply, the ability to quickly stabilise the electricity grid in times of unusual demand or supply will be critical over the coming decades.

Under a range of different potential future scenarios where global temperature increase is limited to 1.5 degrees Celsius, natural gas remains an integral part of the energy mix out to 2050. The International Energy Agency's (IEA) Net Zero by 2050 scenario assumes world demand of about 32,000 petajoules of gas per year in 2050, of which almost 60 per cent would be served with abated gas through carbon capture and storage (IEA, 2023). An analysis of 97 IPCC scenarios which limit global temperature increase to 1.5 degrees with low or no overshoot indicates ongoing demand for gas to 2050, particularly in the APAC region where median gas demand in 2050 is comparable with demand in 2020. (IEA, 2023)

These almost 100 scenarios, all aligned to the temperature goals of the Paris Agreement, show a range of gas demand profiles, however all include a continued role for gas in global energy generation out to 2050.

With respect to gas demand for the Asia-Pacific region per Figure 6-2, the median of the IPCC scenarios shows gas demand increasing between 2022 and 2030. From 2030 to 2050 there is a subsequent slight decline in gas demand, however 2050 demand remains at 28EJ, only approximately 9% decline from 2020 demand.

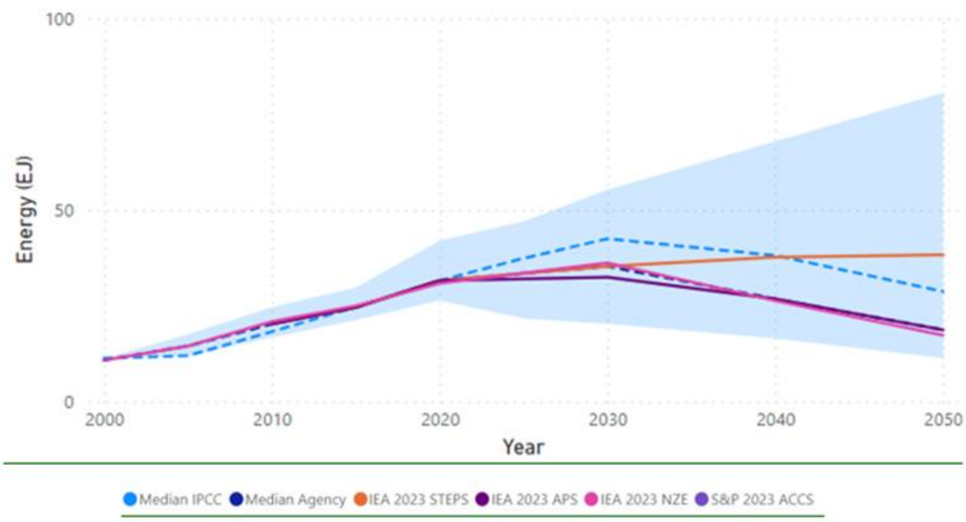

Figure 6-2: Asia-Pacific Gas Demand 2020-2050 for 1.5-degree aligned scenarios

The gas from VI Hub is sold exclusively into the Australian domestic market. As outlined in the Australian Government's Future Gas Strategy, natural gas is integral to the Australian economy and Australian industry requires a reliable and affordable supply of gas. Without continued investment in our gas sector and development of supply sources, Australia faces the risk of supply gaps emerging by 2030 on the west coast.

One of the six actions in the Future Gas Strategy is to prevent gas shortfalls, as a reliable supply of gas is essential for energy production and industrial and residential use; forecast shortfalls may put upwards pressure on prices. The recent Parliamentary enquiry into the WA Domestic Gas Policy also emphasised the need for substantial new sources of gas to meet domestic demand. These findings underscore the importance of continuing to develop and invest in domestic gas supply sources and maintain existing production levels.

6.3.2.7.1 Global Carbon Budget

The United Nations Intergovernmental Panel on Climate Change in its Sixth Assessment Report forecast the remaining net carbon budgets (from 1 January 2020) for a 50% likelihood to limit global warming to a specified range of temperature increase based on pre-industrialised levels (i.e. since 1850-1900) (IPCC, 2021). See Section 6.3.3.1 for a description of the international framework for management of greenhouse gas emissions.

Global Surface Temperature Change	Estimated carbon budgets (50th percentile) $MtCO_2$
1.5°C	500,000
2.0˚C	1,350,000

6.3.2.7.2 Australian Carbon Budget

The Commonwealth Government has modelled a range of annual carbon reduction scenarios for Australia. The scenario modelled that Santos considers to be most relevant to this assessment is the 'with additional measures' scenario, which includes policies and measures in place at the time of publication. The 'with additional measures' scenario includes the 82% renewable energy target in Australia's electricity grid by 2030 and the emissions reduction from the Safeguard Mechanism reforms (DCCEEW, 2023b). This scenario is aligned with Australia's 2050 net zero target which is aligned with Australia's Paris Agreement commitments and a temperature increase of 1.5˚C – 2˚C (DCCEEW, 2023b) – see Section 6.3.3.2 for a description of Australia's greenhouse gas emissions management framework.

The 'with additional measures' scenario can be used to develop an Australian carbon budget by taking the emissions budget trajectory from 2020 to 2030 (the extent of the budget trajectory forecast), assuming a linear decline in emissions to net zero emissions between 2030 to 2050, and net zero emissions beyond 2050. This creates a net carbon budget of 7966 Mt CO_2-e. The net carbon budget comprises gross economy wide emissions (additions) less total carbon sequestration volumes (subtractions).

Table 6-7 presents the GHG emissions contributions from VI Hub Operations (Commonwealth and State) in the context of the Australian and global carbon budgets.

Table 6-7: Varanus Island Hub Operations contributions to climate change impacts from an international and domestic context

	Emissions over life of EP ($MtCO_2e$) (2024-2027)	Global Carbon Budget		Australian Carbon Budget (Domestic)[1]
		1.5 °C[1]	2.0 °C[1]	
Carbon budget remaining (Mt)	NA	500,000	1,350,000	7,966
VI Hub Operations Emissions % Contribution				
Scope 1 ex onshore	0.0452	0.000009%	0.000003%	0.000568%
Scope 1 total	1.275	0.000255%	0.000094%	0.016006%
Scope 3 ex condensate [2]	14.371	0.002874%	0.001065%	0.18404%
Scope 3 total	15.493	0.003099%	0.001148%	NA [3]
Total scope 1 & 3	**16.768**	**0.003354%**	**0.001242%**	**0.210495%**

[1] Budget to 2050

[2] Scope 3 sources within Australia. Condensate is exported.

[3] This is not applicable as it includes emissions outside of Australia

It is noted that while Table 6-7 summarises Varanus Island's percentage contribution to the Australian and global carbon budgets over the life of the EP (2024-2027), Varanus Island Hub production is forecast to continue until 2043 when John Brookes reaches EOFL. Over the remaining life of the VI Hub (2024-2043), the upper range of forecast total emissions are:

- 50.97 MtCO_2e including condensate emissions outside of Australia. This represents 0.010% of the 1.5 °C and 0.004% of the 2.0 °C global carbon budget.
- 47.39 MtCO_2e excluding condensate emissions outside of Australia. This represents 0.595% of the remaining Australian carbon budget.

6.3.2.8 Risks of climate change to the Environment

This section provides a discussion of a wide range of predicted effects on global and the Australian environment from human-induced climate change. Most marine and terrestrial systems are susceptible to impacts from climate change; however, the predicted impact is highly variable, both between ecosystems and within individual ecosystems. This impact assessment considers the potential impacts of climate change on sensitive receptors, including matters of national environmental significance within Australian jurisdictions.

Physical impacts of climate change on environmental receptors are the result of global GHG emissions from a multitude of sources (minus the GHG sinks) that have accumulated in the atmosphere. As such, the physical effects of climate change on environmental receptors cannot be attributed to emissions from any one particular source.

Although the impacts on the climate cannot be attributed to one specific sector or activity, each contribution of GHGs may be considered as relative. In the context of evaluating potential impacts and risks that may be associated with GHG emissions from all sources globally, including from this Activity, Santos has considered broader climate change issues. This section outlines the potential environmental impacts that could occur due to global climate change. Santos recognises the scientific consensus on climate change assessed by the IPCC.

The IPCC is the United Nations body for assessing the science related to climate change and finalised the Sixth Assessment Report (AR6) in 2023. This consists of three Working Group contributions and a Synthesis Report. A summary of outcomes of the working group's contributions comprises a range of matters, which amongst others include:

- The AR6 Working Group I (AR6-WG1) report stated that it is unequivocal that there is human-induced warming. It also stated that increased atmospheric carbon dioxide (CO_2) levels, generated by human activity, are the largest driver of warming over the longer term, and that there are a range of factors, including emissions of methane, which increase warming in the short-term.
- The AR6-Working Group II report stated that human-induced climate change, including more frequent and intense extreme events, has caused widespread adverse impacts and related losses and damages to nature and people, beyond natural climate variability. It stated that global warming, reaching 1.5°C in the near-term, would cause unavoidable increases in multiple climate hazards and present multiple risks to ecosystems and humans. The report noted that societal choices and actions implemented in the next decade will determine the extent to which medium- and long-term pathways will deliver climate resilient development.
- The AR6 Working Group III (AR6-WG3) report provided an updated global assessment of climate change mitigation progress and pledges and examined the sources of global emissions. It explained developments in emissions reduction and mitigation efforts and assessed the impact of national climate pledges in relation to long-term emissions goals. More than 2000 quantitative emissions pathways were submitted to the IPCC, of which 1202 scenarios included sufficient information for assessing the associated warming. The report found that there are many pathways in the literature that likely limit global warming to 2°C with no overshoot, or to 1.5°C with limited overshoot. These variations occur because, while climate science is able to calculate a 'carbon budget' of net emissions before any particular temperature outcome is reached, the allocation of this budget between different human activities requires additional judgements about for example technology, economics, consumer preferences and policy choices.

The State of the Climate 2024 (Commonwealth of Australia, 2024) states that Australia is projected to experience the following in the coming decades:

- continued warming, with more extremely hot days and fewer extremely cool days.
- a further decrease in cool season rainfall across many regions of the south and east.
- continued drying in the south-west of Western Australia, especially during winter and spring.
- likely increases in the average duration of drought and aridity in regions within the south and east.
- a longer fire season for the south and east, and an increase in the number of dangerous fire weather days

- more intense short-duration heavy rainfall events, even in regions where the average rainfall decreases or stays the same.
- fewer tropical cyclones, but a greater proportion projected to be of high intensity, with ongoing large variations from year to year. The intensity of rainfall associated with tropical cyclones is also expected to increase and, combined with higher sea levels, is likely to amplify the impacts from those tropical cyclones that do occur.
- fewer east coast lows on average, particularly during the cooler months of the year
- ongoing sea level rise through this century and beyond, at a rate that varies by region. Recent research on potential ice loss from the Antarctic ice sheet suggests that a scenario of larger and more rapid sea level rise can't be ruled out.
- more frequent extreme sea levels linked to coastal inundation and coastal erosion. For most of the Australian coast, extreme sea levels that had a probability of occurring once in a hundred years are projected to become an annual event by the end of this century with lower emissions, and by the mid-21st century for higher emissions.
- continued warming and acidification of surrounding oceans with consequent impacts on biodiversity and ecosystems.
- increased and longer-lasting marine heatwaves, which will further stress marine environments, such as kelp forests, and increase the likelihood of more frequent and severe bleaching events in coral reefs around Australia, including the Great Barrier Reef and Ningaloo Reef.
- an increase in the risk of natural disasters from extreme weather, including 'compound extremes', where multiple extreme events occur together or in sequence, thus compounding their impacts.

The report also provides the following updated projections of Australia's average temperature over the next two decades:

- the average temperature of each future year is now expected to be warmer than any year prior to the commencement of human-caused climate change.
- ongoing climate variability means each year will not necessarily be hotter than the last, but the underlying probabilities are changing. This leads to less chance of cool years and a greater chance of repeatedly breaking Australia's record annual average temperature (e.g. record set in 2005 was subsequently broken in 2013 and then again in 2019).
- while the previous decade was warmer than any other decade in the 20th century, it is likely to be the coolest decade for the 21st century.
- the average temperature of the next 20 years is virtually certain to be warmer than the average of the past 20 years
- the amount of climate change expected in the next decade is similar under all plausible global emissions scenarios. However, by the mid-21st century, higher ongoing emissions of greenhouse gases will lead to greater warming and associated impacts, while lower emissions will lead to less warming and fewer impacts
- warming is generally expected to be greater in the interior of Australia than near the coast.

Ecosystems are particularly susceptible to adverse effects of climate change. The 'loss of climatic habitat caused by anthropogenic emissions of greenhouse gases' has been listed as a key threatening process under the EPBC Act (DCCEEW, 2021), consisting of reductions in the bioclimatic range within which a given species or ecological community exists due to emissions induced by human activities of greenhouse gases (DCCEEW, 2021). The process is considered to have a continental distribution, including both terrestrial and marine areas. Ecosystems in which the process occurs include: alpine habitats, coral reefs, wetlands and coastal ecosystems, polar communities, tropical forests, temperate forests, and arid and semi-arid environments (DCCEEW, 2021).

Redistribution and reorganisation of natural systems, driven by climate change, is a major threat to biodiversity (Chapman et al., 2020). A report by Australia's Biodiversity and Climate Change Advisory Group summarises the potential impacts of climate change to marine and terrestrial species, habitats and ecosystems across Australia (Steffen et al., 2009), this is summarised in Table 6.8.

Extensive modelling and monitoring studies over the last 20 years provide considerable evidence that global climate change is already affecting and will continue to affect species (Hoegh-Guldberg et al., 2018). However, these impacts are likely to be highly species-dependant and spatially variable. Climate change may not only change species distribution patterns but also life-history traits, such as migration patterns, reproductive seasonality and sex ratios.

Increases in fire regimes will impact Australian ecosystems, altering composition structure, habitat heterogeneity and ecosystem processes. Changes in climate variability and averages could also be important drivers of altered species interactions, both native and invasive species (Dunlop et al., 2012). Climate change could result in significant ecosystem shifts, as well as alterations to species ranges and abundances within those ecosystems (Hoegh-Guldberg et al., 2018). Some of the predicted potential taxa level effects (potential vulnerabilities) are presented in Table 6.9.

Climate variability and change has been identified as a threat to some EPBC Act protected species in relevant conservation management plans and recovery plans, including marine turtles mammals, sharks and seabirds and migratory shorebirds as per Table 3-7.

The North-west Marine Parks Network Management Plan 2018 (DNP, 2018) identifies climate change as a pressure that may impact marine park values. The management plan states that “the impacts of climate change on the marine environment are complex and may include changes in sea temperature, sea level, ocean acidification, sea currents, increased storm frequency and intensity, species range extensions or local extinctions, all of which have the potential to impact on marine park values” (DNP, 2018).

Within the Marine Bioregional Plan for the North-West Marine Region (NWMR) (DSEWPaC, 2012a), pressures related to climate change are assessed as ‘of potential concern’ for species of marine turtle, inshore dolphins, sawfish, sea snakes, whale shark, dugong, and seabird and shorebird, as well as the KEFs and shipwrecks known to occur in the NWMR.

Changes to climate can also result in impact to social receptors that have values which include the ecological receptors described above, including KEFs and Australian Marine Parks (AMPs). Climate change may also impact on the functions, interests or activities of other users which rely on these ecological values, including commercial and recreational fisheries and tourism. A temperature change of between 0.9 oC to 2.0 oC is forecast to reduce fisheries yield as the maximum catch potential around Australia by between 3% and 10% (IPCC 2023).

Impacts to cultural heritage sites and places of spiritual importance in coastal locations may also be experienced due to rising sea levels. Sea levels have been estimated to have risen on average by 1.2 mm per year between 1920 and 2000 due to climate change (Church et al. 2006). Research suggests that by 2100, sea levels potentially may have risen a further 18 to 59 cm in response thermal expansion and melting of icesheets (Solomon et al. 2007).

Table 6.8: Effects of GHG emissions and resulting climate change on key Australian ecosystems

Key Component of Environmental Change	Effects
Coral Reefs	
CO_2 increases leading to increased ocean acidity	Reduction in ability of calcifying organisms, such as corals, to build and maintain skeletons.
Sea-surface temperature increases, leading to coral bleaching	If the frequency of bleaching events exceeds the recovery time, reefs will be maintained in an early successional state or be replaced by communities dominated by macroalgae. Warming will increase the susceptibility of corals to diseases. Potential for new reefs to develop at higher latitudes where suitable substrates are available and until light becomes limiting; potential decrease in beta diversity of coral communities as tropical-adapted taxa expand their range to the south, amplified by differential survival of different taxa.
Increases in cyclone and storm surge	Increased physical damage to reef structure and inability to return to restoration state because of the increased incidence.
Oceanic Systems (including planktonic systems, fisheries, sea mounts and offshore islands)	
Ocean warming	Many marine organisms are highly sensitive to small changes in average temperature (1 to 2 °C), leading to effects on growth rates, survival, dispersal, reproduction and susceptibility to disease. Increasing temperatures reduce larval development time, potentially reducing dispersal distances; warm-water assemblages may replace cool-water communities.
Changed circulation patterns, including increase in temperature stratification and decrease in mixing depth, and strengthening of East Australian Current	Distribution and productivity of marine ecosystems is heavily influenced by the timing and location of ocean currents; currents transfer the reproductive phase of many organisms, thereby playing an important role in dispersal and maintenance of populations. Climate change may suppress upwelling in some areas and increase it in others, leading to shifts in location and extent of productivity zones.

Key Component of Environmental Change	Effects
Changes in ocean chemistry	Increasing CO_2 in the atmosphere is leading to increased ocean acidity and a parallel decrease in the availability of carbonate ions, which are the building blocks of calcium carbonate skeletons (such as those of many planktonic species and corals). Increased dissolved CO_2 may increase productivity.
Estuaries and Coastal Fringe (including benthic, mangrove, saltmarsh, rocky shore, and seagrass communities)	
Sea level rise	Landward movement of some species (particularly mangroves) as inundation provides suitable habitat; changes to upstream freshwater habitats will have flow-on effects to species such as wetland birds.
Increase in water temperature	Effects on phytoplankton production will affect secondary production in benthic communities.
Savannas and Grasslands	
Elevated CO_2	Shifts in competitive relationships between woody and grass species due to differential responses.
Increased rainfall in north and northwest regions	Increased plant growth will lead to higher fuel loads, in turn leading to fires that are more intense and more frequent, occur over large areas, and occur later in the dry season. Change to ecotonal boundaries between savanna woodlands, grasslands and monsoonal rainforest patches. Changes in rainfall seasonality are likely to be more important that changes in amount.
Tropical Rainforests	
Warming and changes in rainfall patterns	Increased probability of fires penetrating rainforest vegetation, resulting in shift from fire-sensitive vegetation to communities dominated by fire-tolerant species. Cool-adapted species forced to higher elevations, altering competitive interactions.
Change in length of dry season	Altered patterns of flowering, fruiting and leaf flush will affect resources for animals.
Increased intensity of storms or tropical cyclones	Increased physical disturbance to forests, which alters gap dynamics and succession rates; shallow-rooted tall rainforest trees are particularly susceptible to uprooting, breakage and defoliation.
Rising atmospheric CO_2	Differential response of different growth forms to enhanced CO_2 may alter structure of vegetation.
Temperate Forests	
Potential increases in frequency and intensity of fires	Changes in structure and species composition of communities with obligate seeders may be disadvantaged compared with vegetative resprouters.
Warming and changes in rainfall patterns	Potential increases in productivity in areas where rainfall is not limiting; reduced forest cover associated with soil drying projected for some Australian forests.
Rising atmospheric CO_2	Overall increase in productivity and vegetation thickening.
Inland Waterways and Wetlands	
Reductions in precipitation increased frequency and intensity of drought	Reduced river flows and changes in seasonality of flows; reduction of the area available for waterbird breeding. More intense rainfall events will increase flooding, affecting movements of nutrients, pollutants and sediments, riparian vegetation, and erosion. -Groundwater dependent ecosystems may be negatively affected.
Changes in water quality, including changes in nutrient flows, sediment, oxygen and CO_2 concentration	May affect eutrophication levels, incidence of blue-green algal outbreaks; loss of cool-adapted species and increase in populations of warm-adapted species.
Sea level rise	Saltwater intrusion into low-lying floodplains, freshwater swamps and groundwater; replacement of existing riparian vegetation by mangroves.
Warming of water column; increase in depth of seasonal thermoclines in still water	Changes in abundance of temperature-sensitive species, such as algae and zooplankton; reduction in depth of lowest oxygenated zones in some instances.
Arid and Semi-arid Regions	
Increasing CO_2 coupled with drying in some regions	Interaction between CO_2 and water supply critical, as 90% of the variance in primary production can be accounted for by annual precipitation.

Key Component of Environmental Change	Effects
Shifts in seasonality or intensity of rainfall events	Any enhanced run-off redistribution will intensify vegetation patterning and erosion cell mosaic structure in degraded areas. Changes in rainfall variability and amount will also affect fire frequency. Dryland salinity could be affected by changes in the timing and intensity of rainfall.
Warming and drying, leading to increased frequency and intensity of fires	Reduction in patches of fire-sensitive mulga in spinifex grasslands potentially leading to landscape-wide dominance of spinifex.
Alpine Areas	
Reduction in snow cover depth and duration	Potential loss of species dependent on adequate snow cover for hibernation and protection from predators; increased establishment of plant species at higher elevations as snowpack is reduced.

Source: Adapted from Steffen et al. (2009).

Table 6.9 Potential effects of climate change on future vulnerability and adaptation of particular taxa

Taxa	Potential Vulnerability
Mammals	Narrow-ranged endemics susceptible to rapid climate change in situ; changes in competition between grazing macropods in tropical savannas mediated by changes in fire regimes and water availability; herbivores affected by decreasing nutritional quality of foliage as a result of CO_2 fertilisation
Birds	Changes in phenology of migration and egg-laying; increased competition of resident species with migratory species due to migratory birds staying longer at breeding grounds; breeding of waterbirds susceptible to reduction in freshwater flows into wetlands; top predators vulnerable to changes in food supply as a result of increased sea temperatures; rising sea levels affecting birds that nest on sandy and muddy shores, saltmarshes, intertidal zones, coastal wetlands and low-lying islands; saltwater intrusion into freshwater wetlands affecting breeding habitat.
Reptiles	Warming temperatures may alter sex ratios of species with environmental sex determination (e.g., turtles and crocodiles); some species may modify their use of microhabitats to cope with warming in situ.
Amphibians	Frogs may be the most at-risk terrestrial taxa; amphibians may experience altered interactions between pathogens, predators and fires.
Fish	Freshwater species vulnerable to reduction in water flows and water quality; limited capacity for freshwater species to migrate to new waterways; all species susceptible to -flow on effects of warming on the phytoplankton base of food webs.
Invertebrates	Expected to be more responsive relative to vertebrates due to short generation times, high reproduction rates and sensitivity to climatic variables.
Plants	Climate change may impact various functional dynamics of plants due to changes in fires, plant phenology and insect life cycles and specific environmental characteristics; longer lived plants may be more vulnerable if climate change “moves” suitable establishment sites for seedlings beyond their dispersal distances; narrow-ranged endemic plants requiring specific conditions will have limited capacity to disperse to sites with similar conditions.

6.3.2.9 Indirect consequences

EPBC Act Significant Impact Guidelines (Policy Statement 1.1) and Section 527E of the EPBC Act requires the consideration of indirect consequences. For VI Hub Operations, indirect consequences from GHG emissions include the following:

- GHG emissions generated at the onshore Varanus Island processing facility. These GHG emissions are managed by:
    - VI Hub Operations EP (State Waters) (Santos document number EA-60-RI-00186), which includes controls and monitoring commitments to manage and reduce GHG emissions associated with the facility).
    - Establishment of an emissions baseline for VI Hub Operations (one baseline that includes both Commonwealth waters and State waters operations), as required by the National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015 (Cth) (the Safeguard Mechanism) made under the NGERS Act and administered by the Clean Energy Regulator (detailed above).

- Emissions reporting under the NGER Scheme, described above.

- Indirect GHG emissions associated with contracted helicopter and vessel transport from VI facility to VI Hub Commonwealth facilities.
- Indirect GHG emissions associated with the transportation, distribution, processing and use of the product:
  - Gas product from the VI processing facility (including gas from VI Hub facilities in Commonwealth waters) is sold and consumed on the domestic market in Western Australia. As such, indirect emissions associated with VI Hub Operations in Commonwealth waters are effectively managed under existing Australian legislation, regulatory frameworks and reporting requirements, including the Safeguard Mechanism and NGERS scheme.
  - All condensate product produced by the VI processing facility are sold 'free on board' to customers and loaded onto their tankers for export to international markets (Asia).
  - GHG emissions arising from third-party consumption of condensate from the VI Hub Operations are managed through the international framework established by the Paris Agreement, and in turn the national emissions policies and targets set by nations that are signatories to the Paris Agreement.
  - Santos undertakes to only sell products to customers from countries that have a Net Zero commitment or are signatories to the Paris Agreement.

Given the existing management measures, controls and monitoring in place, indirect consequences from GHG emissions associated with the onshore processing, domestic transport and consumption of products associated with VI Hub Operations will not result in any significant impacts. Any impacts are expected to be negligible.

6.3.3 Climate change management frameworks

6.3.3.1 Paris Agreement

The United Nations Framework Convention on Climate Change came into force in 1994 and has been ratified by 197 countries. The convention established a goal of preventing dangerous anthropogenic interference with the climate system. Subordinate treaties and agreements have been ratified by parties to the convention, including the Paris Agreement, which was agreed under the convention at the 21st Conference of the Parties in 2015 and has been endorsed by 197 countries.

One of the principal aims of the agreement is to hold the increase in global average temperature to below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre industrial levels. Australia is a signatory to the agreement; and to assist meeting the aims of the agreement, the Australian Government has set a target of reducing emissions to 43% below 2005 levels by 2030 and net zero emissions by 2050. This emissions reduction targets are enacted in the Climate Change Act 2022 (Cth).

GHG emissions arising from third party consumption of VI Hub condensate are managed and mitigated through relevant domestic and international emissions control frameworks. In that regard, target markets for VI Hub condensate are in countries that have ratified the Paris Agreement. As such, they have agreed to several global targets, including to keeping "global average temperature to well below 2 °C above pre-industrial levels" and to set national targets relating to their own emissions.

The countries to which VI Hub Operations Commonwealth waters condensate will be exported are expected to manage their associated GHG emissions from processing, refining and use of the condensate, within the context of their own NDCs and associated emissions reduction policies and regulation, as parties to the Paris Agreement.

As a signatory to the Paris Agreement, Australia has a legislative framework and commitments in place. The processing of the condensate and gas at the VI facility, as well as the use of the gas product in Western Australia is managed under Australian frameworks and GHG regulation.

6.3.3.2 Australia's Legislative Frameworks Reporting and Regulating GHG

6.3.3.2.1 National Greenhouse and Energy Reporting Scheme

The National Greenhouse and Energy Reporting (NGER) Scheme is a single national framework for reporting company information about greenhouse gas emissions; energy production; and energy consumption.

Key NGER Scheme legislation includes the National Greenhouse and Energy Reporting Act 2007 (NGER Act); the National Greenhouse and Energy Reporting Regulations 2008; and the National Greenhouse and Energy Reporting (Measurement) Determination 2008 (the Measurement Determination).

The NGER Act provides a single, national framework for the reporting and distribution of information related to GHG emissions, energy production, and energy consumption to:

- inform government policy
- inform the Australian public
- help meet Australia's international reporting obligations
- assist Commonwealth, state and territory government programs and activities
- avoid duplication of similar reporting requirements in the states and territories.

The reporting of GHG emissions under the NGER Act applies to reporting of all Scope 1 and Scope 2 GHG emissions. Scope 1 emissions are only relevant to the VI Hub Operations in Commonwealth waters.

6.3.3.2.2 Safeguard Mechanism

One of the key statutory instruments for regulating Australia's emissions in line with Australia's Nationally Determined Contributions (NDCs) under the Paris Agreement, is the National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015 (Cth) (the Safeguard Mechanism) made under the NGERS Act and administered by the Clean Energy Regulator. The Safeguard Mechanism was developed to ensure that industrial facilities that emit more than 100,000 tCO2-e per annum keep their net emissions below an emissions limit (a baseline). Gradually reducing Safeguard Mechanism baselines ensure covered industrial facilities reach net zero emissions by 2050 at a rate of approximately 4.9% per year until 2030. The emissions reductions established under the SGM reform (Safeguard Mechanism [Crediting] Amendment Act 2023 [Cth]) are designed to deliver emissions reductions consistent with Australia's Nationally Determined Contribution (NDC) under the Paris Agreement (DCCEEW, 2023).

VI Hub Operations emissions are regulated under the Safeguard Mechanism. Under this policy, annual emissions are reported under the NGER Scheme and compared against the VI Hub baseline, and Santos is required to generate or procure and surrender carbon credits (either Australian Carbon Credit Units or Safeguard Mechanism Credits) for any emissions above the baseline for the compliance period, to ensure that net emissions for the facility remain under the prescribed baseline.

Key elements of the mechanism include:

- safeguard facilities must meet the reporting and record-keeping requirements of the NGER Act, including the Clean Energy Regulator's requirements for audits prior to baseline setting or to check compliance management
- if a safeguard facility is likely to exceed its baseline, the responsible emitter must act, including by purchasing and/or surrendering Australian carbon credit units, to offset excess emissions
- penalties for non-compliance.

6.3.3.3 Santos' Climate Strategy

Santos recognises the scientific consensus of climate change assessed by the Intergovernmental Panel on Climate Change and supports the objective of the Paris Agreement to limit global temperature rise to less than 2°C and pursue efforts to limit the temperature rise to 1.5°C. I

Santos has a clear strategy that is focused on backfilling and sustaining existing infrastructure, decarbonising operations and investing in the technologies needed to develop the low carbon fuels of the future.

In 2022, Santos released new 2030 emission reduction targets, in addition to its previously announced long-term target of achieving net-zero equity scope 1 and 2 emissions by 2040:

- Reduce equity share Scope 1 and 2 emissions by 30% by 2030 (from the Santos and Oil Search combined 2019–20 - financial year baseline of 5.9 MtCO2e, adjusted for inclusion of the Bayu-Undan and Darwin LNG assets for the full 2019-20 financial year at 68.4 per cent equity).
- Reduce equity share Scope 1 and 2 equity emissions intensity by 40% by 2030 (from Santos' 2019–20 equity scope 1 and 2 baseline of 55 kt CO2-e/mmboe, representing a reduction to 33 kt CO2-e/mmboe or lower).
- Reduce customers' emissions (Santos Scope 3) by at least 1.5 MtCO2e pa from the supply of low carbon fuels and carbon management services.

These targets were reaffirmed in the Sustainability and Climate Report 2023 (Santos, 2024).

In support of delivering on its Climate Strategy and Targets, Santos has established a Climate Transition Action Plan (CTAP). The CTAP focuses efforts in:

- Operational Efficiencies – broad range of initiatives that are designed to reduce the scope 1 and 2 emissions of our operations

- Carbon Capture and Storage – Existing technology that will reduce emissions and pave the way for new revenue streams from future low carbon fuels and carbon solutions
- Carbon Solutions – Opportunities to address emissions that cannot be avoided or reduced by Santos, our customers and third parties.
- Low carbon fuels hubs - Leverage decarbonisation hubs as a platform for low carbon fuels (will be demand led).
- Supply chain collaboration – Working with customers and suppliers t cultivate demand for low carbon fuels and carbon solutions.

6.3.3.3.1 Varanus Island Decarbonisation

- The Santos West Australian, Northern Australia and Timor Leste (WA, NA, TL) Decarbonisation Plan, includes the VI Hub. This plan recognises that direct (scope 1) emissions in Commonwealth waters account for less than 5% of direct (scope 1) emissions across the whole of the VI Hub. Upstream emissions sources are the John Brookes, Linda and Bravo platforms and their respective production pipelines.
- The onshore VI gas plant is the main source of emissions in the VI hub, accounting for amore than 95% of direct (scope 1) VI Hub emissions. There are six main categories of emission sources; compression, John Brooks inlet compression, acid gas venting, flaring, power generation and other (fugitives). The status of identified potential reduction opportunities are tracked and reported on regularly via Reliability, Integrity, Process and Process Safety updates.
- Given that more than 95% of direct (scope 1) emissions occur on the island, that is where emission reduction projects are focused as they will have the largest emission reduction outcome for the whole VI Hub and are more commercially feasible than offshore emission reduction opportunities when comparing the tonnes per annum reduction to total cost. The John Brookes WHP Gas Instrument System Modification project is one such project that was not completed on this basis. Through the projects proposed in the decarbonisation plan, emissions are forecast to reduce by approximately 47 $kTCO_2e$. The projects will reduce emissions as the hub enters late field life. Initiatives will occur over the life of the EP and include:
  - Reduce fuel gas consumption through compressor suspension
  - Reduced flaring through suspension of flares
  - Reduced inlet gas venting through suspension of platforms in state waters
  - Compression reduction following train three suspension
  - Power generation reduction through reduced loading.

The decarbonisation plan recognises that step changes are required to reach net zero, for example retrofitting of post combustion and acid gas capture and carbon capture and storage facilities, and that the purchase of carbon credits will be required to offset emissions above the facility baseline.

6.3.4 Environmental Performance Outcomes and Control Measures

As outlined above, the potential occurrence of climate change impacts depends on there being a net increase in global GHG emissions. Whether or not a net increase in cumulative emissions will occur is subject to multiple variables in Australia and globally, that are outside of Santos' control.. Santos has adopted environmental performance outcomes and control measures directed to minimising the GHG emissions from the Activity to as low as reasonably practical by using the best available, technically and economically feasible technology, processes and practiced that are applicable for the Activity. . A range of controls have been considered for both direct (Scope 1) and indirect (Scope 3) emissions as the operations at VI Hub continue.

In setting the environmental performance outcomes and control measures regarding GHG emissions, Santos has proper regard to the Australian government's policies and legislative/regulatory frameworks across the economy to implement Australia's nationally determined contribution under the Paris Agreement. The Paris Agreement which requires countries to manage and reduce their own emissions with the aim to limit the global temperature increase in this century to 2°C, while pursuing efforts to limit the increase even further to 1.5°C. Santos has developed its EPOs and control measures having regard to Australia's policies and legislative/regulatory frameworks to manage and reduce its emissions to meet its nationally determined contribution under the Paris Agreement.

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EPOs relating to this event include:

- Scope 1 GHG emissions managed in accordance with the Safeguard Mechanism benchmark baseline set by the Clean Energy Regulator, in support of meeting the Australian Government's Paris Agreement Nationally Determined Contribution (EPO-VI-CW-09).
- Actively support the global transition to a lower carbon future by implementing the Santos Climate Policy to support the objectives of the Paris Agreement (EPO-VI-CW-10).

The control measures for this event are shown in Table 6-10, and the environmental performance standards and measurement criteria for the EPOs are described in Table 8-2.

Table 6-10: Control Measure Evaluation for Greenhouse Gas Emissions

Control Measure Ref. No.	Control Measure	Environmental Benefit	Potential Cost/ Issues	Evaluation
Standard Controls				
VI-CW-CM-05	Facilities planned maintenance system (PMS).	Reduces emissions from the John Brookes WHP because the PMS ensures the reliability of gas turbines, reducing the requirement to run diesel powered generators. Also reduces the potential for fugitive emissions, as the asset integrity regime prevents unplanned releases of GHG emissions from equipment	Operational costs and labour access requirements of undertaking facility maintenance.	**Adopted** – Benefits of operating equipment within operational parameters will help control emissions created by equipment.
VI-CW-CM-06	Vessels comply with Marine Order 97 (Marine Pollution – Air Pollution).	Reduces emissions from vessels. Marine Order 97 is required under Australian regulations, implementation is standard practice for commercial vessels as applicable to vessel size, type and class.	Operational costs and labour or access requirements of undertaking vessels maintenance.	**Adopted** – Benefits of operating equipment within operational parameters will help control emissions created by equipment.
VI-CW-CM-08	National Greenhouse and Energy Reporting Scheme and National Pollutant Inventory (NPI) reporting – estimation of greenhouse gas, energy and criteria pollutants.	Control based on legislative requirements to provide the national reporting framework for the reporting and dissemination of information related to emissions, hazardous wastes, greenhouse gas emissions, greenhouse gas projects, energy consumption and energy production to meet the objectives and desired outcomes of the legislation(s) such as: the maintenance and improvement of air and water quality, minimisation of environmental impacts associated with hazardous wastes; an improvement in the sustainable use of resources; and act as the single framework to inform policy, meet reporting requirements, avoid duplication, and to	Minimal cost, standard practice. Santos already reports VI Hub Operations GHG emissions under the NGER scheme and NPI reporting.	**Adopted** – Control based on legislative requirements.

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Control Measure Ref. No.	Control Measure	Environmental Benefit	Potential Cost/ Issues	Evaluation
		ensure that facility net greenhouse gas emissions are managed within applicable baselines.		
VI-CW-CM-09	Comply with the requirements of the Safeguard Mechanism, including purchase and/or surrender of Australian carbon credit units for any emissions above the baseline for the year, as determined by the Clean Energy Regulator.	Control based on legislative requirement utilising the national reporting framework for the reporting of information related to GHG emissions. The Safeguard Mechanism requires Operators to offset carbon emissions in excess of the relevant baseline using Australian Carbon Credit Units (ACCUs).	Minimal cost, standard practice.	**Adopted** – Control based on legislative requirements. Environmental benefit outweighs the minimal cost.
Additional Controls				
VI-CW-CM-10	Reduce GHG emissions for the VI Hub over the life of the EP through the implementation of the Santos WA, NA, TL Decarbonisation Plan.	Reduces GHG emissions across the VI Hub Operations, manages liabilities against the Safeguard Mechanism, and meets Santos emission reduction targets as described in the Climate Transition Action Plan.	Costs associated with implementing the projects.	**Adopted** – Benefits of emissions reduction is outweighed by the cost of carbon credits to comply with the Safeguard Mechanism.
VI-CW-CM-11	VI Hub products generated from the activity will only be sold to customers from countries that are signatories to the Paris Agreement or have a net zero commitment, as at the date of the relevant contract of sale (administrative control).	Reduces indirect GHG emissions from the transportation and third -party end use of hydrocarbon products. Supports the objective of the Paris Agreement to limit global temperature rise to less than 2°C and pursue efforts to limit the temperature rise to 1.5°C to the extent possible by Santos, having regard to the responsibility of each country to meet its net zero commitments and to the autonomy of each country in determining its pathway to achieving its emissions reduction targets.	Limitations on who the VI Hub products can be sold to. Minor costs associated with periodic monitoring.	**Adopted** – The environmental benefit of implementing sales controls to drive focus on global climate targets in the international community outweighs the costs and risks.
VI-CW-CM-61	Leak Detection and Repair (LDAR) program at John Brookes WHP to detect fugitive emissions.	May potentially reduce direct GHG emissions.	Moderate costs associated with implementing fugitive emissions detection.	**Adopted** – Moderate cost outweighed by the environmental benefit of identifying and repairing fugitive emission sources to

Control Measure Ref. No.	Control Measure	Environmental Benefit	Potential Cost/ Issues	Evaluation
				help control emissions created by equipment.
N/A	Eliminate venting from the John Brookes WHP.	Eliminate GHG emissions from the venting of hydrocarbons.	Not feasible. There is no flare on the John Brookes WHP. Venting is required during some routine and non-routine maintenance activities and cannot be eliminated.	**Not Adopted** – Not economically feasible to eliminate venting on the John Brookes WHP. Venting is required during some routine and non-routine maintenance activities.
N/A	Voluntary purchasing of offsets to cover direct GHG emissions	Reduces net direct GHG emissions	Cost of purchasing offsets	**Not Adopted –** Cost of purchasing voluntary offsets outweighs the negligible environmental benefit. Direct emissions from VI Hub Operations in Commonwealth waters represent 3.55% of total direct emissions for the VI Hub operations. As stated in the Santos Climate Report, Santos' Climate Transition Plan provides Santos' carbon mitigation hierarchy, which is avoidance first, followed by reduction and then lastly, offsetting. With respect to reduction, Santos is implementing the WA, NA, TL Decarbonisation Plan. With respect to offsetting, there is little to no potential for direct emissions from VI Hub in Commonwealth waters to contribute to exceedance of the Safeguard Baseline for the entire VI Hub. Therefore, the voluntary purchasing of offsets for Commonwealth waters direct GHG emissions is not required as it does not achieve a meaningful reduction in emissions.

Control Measure Ref. No.	Control Measure	Environmental Benefit	Potential Cost/ Issues	Evaluation
N/A	Voluntary purchasing of offsets to cover indirect GHG emissions	Reduces nett indirect GHG emissions	Cost of purchasing offsets	**Not Adopted –** Minor cost of voluntary purchasing offsets outweighs the negligible environmental benefit. Customers emissions for consumption of the exported condensate are managed by their own country commitments under the Paris Agreement. The primary customers for gas (domestic market) fall under Australia's commitments for the Paris Agreement. Therefore, the voluntary purchasing of offsets for indirect GHG emissions is not required as it does not achieve a meaningful reduction in emissions compared to the adopted control measures.
N/A	Use incinerators and engines with higher environmental efficiency.	Improves air quality by more efficient burning or fuel combustion.	Significant cost in changing unknown vessel equipment.	**Not Adopted –** Cost grossly disproportionate to low environmental benefit (impact rated Negligible).

6.3.5 Environmental Impact Assessment

The impacts and consequence ranking for GHG emissions are outlined in Table 6-11

Table 6-11: Impacts and Consequence Ranking- Greenhouse Gas Emissions

Receptor	Consequence Level
Threatened, migratory or local fauna Physical environment or habitat Threatened ecological communities Protected areas Socio-economic receptors	Impacts as a result of climate change include temperature increases across Australia, rainfall patterns will change significantly and extreme events such as droughts, floods and wildfires will become more common. These changes impact on individual species, ecosystems and ecosystem services such as food and water availability. Within decades, environments across Australia may be substantially different (CSIRO 2015). Considering that: • The potential occurrence of climate change impacts depends on there being a net increase in global GHG emissions. Whether or not a net increase in cumulative emissions will occur is subject to multiple variables outside of Santos' control; and • In any event, even assuming that emissions from the Activity will cause an equivalent net increase in cumulative Australian and global emissions, this increase is de minimis in the context of Australian and global carbon budgets; and • In any event, there is no correlation between where GHG emissions are released and where climate change impacts are felt, it is not possible to draw a link between GHG emissions from the Activity and any specific climate related impact on the Australian environment which may result from any net increase to cumulative GHG emissions globally. Conservatively, the associated potential environmental impacts is assessed as I – Negligible, on the basis that there are no environmental impacts associated with GHG emissions from this Activity.

Receptor	Consequence Level
Worst-case consequence level	I-Negligible

6.3.6 Demonstration of as Low as Reasonably Practicable

Power generation through combustion of fossil fuels is essential to undertaking the operational activities either by vessel, power generation or helicopters. Given the controls in place, including:

- Facility planned maintenance systems
- Vessels comply with Marine Order 97
- NGERS reporting
- Safeguard Mechanism, providing a cost driver to implement emissions reduction measures to reduce emissions to the baseline, where the cost of abatement is less than the cost of carbon credits
- Measures which (while recognising that indirect emissions associated with the use of the gas and condensate are outside of Santos' control and that each country is responsible for determining the manner in which it decarbonises to meet net zero commitments) restrict the onshore processing and sale of products generated by the activity to facilities and customers where there is an appropriate regulatory regime and/ or international commitment to the climate transition.
- A periodic LDAR program to detect and manage fugitive emissions at the WHP.

Santos considers all practicable management measures are considered to have been implemented. Implementation of the Santos management system (Section 8.1) takes into account uncertainty around the potential impacts from direct and indirect GHG emissions by providing an adaptive management framework to actively undertake GHG emissions reductions measures and track changing GHG and climate change related policy and legislation. Therefore, the impacts and risks associated with direct and indirect GHG emissions from the VI Hub Operations in Commonwealth waters are considered ALARP.

6.3.7 Acceptability Evaluation

Is the consequence ranked as I (Negligible) or II (Minor)	Yes – maximum consequence from GHG 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 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 – management of the impacts and risks from GHG emissions associated with VI Hub Operations are consistent with relevant global agreements and frameworks and Australian legislative requirements, including: • The Paris Agreement: as agreed under the United Nations Framework Convention on Climate Change at the 21st Conference of the Parties in 2015, which sets an ambitious climate-related goal (Article 2) and establishes a global goal on adaptation of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change (Article 7). The Paris Agreement commits individual signatory countries to define their nationally determined contributions, reach peak GHG emissions as soon as possible (Article 4), adopt rules and procedures to mitigate GHG emissions, and adopt a compliance and reporting mechanism, as well as adaptive management and continuous improvement. • Compliance with Australian GHG emissions legislative requirements, including: – The regulatory mechanism of primary relevance to VI Hub Operations in Commonwealth waters GHG emissions is the Safeguard Mechanism. This requires the net scope 1 emissions from a Safeguard Mechanism facility to reduce to a baseline, which is designed to deliver emissions reductions consistent with Australia's NDC under the Paris Agreement. • Relevant species recovery plans, conservation management plans and management actions, including but not limited to Recovery Plan for Marine Turtles in Australia 2017–2027 (DoEE, 2017), , Approved Conservation Advice for Balaenoptera physalus (fin whale), Approved Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015c)(TSSC, 2015b), Approved Conservation Advice for Rhincodon typus (whale shark) (TSSC, 2015a), National Recovery Plan for the Southern Right Whale (*Eubalaena australis*, Blue Whale Conservation Management Plan 2015 - 2025 (DoE, 2015c), Recovery Plan for the Australian Sea Lion (*Neophoca cinerea*) (DSEWPaC, 2013b), Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (DoE, 2014) and relevant recovery plans and conservation advices for birds. • EPBC Act Significant Impact Guidelines (Statement 1.1) and Section 527E of the EPBC – Indirect Consequences.
Are risks and impacts consistent with Santos' Environmental, Health and Safety Policy?	Yes – aligns with • Santos' Environment, Health and Safety Policy. • Santos' Climate Policy Aligns with Santos' Sustainability and Climate Change Report and climate change targets.
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 overall impacts to the atmosphere and sensitive receptors from VI Hub Operations direct and indirect GHG emissions are expected to be negligible.

Santos has implemented an adaptive management framework to reduce emissions on an ongoing basis and ensure compliance with the Safeguard Mechanism. There are no effective controls that Santos can adopt to manage customer emissions associated with end product use. Condensate export customer emissions are managed under their country's own commitments under the Paris agreement. Domestic gas customers emissions are managed under Australia's commitments to the Paris Agreement.

6.4 Atmospheric Emissions

6.4.1 Description of Event

Event	Atmospheric emissions, such as sulphur oxides (SO_X) and nitrogen oxides (NO_X), are discharged to the atmosphere during continued operations of the John Brookes, Spartan and Greater East Spar facilities, contributing to a localised reduction in air quality. Atmospheric emissions from John Brookes and Greater East Spar operations are derived from: • hydrocarbon combustion by-products from the operation of power-generating equipment (such as crane engine, microturbines, diesel generator set) or temporary equipment on the WHP, support vessels and helicopters • venting of: – volatile organic compounds (VOCs) from drain systems on the WHP and fugitive emissions from flexible flowlines, relief valves and sumps and also their actuation – pigging operations, process equipment maintenance, well maintenance, servicing, suspension and abandonment, or – fugitive emissions from the process control system • vessels may also use: – an incinerator to manage wastes, or – ozone-depleting substances in closed-system rechargeable refrigeration systems.
Extent	Localised: The quantities of gaseous emissions are relatively small and will, under normal circumstances, quickly dissipate into the surrounding atmosphere.
Duration	Air emissions generated during the operational life of the field.

6.4.2 Nature and Scale of Environmental Impacts

Potential receptors include:

- Physical environment (air quality)

Hydrocarbon combustion may result in a temporary, localised reduction of air quality in the environment immediately surrounding the discharge point during the activity. Non-GHG emissions, such as NOX and SOX, can lead to a reduction in local air quality.

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

As Santos' operations occur in open-ocean offshore waters, the combustion of fuels and incineration in such remote locations will not impact on air quality in coastal towns. The quantities of gaseous emissions are relatively small and will quickly dissipate into the surrounding atmosphere.

VOCs can be harmful to human health and also to the environment, as they can be toxic; however, this is generally relevant to high concentrations of VOCs in closed environments. VOCs are not expected to be in large enough volumes to be harmful. The typically windy region will also rapidly disperse any VOCs, reducing their impacts.

The circumstances leading to cold venting include both planned and unplanned maintenance activities. These planned maintenance activities are scheduled to occur infrequently, at most annually (e.g., pigging). The volumes of hydrocarbons, including non-GHGs, are small.

Minor amounts of fugitive emissions are expected to occur on the WHP due to potential leak paths from the production equipment. Hydrocarbon vapours, including VOCs, are released from storage tanks and equipment during filling of the diesel tanks and continuous minor venting, although emissions from storage tanks are expected to be minimal as the tanks themselves are very small (approximate tank size is 3.1 m^3). Air emissions will be similar to other facilities operating in the region for both petroleum and non-petroleum activities.

6.4.3 Environmental Performance Outcomes and Control Measures

The EPOs relating to this event are:

- Reduce impacts to air and water quality from planned discharges and emissions from operational activities (EPO-VI-CW-03).

The control measures for this event are shown in Table 6-12, and the environmental performance standards and measurement criteria for the EPOs are described in Table 8-2.

Table 6-12: Control Measure Evaluation for Atmospheric Emissions

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls				
VI-CW-CM-05	Facilities planned maintenance system.	Reduces emissions from the John Brookes WHP because the PMS ensures the reliability of gas turbines, reducing the requirement to run diesel powered generators. Also reduces the potential for fugitive emissions, as the asset integrity regime prevents unplanned releases of GHG emissions from equipment.	Operational costs and labour or access requirements of undertaking facility maintenance.	**Adopted** – Benefits of operating equipment within operational parameters will help control emissions created by equipment.
VI-CW-CM-06	Vessels comply with Marine Order 97 (Marine Pollution – Air Pollution).	Reduces emissions from vessels. Marine Order 97 is required under Australian regulations, implementation is standard practice for commercial vessels as applicable to vessel size, type and class.	Operational costs and labour or access requirements of undertaking vessels maintenance.	**Adopted** – Benefits of operating equipment within operational parameters will help control emissions created by equipment.
VI-CW-CM-07	Fuel oil quality.	Reduces emissions through use of low-sulphur fuel in accordance with Marine Order 97.	Operational costs of refuelling.	**Adopted** – Environmental benefit outweighs cost and it is a legislated requirement.
VI-CW-CM-13	Vessels planned maintenance system.	Reduces emissions from vessels because equipment is operating within its parameters.	Operational costs and labour or access requirements of undertaking vessels maintenance.	**Adopted** – Benefits of operating equipment within operational parameters will help control emissions created by equipment.
VI-CW-CM-14	International Air Pollution Prevention Certificate.	Reduces probability of potential impacts to air quality due to ozone-depleting substance emissions, high NO_X, SO_X and incineration emissions.	Personnel cost of ensuring vessel has current international air pollution prevention certificate during vessel contracting procedure and in premobilisation audits or inspections.	**Adopted** – Benefit of ensuring vessel is compliant outweighs the minimal costs and it is a legislated requirement.
VI-CW-CM-15	Ozone-depleting substance handling procedures.	Reduces probability of potential impacts to air quality due to ozone-depleting substance emissions.	Personnel cost of maintaining ozone-depleting substance record book or recording system.	**Adopted** – Benefit of ensuring no ozone-depleting substance release outweighs the minimal costs.
VI-CW-CM-16	Waste incineration management.	Reduces the potential for emissions or particulates by ensuring only permissible waste is	Personnel cost of maintaining waste records and training of staff.	**Adopted** – Benefit to air quality outweighs the costs associated with transporting

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
		incinerated as per Marine Order 97.		waste to shore for landfill.
Additional Controls				
VI-CW-CM-61	Leak Detection and Repair (LDAR) activities at John Brookes WHP	May potentially reduce direct GHG emissions.	Moderate costs associated with implementing fugitive emissions detection.	**Adopted** - Moderate cost outweighed by the environmental benefit of identifying and repairing fugitive emission sources to help control emissions created by equipment.
N/A	No incineration during vessel-based operations activities.	Eliminate the potential for emissions due to waste incineration to impact air quality.	Increase in health risk from storage of wastes. Increase in risk due to transfers (increased fuel usage, potential increase in collision risk, disposal on land).	**Not Adopted** – Health and safety risks outweigh the benefit given the offshore location. Cost associated with transporting waste to shore for landfill or incineration outweighs onboard incineration.
N/A	Removal of all ozone-depleting substance-containing equipment.	Eliminates potential of ozone-depleting substance emissions occurring, 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 vessel's ability to undertake the activity; therefore, there is no practical solution to the use of refrigeration. It is noted that ozone-depleting substances are rarely found on vessels.	**Not Adopted** – Based on cost to replace all equipment and there is only a low potential for ozone-depleting substance releases.
N/A	Alternative fuel type (non-hydrocarbon based) selected for all vessels and helicopters.	Could reduce level of pollutants released to the environment during fuel combustion.	Practical and reliable alternative fuel types and power sources for the helicopters and support vessels have not been identified. If an alternative was available, vessels have fuel specifications for equipment, and change of fuel may require further modifications to equipment.	**Not Adopted** – Not feasible.
N/A	Use incinerators and engines with higher environmental efficiency.	Improves air quality by more efficient burning or fuel combustion.	Significant cost in changing unknown vessel equipment.	**Not Adopted** – Cost grossly disproportionate to low environmental benefit (impact rated Negligible).

6.4.4 Environmental Impact Assessment

The impacts and consequence ranking for atmospheric emissions are outlined in Table 6-13

Table 6-13: Impacts and consequence ranking-atmospheric emissions

Receptor	Consequence Level
Air Emissions	
Threatened or migratory fauna	Not applicable – Gaseous emissions are relatively small, will quickly dissipate into the surrounding atmosphere, and are not considered to be a potential source of impact for threatened or migratory fauna.
Physical environment or habitat	As Santos' operational activities occur in the open ocean and offshore waters, the combustion of fuels in such remote locations 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 or WHP. The consequence level is therefore assessed as Negligible (I).
Threatened ecological communities	Not applicable – No threatened ecological communities present
Protected areas	Not applicable – Gaseous emissions are relatively small, will quickly dissipate into the surrounding atmosphere, and are not considered to be a potential source of impact for protected areas.
Socio-economic receptors	Not applicable – Gaseous emissions are relatively small, will quickly dissipate into the surrounding atmosphere, and are not considered to be a potential source of impact for socio-economic receptors
Worst-case consequence level	I- Negligible

6.4.5 Demonstration of as Low as Reasonably Practicable

Power generation through combustion of fossil fuels is essential to undertaking the operational activities either by vessel, power generation or helicopters. Given the routine maintenance of these systems by suitably qualified personnel, all practicable management measures are considered to have been implemented and the likelihood of significant impacts occurring has been reduced to ALARP.

6.4.6 Demonstration of Acceptability

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 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 – pursuant to Marine Order 97 (Marine pollution prevention – air pollution), which gives effect under Australian law to MARPOL Annex VI.
Are risks and impacts consistent with Santos' Environmental, 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.

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 (I) if the emissions management is adhered to and impacts from emissions that are generated by the various operational activities are considered to be ALARP and environmentally acceptable.

6.5 Seabed and Benthic Habitat Disturbance

6.5.1 Description of Event

Event	A description of the activities associated with the John Brookes, Spartan and GES operational activities are provided in Section 2. Potential seabed disturbance (temporary) may occur in the operational area due to disturbance to seabed from activities such as: • vessel anchoring (non-routine) • cleaning of subsea infrastructure • sedimentation as infrastructure is placed or relocated on the seabed • wet parking' of equipment (e.g., ROV basket or clump weight); • subsea IMMR activities (e.g., diving; AUV survey activities; ROV operations; cutting; welding; pigging; installation, replacement or modification of subsea equipment; free span 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. This may result in minor seabed disturbance, sedimentation or water quality impacts (i.e., increased turbidity).
Extent	Localised: Within the operational area.
Duration	For operational life of the activity.

6.5.2 Nature and Scale of Environmental Impacts

Potential receptors include:

- physical environment (water quality, benthic habitats, shoals and banks, offshore reefs and islands)
- threatened or migratory fauna (marine reptiles, sharks, fish and rays)
- protected and significant areas (marine parks).

Operational activities may disturb seabed and benthic habitat through the impacts of:

- direct physical disturbance of benthic and seabed habitat, including benthic fauna, by infrastructure
- indirect disturbance to benthic habitats and associated marine fauna by sedimentation
- increased turbidity of the near-seabed water column
- introduction of artificial habitat for benthic fauna colonisation.

Sensitive receptors identified in the operational area potentially impacted by operational activities include:

- soft sediments and benthic fauna
- ancient coastline at 125 m depth contour
- threatened or migratory fauna habitat.

6.5.2.1 Physical Environment

The installation and placement of offshore infrastructure and equipment will directly contact the seafloor and will inevitably result in localised impact (direct and indirect) to water quality, seabed features and the benthic environment in the operational area.

The operational area does not contain any significant or unique areas of benthic habitat. As described in Section 3.2.2 the benthic habitats within the operational area are primarily soft sediments devoid of sensitive benthic habitats and densely bioturbated (less than 75%), epibenthic biota is sparse (less than 5%) and includes invertebrates, such as anemones, sponges and sea urchins. This benthic habitat is widely represented at a regional scale on the North West Shelf (RPS, 2010).

Indirect impacts associated with a temporary (several hours) and localised (within tens of metres) decline in water quality due to increased suspended sediments or sedimentation of the seabed are not expected to affect any key values and sensitivities of regional importance. There are no nearby sensitive benthic habitats to be significantly impacted by localised impacts within the operational area.

6.5.2.2 Threatened or Migratory Fauna

Habitat modification is identified as a potential threat to a number of marine fauna species in relevant recovery plans and conservation advices (Table 3-7). Disturbance of the seabed is not anticipated to significantly affect mobile marine fauna, such as marine mammals, marine reptiles, fish, sharks and rays. The area of seabed to be disturbed within the operational area also represents a very small portion of the habitat available for these species. No decrease in local population size or in the area of occupancy of species and no loss or disruption of habitat critical to the survival of a species or disruption to the breeding cycle of any of these protected matters is expected.

BIAs for marine turtles occur within the operational area, including the loggerhead turtle (reproduction) and the green, flatback and hawksbill turtles (reproduction and critical nesting habitat) (Table 3-6). However, internesting activities typically occur within shallower waters than those in the operational area (as discussed in Section 6.1.2) (Whittock et al., 2016; Pendoley, 2017). If a marine turtle was displaced from the area of seabed and benthic habitat disturbance, widespread internesting habitat is available in the immediate vicinity that marine turtles could continue to use within the identified habitat critical to the survival of the species, and BIAs.

Fish, sharks and rays may also forage in the soft sediments for marine invertebrates; however, given the small scale of the activity and the regionally availability of habitat, seabed and benthic habitat disturbance is not expected to affect these species.

6.5.2.3 Protected and Significant Areas

The operational area intersects the Montebello Marine Park (Multiple Use Zone - IUCN Category VI); therefore, seabed and benthic habitat disturbance may occur within the marine park. The conservation values of the marine park (as described in Section 3.2.3) that will be directly impacted include:

+ foraging areas for marine turtles that are adjacent to important nesting sites

+ seafloor habitats and communities of the Northwest Shelf Province provincial bioregion, as well as the Pilbara (offshore) meso-scale bioregion.

Impacts to these values from seabed disturbance are discussed above, are localised and are not expected to significantly impact the conservation values of the Montebello Marine Park.

6.5.3 Environmental Performance Outcomes and Control Measures

Environmental Performance Outcomes (EPOs) relating to this event include:

- Seabed disturbance is limited to the operational area (EPO-VI-CW-04).

The control measures considered for this event are shown in Table 6-14, and the environmental performance standards and measurement criteria for the EPOs are described in Table 8-2.

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

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls				
VI-CW-CM-06	Vessels planned maintenance system.	Reduces likelihood of dropped objects because lifting equipment is operating within its parameters.	Operational costs and labour or access requirements of undertaking equipment maintenance on vessels.	Adopted – Benefits of operating equipment within operational parameters will help reduce the likelihood of dropped objects.
VI-CW-CM-17	Planned subsea and offshore maintenance.	Reduces likelihood of dropped objects because lifting equipment is operating within its parameters.	Operational costs and labour or access requirements of undertaking equipment maintenance on vessels.	Adopted – Benefits of operating equipment within operational parameters will help reduce the likelihood of dropped objects.
VI-CW-CM-18	Dropped object prevention procedure (LEMS).	Impacts to environment are reduced by preventing dropped objects.	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.

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
Additional Controls				
VI-CW-CM-19	Dropped object recovery.	Requires dropped objects to be recovered (where safe and practicable to do so).	Additional personnel and vessel costs to plan and undertake if safe and practicable to do so.	Adopted – Benefits of recovering dropped objects where safe and practicable to do so outweigh the costs.
VI-CW-CM-21	Anchoring and equipment deployment management.	Requires using existing moorings or Santos–approved anchor locations within operational area, except 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.	Adopted – Benefits of using existing moorings prevent further disturbance.
N/A	Cessation of operations until all dropped objects are located or recovered.	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.	**Not Adopted** – Cost outweighs the benefit.
N/A	Elimination of vessels or use of dynamic positioning for all vessels.	Reduces impacts to seabed from anchoring.	Would introduce increased risks for divers or equipment in the water during activities such as diver inspections or maintenance activities.	**Not Adopted –** Increased (transferred) risk disproportionate to environmental benefit.

6.5.4 Environmental Impact Assessment

Table 6-15: Impacts and consequence ranking – seabed and benthic habitat disturbance

Receptor	Consequence Level
Threatened or migratory fauna	Given the small scale of the activity, minor and short-term nature of indirect impacts and the regional availability of the habitats present, seabed and benthic habitat disturbance is not expected to impact threatened or migratory species at a population level. The consequence level is therefore assessed as negligible (I).
Physical environment or habitat	Impacts from seabed disturbance are expected to be localised, and indirect impacts may result in short-term increases in turbidity in the immediate vicinity. Given that the nature of the habitats within the operational areas are representative of those within the region and the localised nature of any disturbance, impacts to the physical environment or habitat are assessed as negligible (I).
Threatened ecological communities	Not applicable – No threatened ecological communities are identified in the area where seabed disturbance could occur.
Protected areas	The operational area intersects the Montebello Marine Park (Multiple Use Zone – IUCN Category VI). The relevant values of the marine park are not anticipated to be significantly affected by seabed distance activities, and therefore the consequence has been assessed as negligible (I).
Socio-economic receptors	Not applicable – Disturbance of the seabed and benthic habitat within the operational area is highly unlikely to impact socio-economic receptors such as shipping and tourism. Any minor alteration or modification to habitats is not expected to impact commercial fisheries' target species based on the small size of disturbance relative to the available fishing grounds. No stakeholder concerns have been raised regarding this aspect.
Overall worst-case consequence	I – Negligible

6.5.5 Demonstration of as Low as Reasonably Practicable

Operation, inspection, maintenance, monitoring and repair of John Brookes, Spartan and Greater East Spar facilities are unavoidable. There are no additional practicable alternatives to proceed in a successful and safe manner to reduce seabed disturbance associated with the operational activities. Management controls and installation procedures are designed to further limit the extent of direct seabed disturbance. Additionally, adherence to the materials handling, lifting and transfer procedures results in the likelihood of dropped objects to seabed being minimised.

Impacts will be localised as they will be within the operational area. Dedicated vessel moorings off the John Brookes WHP help minimise the requirement for additional vessel seabed anchoring. The placement of equipment as part of IMMR activities will leave indentations on the seabed and cause a temporary increase in water column turbidity, but this will be limited to the top layer of sediment. The benthic habitat would be expected to recolonise within weeks to months following the completion of the installation, which will create artificial benthic habitat that, over time, is likely to be utilised by marine species.

Given the lack of sensitive receptors within the operational area and the expected rapid recovery time, minor environmental impacts are expected (I – Negligible). Potentially impacted benthic habitats, including soft sediments, are widespread and common throughout the region.

The proposed management controls for seabed disturbance are in accordance with the Santos risk management criteria and are considered appropriate to manage the risk to ALARP.

6.5.6 Acceptability Evaluation

Is the consequence ranked 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 ESD?	Yes – activity evaluated in accordance with Santos' Environmental Hazard Identification and Assessment Procedure which considers principles of environmentally 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)?	N/A – no relevant requirements regarding this event in this area, given the localised nature and extent of the operational facilities. IUCN principles of nearby reserves (Montebello Marine Park) (Multiple Use Zone – IUCN Category VI) are met (Table 3-4).
Are risks and impacts consistent with Santos' Environmental, 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.

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

6.6 Physical Presence

6.6.1 Description of Event

Event	*Interaction with Other Marine Users* Interactions with other marine users may occur through undertaking operational activities or through the presence of permanently abandoned and temporarily abandoned wells prior to their future planned decommissioning. Support vessels will be regularly transiting the area and, at times of maintenance, inspection, monitoring and repair, may need to operate 24 hours a day. The presence of vessels in the operational area could potentially inhibit marine user groups, tourism, commercial shipping, fishing and other oil and gas activities. The presence of vessels and marine infrastructure could pose a collision or snagging risk and inconvenience to fishing practices during these operations, although the WHP, subsea wells and pipelines are charted (see Section 6.6.3). Note the potential impacts to fauna from helicopters and vessels is assessed in Section 7.2. *Interaction with Fauna* The presence of the WHP may attract birds. The bird deterrent system is designed to scare birds from landing on the WHP and avoid harming them (Section 2.8.3).
Extent	Localised: Within the operational area.
Duration	Temporary and intermittent interaction with vessels when they are transiting the operational area. Permanent exclusion of other marine users within the 500-m petroleum safety zone (under Section 6 of the OPGGS Act) of the John Brookes WHP for the operational life of the field. Bird deterrents will be used during the duration of operations at the WHP.

6.6.2 Nature and Scale of Environmental Impacts

Potential receptors include:

- protected and significant areas (marine parks)
- socio-economic receptors (fisheries, tourism, shipping traffic and other oil and gas activities).
- Commercial and Traditional Fisheries
- Birds

Commonwealth and State fisheries that overlap the operational area are described in Section 0. Potential impacts to commercial fisheries include temporary loss of fishing area, target fish species being attracted to the offshore facilities away from fishing areas through lighting or artificial habitat, and damage to fishing equipment that may snag on subsea infrastructure. These impacts could potentially result in reduced catches and associated income.

An analysis of the current fishery closures, depth range of activity, historical fishing effort data, fishing methods and consultation feedback (refer to Section 4) has revealed that there is a low potential for interaction with commercial fisheries. None of the Commonwealth fisheries identified in Section 0 are likely to be active in the operational area.

For State-managed fisheries, the Mackerel Managed Fishery, Pilbara Trap Managed Fishery and the Pilbara Line Fishery of the Pilbara Demersal Scalefish Fishery may access the operational area. The benthic habitat within the operational area is primarily soft sediments (Section 3.2.2), which provide little habitat for the target species of State-managed fisheries occurring in the area. It is possible that demersal fishes may be attracted to subsea infrastructure, while some attraction of pelagic fishes is likely to occur around the John Brookes WHP. However, it is unlikely that the presence of the infrastructure would attract fish away from fishing areas to the extent that fishery-level impacts would be felt. Natural variability in fish stocks and fishing conditions is likely to be on a much greater scale than any impacts that could be associated with the planned operational activities.

The ongoing physical presence of permanently and temporarily abandoned wells and associated seabed infrastructure such as wellheads until future planned decommissioning may pose a potential snag hazard for commercial fishers operating in the operational area. The Mackerel Managed Fishery is a line fishery, focusing on pelagic fish species in the upper water column and is not expected to interact with wells temporarily abandoned until future planned decommissioning. Future interactions with the Pilbara Trap and Line fisheries and permanently and temporarily abandoned wells are not expected given the locations of remaining infrastructure above the mudline being provided to the AHO for marking on charts. Therefore, impacts to commercial fishing from the ongoing physical presence of permanently or temporarily abandoned wells until decommissioning are expected to be negligible.

As described in Section 0, indigenous marine users or subsistence or traditional fishers could occur in the operational area. However, there are no recorded seabed Aboriginal sites in the waters of the Montebello Islands and Barrow Island reserves (DEC, 2007), and no interactions with traditional fishers has been recorded during previous activities in the operational area.

Birds may use the WHP as a place to rest and forage (Section 3.2.5). Bird deterrent techniques (Section 2.8.32.8.3) are in place to deter birds from the WHP.

6.6.2.1 Tourism and Recreation

Tourism activities, such as snorkelling, diving, surfing and recreational fishing, may occur around the Montebello Islands but are not expected to occur in the operational area, given the water depth (45 m to 100 m), lack of seafloor features and distance from shore.

Recreational fishing practices are typically observed near or around shoal, bank, reef and islands features in the region. Consequently, these practices are generally expected to be geographically separate from the planned project activities that occur within the operational area.

6.6.2.2 Shipping Traffic and Other Oil and Gas Activities

There are no recognised shipping routes in or near the operational area, with the nearest designated shipping routes located on the eastern side of Barrow Island (Figure 3.22). However, analysis of historical Australian Ship Reporting System shipping data indicates that commercial vessels do use the general area, most likely vessels in the oil and gas industry. Should commercial vessels need to deviate from planned routes to avoid operational vessels, this may slightly increase transit times and fuel consumption. As the operational area is in open waters with no grounding or navigational hazards, it is not likely that any such deviation would increase the potential for vessel collision or grounding. In addition, no concerns have been raised by the shipping industry in the past five years relating to disturbance to shipping routes as a result of activities within the VI Hub operational area. The ongoing physical presence of permanently and temporarily abandoned wells until future planned decommissioning is not expected to interfere with commercial shipping.

6.6.2.3 Protected and Significant Areas

The operational area intersects the Montebello Marine Park (Multiple Use Zone – IUCN Category VI). Other marine users within the Montebello Marine Park include tourists and recreational visitors, commercial fishers, and other oil and gas operators. These marine users are important socio-economic values for the marine park.

These socio-economic values of the marine park are discussed in the sections above. Activities associated with the operation of the VI Hub are not expected to significantly impact the socio-economic values of the Montebello Marine Park.

6.6.2.4 Birds

The potential impacts to birds from the physical presence of the WHP relate to firstly to the infrastructure being a form of temporary habitat for birds, and secondly the potential impacts to those birds by deterring them from the WHP.

Attraction to the WHP

The physical presence of the WHP may alter bird behaviour by creating a potential resting habitat. Birds are often on offshore platforms as they provide a safe place for birds to roost (CoA 2020). Birds known to rest at the WHP are listed in **Table 3-8**, while birds that may potentially interact with the platform are listed in **Table 3-9**.

Migratory birds rest or forage at the WHP, which can be considered a localised and short term change to their behaviour. These behavioural changes would have a negligible impact on the birds across the regional area.

The activity is consistent with conservation management plans and advice for seabirds (Section 3.2.4); and does not contradict the objectives and actions listed in the management plans and conservation advice.

The physical presence and attraction of the WHP will have a negligible impact on seabird species at a regional level.

Deterrent from the WHP

As described in Section 2.8.32.8.3, bird deterrent measures are required to ensure aviation safety. The potential impacts to seabirds is summarised in Table 6-17. The bird-deterrent system aims to have a behavioural impact on birds to prevent them breeding and nesting on the WHP. Encouraging them to stay away protects birds from helicopter strike and makes the WHP safe for helicopters to land on and take-off from.

Table 6-17: Potential impacts of deterrents to birds

Deterrent	Potential Physical Impacts	Potential Behavioural Impacts
Bird spikes and wires	Bird spikes and wires are a common and humane control for deterring birds from offshore infrastructure and vessels. The upward pointing wires or 'spikes' and horizontal wiring, act as a physical barrier to the birds, preventing them from landing or accessing areas, without hurting them. The spikes and wiring are not expected to cause injury or fatalities to birds.	Deterrents may cause the birds to relocate to other resting locations, such as: • Barrow Island (~40km from the WHP). • Montebello Islands (~40km from the WHP). • Passage Islands (~96km from the WHP). • Mainland Australia (~100km from the WHP). Refer to the detailed assessment below.
Netting	Netting is commonly used to prevent the ingress of birds into offshore infrastructure, equipment and vessels. As well as offshore. used in the onshore to prevent birds from accessing particular areas on infrastructure. In rare cases, birds may become entangled in netting.	
Decoys	The decoys of predatory birds or decoys of people are not expected to have physical risks to birds. The decoys may deter birds from the WHP.	
Acoustic	As per Section 6.1, acoustic deterrents are not expected to cause physical harm to birds.	

Behavioural Impacts

The potential behavioural impacts are assessed in greater detail below, grouped into several assessment categories based on the bird commonalities.

Species known to interact with the John Brookes Wellhead Platform

Several bird types are known to interact with the WHP (Table 3-8) including the Brown Booby, Masked Booby, Greater Crested Tern, Bridled Tern, Common Noddy / Brown Noddy, Lesser Crested Tern, Australasian Gannet and Silver Gull. There are no Approved Conservation Advice reports or Recovery Plans for these bird types, and none have endangered, threatened or vulnerable EPBC listings.

Potential behavioural impacts may include dispersion of birds from the WHP to nearby areas such as other islands for roosting/resting. These potential impacts are considered negligible given the proximity of other nearby structures to rest/roost on, the abundance of foraging opportunities nearby.

Species with known breeding locations outside the region

These species* are typically migrating birds and while there is no previous record of these species utilising the platform, it is assumed that due to the physical presence of the structure there is potential for one or more of the species to use the platforms as a resting location only.

Therefore, the largest impact on these species would be the removal of a resting location due to the bird deterrent activities. The removal of a resting location is not considered to have a significant impact on the species population for the following reasons:

- These species have not been recorded utilising these offshore platforms as resting sites, therefore removing the WHP as a potential resting location them will not negatively impact their migration and subsequent breeding activity.
- The platform has only been present since 2004 and therefore have only recently become available to birds as a resting structure. It is unlikely to have altered bird behaviour on a generational or species-wide level.
- Alternative offshore resting locations are located nearby, the nearest islands (Montebello Group and Barrow Island) are located approximately 22 NM from the John Brookes WHP.
- *Examples include: Red knot, Curlew Sandpiper, Western Alaskan Bartailed Godwit, Northern Siberian Bartailed Godwit, Southern Giant Petrel, Eastern Curlew, Softplumaged petrel, Fork-tailed Swift.

Species with distinct preferred breeding habitats

Species whose preferred breeding and/or foraging habitats are significantly different to the habitat provided by the John Brookes WHP are considered unlikely to rely on the WHP as a refuge. This includes species who are known to excavate burrows during nesting season or to nest on soft substrate underneath trees and shrubs.

- White-winged Fairy Wrens are known to specifically inhabit and breed on Barrow Island in a single contiguous breeding population. However, they are known to inhabit grasslands and low shrublands with dense ground cover. Very unlikely to interact with the WHP.
- Soft-plumaged Petrels breed in very low numbers at Mastsuyker Island, Tasmania (6 pairs) with the rest of the population breeding on two southern Australian sub-Antarctic islands. In addition, they are known to breed in burrows among rocks and tussocks. Soft-plumaged Petrels forage in open ocean environments well off the continental shelf and are very unlikely to interact with the WHP.

- Flesh-footed Shearwaters nest in colonies in burrows under trees or shrubs. However, most feeding is conducted offshore over continental shelves. This species migrates north from southern breeding areas before heading west into the tropical Indian Ocean from the Houtman Abrolhos (Powell 2009). Very unlikely to interact with the WHP.
- Wedge-tailed Shearwater: The Montebello, Lowendal and Barrow Islands and islands of the Dampier Archipelago are known important nesting areas for the species. However, the species usually excavates burrows on flat or flattish areas with dense grassy and tussocky vegetation or below the cover of trees and shrubs. Very unlikely to interact with the WHP.
- Streaked Shearwaters breed in colonies on offshore islands in Japan, occupying burrows on forested hills. Streaked Shearwaters do not approach structures or vessels. Very unlikely to interact with the WHP.

Species known to nest in the region under similar conditions

Although nesting or breeding has not been observed at John Brookes WHP, as a conservative measure Santos has conducted an impact assessment on species which could potentially breed on the platform. The proposed bird deterrent system is most likely to have an impact on breeding species, in particular on fledglings. This could have an impact on a species population if the species is geographically very limited in its distribution. Species are considered on a case-by-case basis in more detail below:

- The Common Noddy can nest under a variety of different circumstances, including on bare rock and in the forks of tall trees. It is therefore considered feasible that nesting conditions are satisfied by the WHP. The Common Noddy is one of the most numerous breeding species in Western Australia and represents approximately 74% of Australian population. Historically they have been known to nest on offshore facilities and have been recorded building nests on other WHPs and at manned FPSOs. The species is considered to be mostly stable in Australia and is not considered as a threatened species. For this reason, it is considered unlikely that the operation of bird deterrent systems on the WHP will have a measurable impact on the species, even if nesting has occurred in isolated instances.
- Caspian Terns breed in small colonies throughout north-west Australia, including on the islands of the Dampier Archipelago and the Montebello/ Lowendal Islands. Nests may be in the open, or among low or sparse vegetation or other shelter. It is therefore considered feasible that nesting conditions are satisfied by the WHP. However, the species has a widespread occurrence in both coastal and inland habitat within Australia, and is also known to breed in North America, Africa and Eurasia. For this reason, it is considered unlikely that the operation of bird deterrent systems on the WHP will have a measurable impact on the species, even if nesting has occurred in isolated instances.
- Bridled Terns are most common on offshore islands in tropical and sub-tropical regions of Australia, with known breeding populations on Ashmore Reef and the Montebello/Lowendal/Barrow Islands. Nests are usually found in rocky or concealed areas, such as under rocks, among coral rubble or on the ground beneath low shrubs. Due to the regional presence of breeding populations it is considered possible that favourable nesting conditions are satisfied by the WHP. However, the species is widespread in Australia, with subspecies also widespread globally, although the population numbers are unknown. As the species is not listed as threatened, it is considered unlikely that the operation of bird deterrent systems on the WHP will have a measurable impact on the species, even if nesting has occurred in isolated instances. Bridled Terns can roost in reasonable numbers usually on structures closer to the seas surface rather than on exposed helidecks (Surman per comms).
- Roseate Terns in Australia breed mainly off the coast of Western Australia and Queensland, with known breeding populations located around Bedout Island, the Montebello islands and Ashmore Reef. Globally, the species occurs in North and South America, the eastern Atlantic coast and Asia. Due to the wide geographical spread of the species population and the fact that the species is not listed as threatened, it is considered unlikely that the operation of bird deterrent systems on the WHP will have a measurable impact on the species, even if nesting has occurred in isolated instances.

The presence of the platform and the location of alternative nearby land means that the bird nesting effort and behaviour would not be significantly affected on a generational or species-wide level (i.e. short term behavioural impact to a small proportion of the local population only).

Overall behavioural impacts

Potential behavioural impacts may include dispersion of birds from the WHP to nearby areas such as other islands for roosting/resting. Additionally, birds that are dispersed from the WHP may be displaced from a small portion of bird foraging habitat around the base of the WHP as the structures are known to act as a fish attracting device. These potential impacts are considered negligible given the proximity of other nearby structures to rest/roost on, the abundance of foraging opportunities nearby and the decrease in dispersion efficiency of the bird deterrent system with distance which may still allow species to forage in the immediate vicinity of the WHP.

Conclusion

In conclusion, none of the bird species would be significantly impacted by the use of a bird deterrent system on the WHP. Most species of birds are considered unlikely to breed on the platform, due to their geographical spread and preferred breeding habitats. In addition, there have been no reports of breeding or nesting birds on the WHP. Bird deterrence from the platform would therefore not have a significant impact on the species population (i.e. is not expected to decrease local population size).

Operation of the bird deterrent systems may have a short-term behavioural impact on birds utilising the WHP as a resting place. Birds are currently using the platform as a resting structure and also potentially as a foraging location. Birds may be attracted to the WHP due to increased feeding opportunities on pelagic fish. However, these behavioural changes are unlikely to alter population dynamics or significantly change the habitat use of birds. The presence of the WHP is not expected to alter bird behaviour on a generational or species-wide level. Therefore, the bird deterrent system is considered to have a short-term behavioural impact only to a small proportion of populations. The reduction in bird numbers utilising the platform will in turn reduce the likelihood and frequency of bird strike events which will benefit individual birds.

Any impacts to birds will be short term intermittent local avoidance only to a small proportion of local populations. Detrimental impacts to birds from bird-deterrent devices are not expected at an individual or population level.

- *Monitoring*

The Wildlife Conservation Plan for Seabirds states that implementing a comprehensive monitoring program of impacts of offshore platforms should include nature, timing and extent of bird mortality caused by the platform. This information can then be used to better inform regulators responsible for exploration and extraction proposals (CoA 2020). For the WHP, Santos monitors the presence of birds interacting with the WHP, and any bird injuries or mortalities associated by the activities are logged and reported.

- Due to restrictions with bandwidth between the John Brookes WHP and the Varanus Island control room, live CCTV monitoring cannot be adopted. Instead the John Brookes bird deterrent system will store CCTV footage which will be downloaded opportunistically by personnel visiting the normally unmanned facility. The CCTV footage will be sampled and reviewed to document the effectiveness of the deterrent system and to assess the bird numbers and types. Observations of bird species, numbers and response to the deterrent activities will be recorded. This will be carried out in accordance with the Work Instruction for Bird Deterrence Monitoring, the ‘bird count and activity log’ sheets and species identification cards.
- During visits to the WHP, personnel will also do onsite visual surveys of birds using the relevant monitoring forms, and will assess the effectiveness of the deterrent system.
- *Reporting*
- Annually, the data collected during the above-mentioned monitoring shall be collated and organised into a spreadsheet or similar and reviewed by the Environment Team. The review shall consider whether the potential risks and impacts to birds have significantly changed, whether the control measures are adequate, and whether the risks remain ALARP and acceptable.
- All strikes will be reported by the helicopter operator to Santos. In addition, the helicopter operator will advise Santos of near misses and other relevant hazards. Any items or concern observed by Santos personnel visiting the platform will be reported to site management. Examples include reports of increased bird activity; or changes in activity on the platform such as nesting. Incidents and hazards will be entered into the Santos incident database and incorporated into future revisions of this BMP as appropriate. Routine information will be filed in the Santos’ document management system.
- External reporting of bird injury or mortality is in accordance with Table 8-4.

6.6.3 Environmental Performance Outcomes and Control Measures

The EPOs relating to this event include:

- Reduce 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.
- No injury or mortality to EPBC Act and WA Biodiversity Conservation Act 2016 listed marine fauna during operational activities.No injury or death to EPBC Act and WA Biodiversity Conservation Act 2016 listed threatened, migratory or marine species as a result of the operation of the John Brookes WHP bird deterrent system.

The control measures for this event are shown in Table 6-17, and environmental performance standards and measurement criteria for the EPOs are described in Table 8-2.

Table 6-17: Control measure evaluation for physical presence

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls				
VI-CW-CM-21	WHP petroleum safety zone.	Petroleum safety zone applies around the John Brookes WHP and is shown on Australian nautical charts.	No additional costs to Santos. Other marine users may be temporarily excluded from areas, disrupting their activities.	**Adopted** – Risk of excluding other marine users within a 500-m radius of the John Brookes WHP is unlikely to significantly impact upon the marine user. The benefits to safety of the activity (thus reducing risk of environmental impacts due to vessel collisions) outweigh potential costs.
VI-CW-CM-23	Navigational charting of infrastructure.	Offshore facilities and subsea infrastructure, including permanently and temporarily abandoned wells, is charted on Australian Hydrographic Service nautical charts.	No additional costs to Santos. Other marine users may be temporarily excluded from areas, disrupting their activities.	**Adopted** – The positive benefits of identifying subsea infrastructure to other marine users outweigh the process of arranging their charting with Australian Hydrographic Service.
VI-CW-CM-24	Navigation lighting and aids.	Reduces risk of environmental impact from vessel collisions due to ensuring safety requirements are fulfilled.	Negligible costs of operating navigational equipment.	**Adopted** – The safety benefits (and thus environmental benefits) outweigh the cost.
VI-CW-CM-25	Seafarer Certification.	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.
VI-CW-CM-26	Constant bridge watch on support vessels.	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.
VI-CW-CM-27	Stakeholder consultation.	Santos will update Santos wide stakeholder group on a quarterly basis. All external stakeholder communications are recorded in a database.	Costs associated with personnel time in preparing and distributing information and collating and addressing any feedback provided.	**Adopted** – Benefits considered to outweigh negligible costs to Santos.
VI-CW-CM-02	Bird deterrent system CCTV footage retrieved and reviewed opportunistically from the John Brookes WHP.	Reduces the potential for adverse impacts to birds by reviewing the CCTV footage, confirming the effectiveness and performance of the deterrent system and	Minor cost, standard practice	**Adopted-** environmental benefit outweighs the minor cost.

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
		recording bird species, numbers and response to the deterrent system.		
Additional Controls				
N/A	Manage the timing of the operational activities to avoid peak marine user periods (e.g., fishing).	Would eliminate potential impacts to other marine users.	Not considered feasible as marine users could potentially be in the area all year round when operational activities are required all year round. The area that stakeholders 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.	**Not Adopted –** Stakeholders in the area all year round.
VI-CW-CM-22	Notify AHO and AMSA's JRCC prior to commencement of vessel based IMMR at Rosella-1.	Whilst not a legal requirement the notification provides a mechanism to notify other marine users that an IMMR vessel will be present around Rosella-1.	Time and minimal cost associated with preparing the notifications.	**Adopted** – Benefits considered to outweigh the costs in lieu of no PSZ and given Rosella-1 relative isolation from the cluster of other operational infrastructure.
NA	Notify AHO and AMSA's JRCC prior to commencement of vessel based IMMR at all subsea wells with no PSZ.	Whilst not a legal requirement the notification provides a mechanism to notify other marine users that an IMMR vessel will be present around subsea wells with no petroleum safety zone so that they can avoid the area.	Not practicable when there are multiple trips required, which can be adhoc (not routine). All subsea wells are marked on nautical charts. Even if a PSZ is present, there isn't the ability to ensure a vessel doesn't enter the zone because the zones are subsea.	**Not Adopted** – Control unable to be practically implemented for all subsea wells.
N/A	Rock dump of pipeline to protect from external impacts (overtrawl).	Rock dump of pipeline will reduce the risk of dropped objects impact.	Large cost and seabed disturbance associated with rock dump. Burying the infrastructure also causes technical inspection and maintenance activity issues.	**Not Adopted** – Large cost associated with rock dump disproportionate compared to risk. May also cause operational issues in relation to access for IMMR activities.
N/A	Establish a PSZ around subsea wells that don't currently have a PSZ.	Discretionary tool available under S616 of the OPGGS Act as an administrative control preventing interactions between other marine users and the subsea wells through the imposition of a 500 m exclusion zone around the subsea well.	Impractical to in force as there are no practical ways of remotely monitoring a PSZ. Consultation to date. Adding additional PSZ's creates further exclusion zones impacting on fisheries.	**Not Adopted** – Control unable to be practically implemented for subsea wells.

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
N/A	Elimination of bird deterrent usage.	Would eliminate potential impacts associated with deterring birds from the WHP.	Limits the type of bird-deterrent devices able to be used and potentially prohibits landings because the helideck integrity may be affected by bird guano and the risk of bird strike would create safety issues. Would also require mobilisation of personnel via vessel to the WHP to clean the decks, introducing safety risks to personnel due to climbing the WHP and inhalation of guano.	**Not Adopted** – Given the intermittent use and minimal risk of impacts to birds occurring, safety risk associated with personnel and helicopter use outweigh the environmental benefit.
N/A	View bird deterrent system CCTV footage directly from the VI Control Room.	Would allow real time viewing of the effectiveness of the system and interaction with birds.	Not feasible. Due to restrictions with bandwidth between the John Brookes WHP and the VI control room, live CCTV monitoring cannot be adopted. Alternatively, the John Brookes bird deterrent system will store weekly CCTV footage which will be downloaded opportunistically by personnel visiting the normally unmanned facility (VI-CW-CM-02).	**Not Adopted** – It is not feasible to implement live monitoring of the bird deterrent CCTV footage from the VI Control Room.
VI-CW-CM-56	Santos staff listed in the Santos Bird Management Plan for Offshore Platforms will be provided with information summarising the key components of the document.	Ensures personnel are aware of the deterrent system and risks to birds.	Minor administrative costs.	**Adopted –** Benefits considered to outweigh negligible costs to Santos.
VI-CW-CM-57	Bird counts,activity logs and effectiveness of the deterrent system, will be recorded during campaigns at the WHP.	Ensures the latest information about bird presence and behaviour is recorded and tracked.	Minor administrative costs.	**Adopted –** Benefits considered to outweigh negligible costs to Santos.
VI-CW-CM-58	All strikes will be reported by the helicopter operator to CASA and Santos. In addition, the helicopter operator will advise Santos of near misses and other relevant hazards.	Ensures the latest information about bird presence and behaviour is recorded and tracked.	Minor administrative costs.	**Adopted –** Benefits considered to outweigh negligible costs to Santos.

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
VI-CW-CM-59	Effectiveness of the deterrent system will be checked during campaigns at the WHP.	Ensures that the deterrent system is functioning correctly.	Minor administrative costs.	**Adopted –** Benefits considered to outweigh negligible costs to Santos.
VI-CW-CM-60	Maintenance of the acoustic bird deterrent device.	Ensures that the deterrent system is functioning correctly.	Minor administrative costs.	**Adopted –** Benefits considered to outweigh negligible costs to Santos.
N/A	Install bird netting around the entire WHP to prevent bird ingress.	May reduce the likelihood of birds resting on the WHP.	Significant logistics challenges with this measure. Loose or damaged netting would also allow birds to enter and potentially be trapped. Loose or damaged netting would have to be repaired which would require more visits to the WHP with accompanying costs and risks.	**Not Adopted** – The costs and additional risks outweigh the potential gain.
N/A	Use of lasers to deter birds	May reduce the likelihood of birds resting on the WHP.	Lasers are not included in the EPBC Permit E2020-0173. Seeking an update to the permit to include lasers has administrative costs, and given the current deterrent system is functioning correctly, changes to the permit or the deterrent system are not required.	**Not Adopted –** The costs outweigh the potential gain**.**
N/A	Tagging trackers and banding of birds to monitor behaviours and spatial distributions.	May improve the understanding of bird behaviour at the WHP.	Significant financial and logistics costs for a very low risk. The action would require more frequent visits of personnel and specialists to the WHP.	**Not Adopted -** The costs outweigh the potential gain.
N/A	Install a water jet deterrent system.	May reduce the likelihood of birds resting on the WHP.	Using seawater would be an integrity risk for the WHP equipment. Using potable water would introduce significant logistics challenges.	**Not Adopted -** The costs outweigh the potential gain.

6.6.4 Environmental Impact Assessment

The impacts and consequence ranking for interactions with other marine users are outlined in Table 6-18.

Table 6-18: Impacts and consequence ranking - Physical Presence

Receptor	Consequence Level
Threatened or migratory fauna	The physical presence of the WHP may cause birds to be attracted to the location for resting. The potential is for a negligible proportion of bird populations to be impacted.

Receptor	Consequence Level
Physical environment or habitat	Physical impacts to birds from bird-deterrent devices are not expected at an individual or population level. Deterring birds that may want to rest at the WHP is not expected to cause impacts to bird populations, and there are nearby land masses for resting.
Threatened ecological communities	
Protected areas	Commercial tourism, commercial fishing, mining and recreation are important socio-economic conservation values for the Montebello Marine Park. The values of the marine park that would be impacted by interaction with other marine users are described below and are assessed as negligible (I).
Socio-economic receptors	The impact of the VI Hub operations on socio-economic receptors are considered to be negligible (I) due to the fact that: • The operational area is not extensively fished – commercially, traditionally or recreationally – due to a lack of seafloor features. Any behavioural impacts to demersal and pelagic fishes are not considered significant due to the small scale of the infrastructure and the abundance of alternative fishing grounds. • The continued presence of permanently and temporarily abandoned wells until future planned decommissioning is not expected to significantly impact other marine users including commercial fisheries such as the Mackerel Managed Fishery, Pilbara Trap Managed Fishery and the Pilbara Line Fishery of the Pilbara Demersal Scale fish Fishery. • Tourism activities may occur around the Montebello Islands but are not expected to occur in the operational area, given the water depth (45 m to 100 m), lack of seafloor features and distance from shore. • Stakeholder consultation and a review of recent shipping data did not raise any concerns regarding disruptions to commercial shipping or other oil and gas operators.
Overall worst-case consequence	I – Negligible

6.6.5 Demonstration of as Low as Reasonably Practicable

No alternative options to the use of vessels are possible to undertake marine-based operational activities. The OPGGS Act requires the presence of a 500 m petroleum safety zone. Other navigational controls, as specified in the Navigation Act, will also be implemented (lighting, communication aids and charting). If the management controls are adhered to, then the risk of interacting with other users of the sea will have been reduced to ALARP. Wells that are temporarily and permanently abandoned are marked on nautical charts. Santos plans to decommission all permanently and temporarily abandoned wells associated with East Spar, including Rosella 1 ST2 in accordance with Santos decommissioning plan proposed for submission by Q2 2025

Santos' stakeholder consultation process is described in Section 4. Throughout the five-year duration of the EP, details of the ongoing activities have been communicated to relevant stakeholders as appropriate. In consultation, stakeholders are made aware of the proposed area from which other marine users may be excluded.

During operational activities, support vessels may assist in maintaining the 500 m petroleum safety zone around the WHP, to reduce the potential incursion by other marine users. No concerns have been raised by stakeholders regarding the potential exclusion from the proposed operational area (I – Negligible).

The potential risks of attracting birds and deterring birds using the deterrent system is reduced to ALARP through the measures listed in Section 6.6.3.

The proposed management controls for marine user interaction are considered appropriate to manage the risk to ALARP.

6.6.6 Acceptability Evaluation

Is the consequence ranked as I (Negligible) or II (Minor)	Yes – maximum interaction with other marine users consequence 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 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 – management consistent with Safety of Life at Sea (SOLAS) 1974 and Navigation Act 2012. IUCN principles of nearby reserves (Montebello Marine Park) (Multiple Use Zone – IUCN Category VI) are met (Table 3-4). The activity is consistent with conservation management plans and advice for birds (Section 3.2.4). Consistent with EPBC Act Part 13 Permit (Permit E2020 0173).
Are risks and impacts consistent with Santos' Environmental, Health and Safety 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 WHP support vessels and permanently and temporarily abandoned wells is not expected to significantly affect other marine users, including commercial fishing operations or shipping traffic, given the small petroleum safety zone (500 m), marking of the facility on navigational charts, distance from defined shipping routes and absence of any navigation hazards. A petroleum safety zone around the WHP is required under maritime legislation, and the controls proposed will ensure that other users are aware of its presence and readily able to navigate accordingly, such that potential impacts are ALARP and are considered to be environmentally acceptable.

The presence of the WHP and the use of bird deterrent measures are not predicted to cause population impacts on birds. Safety of aircraft and passengers visiting the John Brookes WHP is critical and requires management of birds to ensure the safe landing and take-off of helicopters. The potential risks to birds have been reduced to ALARP and acceptable levels and do not contravene relevant management plans and conservation advice reports.

6.7 Planned Operational Discharges

6.7.1 Description of Event

Event	Planned discharges from the John Brookes WHP to the marine environment include: • sewage and grey water • deck drainage • discharges associated with WHP maintenance activities. Planned discharges from support vessels within the operational area may include: • deck drainage • sewage and grey water • food wastes • cooling water • bilge water • ballast water • brine. Planned discharges associated with subsea infrastructure within the operational area include: • hydraulic fluid (valve operation on subsea XT and manifolds) • cathodic protection system discharges from subsea pipelines • discharges from IMMR activities (e.g., from venting or releases during removal, replacement or repair of subsea flowlines, spools, pipelines, umbilicals, wellheads (e.g., valves, chokes), pig launchers and receivers, leak testing, fabric maintenance) • paint and chemicals from cleaning, inspection and repair of infrastructure and pipelines • Discharge of permeated gas from Spar-2, Halyard & Spartan flexible flowline annulus gas release valves as designed and in accordance with Varanus Island Offshore Performance Standard Assurance Plans PS-03. There are multiple sections of flexible pipe that make up each of the Spartan, Halyard and Spar flowlines and there is a gas release valve on each section. *WHP Discharges* *Sewage and Grey Water* A long-drop toilet and hand basin is provided on the WHP for use when the WHP is manned. The toilet does not provide any form of treatment. However, use is very infrequent, and waste is discharged in accordance with Marine Order 96 (Marine pollution prevention – sewage) requirements. Deck Drainage Drainage water on offshore facilities consists of rainwater and seawater spray and may potentially contain small quantities of oil, grease and detergents if present or used on the decks. However, controls are in place to prevent, contain and clean up such spills. Deck drainage discharges from the WHP will be small volumes and intermittent and will depend on rainfall. Deck drainage from rainfall or washdown operations discharges directly to the marine environment. Assessment of the spillage of hydrocarbons and other environmentally hazardous liquids is discussed in Section 7.4 *Discharges Associated with WHP Maintenance* Typical cleaning of WHP topsides infrastructure involves using high-pressure sprayers or steam cleaning. Cleaning agents (e.g., garnet in the case of grit blasting) are transferred to the WHP and are injected into the cleaning process system. Cleaning wastes (e.g., cleaning agents and cleaning residues) are collected and transferred off the WHP. The discharge of these wastes, which could contain hazardous material (e.g., residual hydrocarbons), is considered as unplanned events in Section 7.4 *Support Vessel Discharges* *Sewage and Greywater* Depending on waste production rates and the specifications of sewage systems available, the total volume of this waste stream typically ranges between 0.04 and 0.45 m^3 per day per person. *Food Waste* Putrescible waste is estimated to consist of approximately 1 L of food waste per person per day. *Deck Drainage* As discussed above for WHP discharges. *Vessel Cooling Water* Seawater may be used by some vessels 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 temperatures may vary depending on the vessel's engines' workload and activity. *Vessel Bilge Water* While in the operational area, support vessels may discharge oily water after treatment to 15 ppm via a MARPOL-approved oily water filter system. Vessel Ballast Water Ballast water could potentially be discharged to the marine environment from support vessel ballast tanks. The primary concern from ballast discharge is the introduction of marine pest species from ballast water, which is considered an unplanned impact and is assessed in Section 7.1 *Brine* Brine generated from the water supply systems on board the support vessels will be discharged to the ocean at a salinity of approximately 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. *<u>Subsea Discharges</u>* *Hydraulic Fluid* During ongoing operations of the VI Hub subsea infrastructure, hydraulic fluid is used in the subsea control system for GES field, and Spartan. When a subsea valve is closed, due to the open loop hydraulic control system design, approximately 2L to 5L of hydraulic fluid is released to the environment (depending on the valve size). During commissioning of the Halyard-2 well, the valves on the Xmas tree may require to be closed. Consistent with ongoing operations, during these valve operations hydraulic fluid will be released to the marine environment, up to a maximum of 25L **(Section 2.7**). Normal ROV operations and valve actuation can result in small releases directly to the marine environment; for instance, when using an ROV hot stab (a hydraulic coupling) to XT or other subsea structures. During the change out or replacement of various subsea infrastructure, such as flowlines or jumpers spools, a small release of hydraulic fluid or residual hydrocarbons may occur. Unplanned discharges (i.e., spills) from marine operations are covered in Section 7.4 Hydraulic fluids are used extensively in the petroleum industry in subsea production systems. Hydraulic fluids are either petroleum or water-based blends with additives. The main properties required of a hydraulic control fluid are low viscosity, low compressibility, corrosion protection, resistance to microbiological attack, and compatibility with seawater. *Metal Ions from Cathodic Protection* Use of sacrificial anodes for cathodic protection or 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 IMMR Activities* Residual hydrocarbons, corrosion inhibitor, biocides and treated seawater are likely to enter the subsea marine environment from maintenance and other operations activities. Small volumes of treated seawater will be released into the marine environment during these activities (approximately 19 m^3). Leak testing of the subsea system may occur and result in the release of small volumes (estimated at less than 50 mL) of fluorescein dye. Integrity testing of subsea infrastructure can result in a methane gas bleed off. Brine (NaCl) may also be released during this activity in small volumes. Non-routine work on subsea systems may require opening of the system (e.g., for the repair or replacement of equipment). This type of work occurs infrequently, typically every few years. Prior to work involving opening of the subsea system, hydrocarbons are flushed towards the VI processing plant with seawater containing chemicals (biocide) used to preserve the system. By opening the existing system or replacing infrastructure during upgrade 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, although the flushing process is designed to reduce the amount of hydrocarbons left in the system to as low as reasonably practicable. Biocides are used at a concentration required for effective preservation of the subsea system (typically 200 to 1,000 ppm). 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 it is typically in the order of 2 m3. As with replaced equipment or infrastructure, new equipment or infrastructure may also be dosed with biocide (e.g., biocide sticks) prior to hook up to the existing facility. Chemicals planned for use and discharge to the marine environment are selected and assessed using Santos' Operations Chemical Selection Evaluation and Approval Procedure. *Subsea Cleaning* The removal of corrosion, external coating or marine growth from subsea infrastructure during cleaning releases inert materials and marine growth into the marine environment that will either fall to the seabed floor or be dispersed with the prevailing currents.

	Subsea cleaning may require the use of acid wash chemicals to assist in calcareous marine growth removal. Chemicals will be selected for use during this activity in accordance with Santos' Operations Chemical Selection Evaluation and Approval Procedure.
Extent	Localised: Within the area around the discharge points and in the direction of the prevailing current in surface waters.
Duration	During the operational life of the activity localised impacts to water quality will occur.

6.7.2 Nature and Scale of Environmental Impacts

Potential receptors include:

- physical environment (water quality, benthic habitats, shoals and banks, offshore reefs and islands)
- threatened or migratory fauna (sharks, fish, and rays, marine mammals, marine turtles and seabirds)
- protected and significant areas (marine parks).

6.7.2.1 Physical Environment

A number of planned discharges to the marine environment will be required for the continued operation of the VI Hub (as outlined in Section 6.7.1). Planned non-hazardous discharges will be small in volume, with volumes dependent on a range of variables. The discharge of non-hazardous wastes to the marine environment will result in a localised reduction in water quality. This would be expected to be temporary (minutes to hours) and localised. 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 non-hazardous wastes are as follows.

6.7.2.1.1 Eutrophication impacts from sewage, grey water and putrescible wastes.

The discharges of treated sewage and grey water can result in localised increases in nutrient concentrations (e.g., ammonia, nitrite, nitrate and orthophosphate), organics (e.g., volatile and semi-volatile organic compounds, oil and grease, phenols and endocrine-disrupting compounds) and inorganics (e.g., hydrogen sulphide, metals and metalloids, surfactants, phthalates and residual chlorine). Increased biological oxygen demand on the receiving waters may promote localised elevated levels of phytoplankton and bacteria activity due to nutrient inputs.

However, dispersion and dilution of discharges is expected to be rapid, as the discharges are of low volume (temporary and intermittent vessel use); the discharges are subject to biodegradation of organics through bacterial action, oxidation and evaporation; and the operational area is located in deep offshore waters dominated by swift currents, resulting in short-term changes to surface water quality within the operational area.

Food scraps may be discharged by support vessels on an infrequent basis during their time of operation in the field. Given the small quantities, intermittent nature of disposal and swift currents, no deleterious water quality impacts are predicted that could arise from addition of food wastes (e.g., bacterial loading, dissolved oxygen reduction).

The discharge of sewage, grey water and putrescible wastes is not expected to contact nearby offshore reefs, islands, shoals or banks.

6.7.2.1.2 Salinity increases

The desalination of seawater results in a discharge of brine with a slightly elevated salinity (around 10% higher than seawater). On discharge to the sea, the desalination brine, being of greater density than seawater, is expected to sink and disperse in the currents. On average, seawater has a salt concentration of 35,000 ppm. The volume of the discharge depends on the requirement for fresh (or potable) water and the number of people on board.

Given the relatively low-volume, temporary and intermittent nature of brine discharges from support vessels and the deep, open water surrounding the vessels, impact on water quality in the operational area is expected to be low and short term.

The brine discharge is not expected to contact nearby offshore reefs, islands, shoals or banks.

6.7.2.1.3 Changes in temperature

Cooling water will be discharged 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 CT 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 contributing to benthic ecosystems. Given the relatively low volume of cooling water, the low temperature differential, and the deep, 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 nearby offshore reefs, islands, shoals or banks.

6.7.2.1.4 Contamination from releases of bilge water

Discharges of oily bilge water could result in a localised reduction in water quality with impacts on protected marine fauna and plankton. However, oily water discharged from vessels will be treated to a concentration of less than 15 ppm before release, in accordance with the requirements of Marine Order 91 (Marine pollution prevention – oil), which will be unlikely lead to any impacts to the receiving environment. The concentration and dosage within surface waters is expected to be very low and toxic impacts to water quality and benthic habitats would be on a negligible scale.

6.7.2.1.5 Contamination from discharges associated with IMMR activities

Discharges from IMMR may occur at or near to the seabed. Therefore, benthic habitats may be exposed to changes in water quality. Discharges to the physical environment associated with IMMR activities include residual hydrocarbons, treated seawater, dye (for leak testing), hydraulic fluids and residual subsea cleaning products (as outlined in Section 6.7.1). Any impact due to discharges associated with IMMR activities will depend upon the toxicity of the chemical, the concentration of chemicals and residual hydrocarbons within the subsea system, the volume and duration of release. The potential impacts associated with discharges associated with IMMR activities such as may result in a localised and temporary (hours) reduction in water quality during the activity, but this will be short term and infrequent.

The removal of paint or external coating and marine growth from infrastructures releases inert materials and fouling organisms into the marine environment which will either fall to the seabed floor or be dispersed with the prevailing currents. Inert material is not expected to have any impact on the marine environment. These activities are carried out infrequently and are not expected to affect the marine environment.

The use of sacrificial anodes for cathodic protection/corrosion prevention continually releases metal ions (typically aluminium and zinc) into the marine environment at an extremely low rate. The release of low levels of metal ions is not known to have any detectable impacts to the physical environment.

As the subsea infrastructure is located in an open oceanic environment where currents would quickly dilute and disperse the planned discharges, and the activities are infrequent (subsea inspection/testing is typically on scale of a year or multiple years between events), it is not expected that impacts to the physical environment will occur.

6.7.2.1.6 Contamination from discharge of permeated gas

Permeated gas will be released to the marine environment at the seabed. As described in Section 2.5.2.4 and 2.6, each flexible flowline is made up of multiple sections. Each section of the flexible pipe's end fittings contains gas release valves which release hydrocarbon gas that has permeated through the pressure sheath into the annulus. The frequency of the gas release valve releases varies depending on the flexible section operating pressure, temperature and pressure sheath material. Some gas release valves will be venting very regularly (every 5-10 seconds), whilst other gas release valves may only vent every few hours. The volumes are as identified in Table 6-19. Table 6-6 The flow rates used to calculate the emissions forecasts are based on permeation through the fluid barrier at maximum operating conditions, ie the most conservative operating pressure and temperature.

The fugitive emissions forecast presented in Table 6-6 is unchanged as a result of these gas release valve emission estimates. As per NGERs calculation methods, fugitive emissions are calculated based on throughput multiplied by a factor.

The estimated release volumes over the life of the EP represent 3.6% of Scope 1 offshore emissions and 0.01% of VI Hub emissions overall. As the subsea infrastructure is located in an open oceanic environment where currents would quickly dilute and disperse the planned discharges, it is not expected that impacts to the physical environment will occur.

Table 6-19: Forecast of greenhouse gas emissions from gas release valves across all flowlines

Scope	Activity/Source	Flowline	CO2-e (tonnes)			
			2024	2025	2026	2027
1	Fugitive emissions	Spartan	120	120	120	120
		Spar	0	100	0	0
		Halyard	0	600	570	0
		Sub-total	120	820	690	120
		Total	1630			

6.7.2.1.7 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 deep waters ranging from 45 m to 110 m. Marine fauna within the operational area are likely to be transient. 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 exposure time may not be of sufficient duration to cause a toxic effect.

The Recovery Plan for Marine Turtles in Australia (2017–2027) identifies chemical discharge as a threat to marine turtle stocks. However, toxicity impacts to marine fauna from the planned release of chemically dosed water or leak testing are unlikely to eventuate because:

- The fluids will be risk assessed for their suitability for discharge to the marine environment prior to use.
- Flowlines will be flushed to ensure residual hydrocarbons are at or below 30 ppm prior to disconnection. Given oil in water concentration at or below 30 ppm and the potential volumes released, the potential impacts to the marine environment are negligible (the potential impacts associated with hydrocarbons released to the marine environment are discussed in Section 7.5 to 7.9).
- Strong ocean currents mean that treated seawater will become further diluted upon discharge, so the duration of exposure of chemicals to fauna will be minimal.
- Any increased in biological oxygen demand is not anticipated to have an impact on benthic habitats as the habitat is mainly bare sand.
- Potential discharges will be localised and temporary within the operational area.

Brine discharges may increase local salinity levels on a short-term basis. Most marine species are able to tolerate short-term fluctuations in salinity in the order of 20 to 30% (Walker & 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. Therefore, it is expected that any marine fauna passing through the impacted area would not experience any adverse impacts.

Other planned discharges may cause changes to behaviour in marine fauna (i.e., 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.

6.7.2.1.8 Protected and significant areas

The operational area intersects the Montebello Australian Marine Park (Multiple Use Zone – IUCN Category VI). All conservation values of the marine park (as outlined in Section 3.2.3) have the potential to be impacted by planned operational discharges through impacts to the physical environment and marine fauna.

Impacts to the physical environment and marine fauna are discussed in the sections above. Planned operational discharges are not expected to significantly impact the conservation values of the Montebello AMP.

6.7.3 Environmental Performance Outcomes and Control Measures

The EPOs relating to this event include:

- Manage impacts to air and water quality from planned discharges and emissions from operational activities (EPO-VI-CW-03).

The control measures considered for this event are shown in Table 6-20, and environmental performance standards and measurement criteria for the EPOs are described in Table 8-2.

Table 6-20: Control measure evaluation for planned operational discharges

Control Measure Ref. No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls				
Sewage				
VI-CW-CM-28	Sewage system.	Reduces potential impacts of inappropriate discharge of sewage. Provides compliance with Marine Order 96 (Marine pollution prevention – sewage).	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 vessel is compliant outweigh the minimal costs of personnel time and it is a legislated requirement.
Oily mixtures (bilge)				
VI-CW-CM-29	Oily mixture system.	Reduces potential impacts of planned discharge of oily water to the environment. Provides compliance with Marine Order 91 (Marine pollution prevention – oil).	Additional time and personnel costs in maintaining oil record book.	**Adopted** – Benefits of ensuring vessel is compliant outweigh the minimal costs of personnel time and it is a legislated requirement.
VI-CW-CM-30	Offshore platform deck drain system and bunding.	Reduces potential for oily residue within deck drainage to reach the marine environment.	Operational costs and labour or access requirements of undertaking facility maintenance.	**Adopted –** Benefits of operating equipment within operational parameters will help prevent leaks.
Waste management				
VI-CW-CM-31	Garbage management.	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 premobilisation 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.
Chemical selection and management				
VI-CW-CM-32	Deck cleaning and product selection.	Improves water quality discharge (reduced toxicity) to the marine environment. Those deck cleaning products planned to be released to sea meet the criteria for not being harmful to the marine environment according to MARPOL Annex V.	Personnel costs of implementing, potential additional cost and delays of chemical substitution.	**Adopted** – Benefits of ensuring vessels are compliant and those deck cleaning products planned to be released to sea meet MARPOL criteria.
VI-CW-CM-33	Chemical selection procedure.	Aids in the process of chemical management that reduces the impact of liquid discharges to sea. Only environmentally	Cost associated with implementation of procedure. Range of chemicals reduced with potentially higher	**Adopted** – Environmental benefit of using lower toxicity chemicals outweigh procedural implementation costs.

Control Measure Ref. No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
		acceptable products are used.	costs for alternative products.	
Subsea discharge management				
VI-CW-CM-34	Pipeline flushing prior to opening of subsea system.	Production fluids (hydrocarbons) will be flushed through with treated water to Varanus Island prior to opening of the subsea system during maintenance activities. Reduces the toxicity of chemicals and residual hydrocarbons in subsea infrastructure before any release to sea during IMMR activities.	Additional costs and time taken to flush pipeline.	**Adopted** – Environmental benefits of flushing outweigh the associated costs.
Additional Controls				
N/A	Scupper plugs on support vessels are continuously in place to prevent deck drainage.	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).	**Not Adopted –** Safety considerations outweigh the benefit given the small volumes of contaminants.
N/A	Mandatory closed-drain system on support vessels to prevent deck drainage discharged overboard.	Would prevent the release of deck spills to sea and therefore minimise 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), increase in crane movements.	**Not Adopted** – Cost outweighs the benefit given the low impact expected from planned discharges and high potential impacts from risk transfer.
N/A	Discharge point for cooling water discharges, restricted to above sea level to allow it to cool further before mixing at sea surface.	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, reduction in temperature would be minimal compared to cost of altering the discharge height.	**Not Adopted** – Cost outweighs the benefit given the low impact expected from planned discharges and high potential impacts from risk transfer.
N/A	Store liquid wastes and transport to land.	No discharge to the marine environment.	This would result in an increase in environmental impacts through increased fuel consumption and increased atmospheric	**Not Adopted** – This would result in an increase in environmental impacts.

Control Measure Ref. No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
			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	

6.7.4 Environmental Impact Assessment

The impact and consequence ranking for planned operational discharges are outlined in Table 6-21

Table 6-21: Impact and consequence ranking- planned operational discharges

Receptor	Consequence Level
Operational discharges	
Threatened or migratory fauna	Minor behavioural changes may occur to threatened or migratory fauna, which will be short term, localised and intermittent. Only marine fauna present within the discharge mixing zone are expected to be exposed. Given the nature of planned discharges, the small volumes that could be released to the marine environment, the high levels of dilution and the nature of the marine environment in the vicinity of the operational area, impacts to threatened or migratory fauna are expected to be negligible (I).
Physical environment or habitat	Planned operational discharges may result in minor, temporary impacts to water quality and benthic habitat in the immediate vicinity of the discharge mixing zone. The implementation of the key management controls, as outlined in Section 6.7.3 will minimise the area influence by planned operational discharges. Given the nature of the planned operational discharges, the small volumes that could be released to the marine environment, the high levels of dilution and the nature of the marine environment in the vicinity of the operational area, impacts to the physical environment and habitat are expected to be negligible (I).
Threatened ecological communities	Not applicable – No threatened ecological communities identified in the area over which operational discharges are expected.
Protected areas	The operational area intersects the Montebello Marine Park (Multiple Use Zone – IUCN Category VI). The objective is to provide for ecologically sustainable use and the conservation of ecosystems, habitats and native species. The values of the marine park, with respect to the presence of marine species (receptors) and water quality are described above and are assessed as negligible (I).
Socio-economic receptors	Not applicable – No planned operational discharges will occur within areas known to be utilised by third-party operators or for tourism and recreation. No impacts to fish stocks are expected to occur; therefore, there is no conceivable impact to commercial, traditional or recreational fisheries.
Overall worst-case consequence level	I-Negligible

6.7.5 Demonstration of as Low as Reasonably Practicable

Santos uses a risk-based approach to selecting chemical products ranked under the Offshore Chemical Notification Scheme (OCNS). Central to the fluid selection process is the use of the OCNS. This scheme lists and ranks all chemicals used in the exploration, exploitation, and associated offshore processing of petroleum on the UK Continental Shelf. Santos uses chemicals with the least environmental impact, as determined under the OCNS ranking as a Gold and Silver for chemicals that can be ranked using the chemical hazard and risk management

(CHARM) model, or E and D for chemicals not applicable to the CHARM model (i.e., inorganic substances, hydraulic fluids or chemicals used only in pipelines).

The OCNS system uses the ecotoxicity data for offshore chemical products to assess the potential environmental risk in the marine environment. The least environmentally hazardous grade is Gold (CHARM assessed) and E (through a non-CHARM assessment). The OCNS system requires bioaccumulation and biodegradation data and aquatic toxicity data from three trophic levels (algae, crustaceans and fish) to predict the potential ecosystem risk and, in turn, rank the product by hazard quotient.

Santos' Chemical Selection Procedure for Operational Activities in Commonwealth Waters (EA-91-II-10001) require that chemicals for use and discharge are CHARM rated Gold/Silver, or non-CHARM rated E/D. To achieve these rankings, the chemicals have the least environmental impact in terms of ecotoxicity, biodegradation and bioaccumulation. If they are not highly rated (Gold/Silver/D/E) and no alternative is available, a risk assessment is conducted providing justification for their use. Any chemicals which are not OCNS CHARM or non-CHARM-able rated are risk assessed through the procedure to provide for a product that is environmentally acceptable for discharge to the marine environment. All flushing and pipeline testing chemicals used for operational activities will conform to the Santos existing chemical selection procedure with all chemicals identified and assessed by the Santos Environment Department prior to commencement of the activity.

IMMR discharges and vessel operational activities cannot be eliminated. Onboard treatment of most wastes and their subsequent discharge to the marine environment is considered to be the most environmentally sound method of disposal, considering that the waste streams will either be treated to a level unlikely to cause significant environmental harm or will be of a nature not considered to pose significant risk to the receiving environment and will meet legislated requirements where they are applicable. The proposed management controls for planned operational discharges are considered appropriate to manage the risk to ALARP.

6.7.6 Acceptability Evaluation

Is the consequence ranked as I (Negligible) or II (Minor)	Yes – maximum planned operational discharge consequence is rated 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 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 – 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. IUCN principles of nearby reserves (Montebello Marine Park) (Multiple Use Zone – IUCN Category VI) are met (Table 3-4).
Are risks and impacts consistent with Santos' Environmental, 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

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.

Deteriorating water quality is identified as a potential threat to turtles in the Recovery Plan for Marine Turtles in Australia (DoEE, 2017) (Table 3-7). However, with the management controls proposed, the operational discharges are not expected to significantly impact the receiving environment because they will be temporary and intermittent in a dispersive open-ocean environment. Therefore, the activities will be result in an acceptable level of impact.

6.8 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 spill response operations or actions have been assessed as planned events in this section.

6.8.1 Description of Event

Event	In the event of a hydrocarbon spill, response strategies will be implemented where possible to reduce environmental impacts to ALARP. The selection of strategies will be undertaken through the net environmental benefit analysis (NEBA) process and evaluation of response strategies outlined in the OPEP. Spill response will be under the direction of the relevant Controlling Agency, as defined in Section 2.2 of the OPEP, which may be Santos or another agency. In all instances, Santos will undertake a 'first-strike' spill response and will act as the Controlling Agency until the designated Controlling Agency assumes control. The response strategies considered to be appropriate for the worst-case oil spill scenarios identified for the activity are detailed in Section 6.1 of the OPEP and comprise: • source control • monitoring and evaluating • 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 upon which poor decisions can be made, 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	Extent of spill
Duration	As required

6.8.2 Nature and Scale of Environmental Impacts

Potential receptors include:

- physical environment
- threatened or migratory fauna
- protected and significant areas
- socio-economic receptors

Given that spill response operations will be within offshore waters and will use vessels and aircraft, the types of impacts are consistent with vessel and aircraft operations described in this EP for routine operations. Details of these environmental impacts and risks for spill response operations are provided in Table 6-22

Table 6-22: Detailed description of the environmental impacts and risks for the activities – spill response operations

Light Emissions	
Spill response activities will involve the use of vessels, which 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, which may require lighting.	
Potential receptors	• Fauna (including threatened or migratory fauna) • Protected areas

Light Emissions	
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 6.2 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. Lighting impacts to fauna are not considered to have the potential to impact supported industries such as tourism.	
Acoustic disturbance	
Spill response activities will involve the use of aircraft and vessels, which 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 clean-up of shorelines (e.g., pumps and vehicles), for accessing shoreline areas (e.g., vehicles) and for supporting temporary camps (e.g., diesel generators).	
Potential receptors:	• Fauna (including threatened or migratory fauna) • Protected areas
Underwater noise from the use of vessels may impact marine fauna, such as fish (including commercial species), marine reptiles and marine mammals, in the worst instance causing physical injury to hearing organs but more likely causing short-term behavioural changes, e.g., temporary avoidance of the area, which may impact key lifecycle processes (e.g., spawning, breeding, calving). Underwater noise can also mask communication or echolocation used by cetaceans. Section 6.1.2 provides further detail on these impacts from vessels and helicopters. Cetaceans have been identified as the key concern for vessel noise within the EMBA. The humpback migration BIA and the pygmy blue whale migration and pygmy blue whale foraging BIAs are all within the EMBA. Spill response activities using vessels have the potential to impact fauna in protected areas, which may impact on the conservation values of the protected areas. This includes the Ningaloo Marine Park recreational use zone and the Australian marine parks identified in Table 3-3. Noise and vibration from terrestrial activities on shorelines has the potential to cause behavioural disturbance to coastal fauna, including protected seabirds and turtles. Shoreline activities involving the use of noise-generating equipment may take place in important nesting areas for turtles and roosting and feeding areas for shorebirds.	
Atmospheric Emissions	
The use of fuels to power vessel engines, generators and mobile equipment used during spill response activities will result in emissions of greenhouse gases (GHGs), such as carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O), along with non-GHGs such as sulphur oxides (SOX) and nitrogen oxides (NOx). Emissions will result in a localised decrease in air quality.	
Potential receptors:	Physical environment of habitat (air quality)
Atmospheric emissions from spill response equipment will be localised; and the use of mobile equipment, vessels and vehicles is not considered to create emissions on a scale where noticeable impacts would be predicted.	
Operational Discharges and Waste	
Operational discharges include those routine discharges from vessels used during spill response, which may include: • 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 and putrescible and municipal waste at camp areas • creation, storage, transport and disposal of oily waste and contaminated organics.	

Light Emissions	
Potential receptors:	• Fauna (including threatened or migratory fauna) • Physical environment or habitat • Protected areas

Operational discharges from vessels may create a localised and temporary reduction in marine water quality. Effects include nutrient enrichment, toxicity, turbidity, and temperature and salinity increases, as detailed in Section 6.7Vessel discharges may occur in shallower coastal waters during spill response activities than that described in Section 6.7. Discharge could potentially occur adjacent to marine habitats, such as corals, seagrass and macroalgae, and in protected areas (i.e., receptors anywhere within the EMBA), which support a more diverse faunal community; however, discharges will be very localised and temporary.

Cleaning of oil-contaminated equipment, vehicles and vessels has the potential to spread oil from contaminated areas to areas not impacted by a spill, potentially spreading the impact area and moving oil into a more sensitive environment.

Flushing of oil from shoreline habitats is a clean-up technique designed to remove oil from the receptor that has been oiled and remobilise it back into the marine environment. It results 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 and putrescible 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 of the environment, which may be within protected areas. The creation, storage, transport and disposal of oily waste and contaminated organics has the potential to spread impacts of oil to areas, habitats and fauna not previously contaminated. Sewage and putrescible and municipal waste generated onshore will be stored and disposed of at approved locations.

Physical presence and disturbance

The movement and operation of vessels, vehicles, personnel and equipment; the undertaking of clean-up activities; and the set-up of temporary camp areas during spill response activities have the potential to disturb the physical environment and marine and coastal habitats and fauna, which may occur within protected areas. Vessel movement and transportation 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, transportation and release of wildlife, which could lead to additional impacts to wildlife.

Potential receptors:	• Fauna (including threatened or migratory and 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 booms and from grounding. Vessel use in shallow coastal waters also increases the chance of contact with or physical disturbance of 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 feeding.

Vehicles, equipment, personnel and cleaning activities during shoreline response activities have the potential to damage coastal habitats, such as dune vegetation, mangroves and habitats important to threatened and migratory fauna, including nests of turtles and birds and bird roosting and 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 coastal species, such as shorebirds and turtles, and could potentially interfere with nesting and feeding behaviours.

Oiled wildlife response may include the hazing, capture, handling, cleaning, rehabilitation, 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 responses can potentially create additional stress and exacerbate impacts from oiling, interfere with lifecycle processes, hamper recovery and, in the worst instance, increase levels of mortality.

Impacts and risks from invasive marine species are described in Section 7.1and are not described further in this section. Impacts from invasive terrestrial species are similar in that the invasive species (e.g., weeds) 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, may occur in specially protected areas and may have flow on impacts to the tourism industry.

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.

Light Emissions	
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 the 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 industries such 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.	

6.8.3 Environmental Performance Outcomes and Control Measures

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 6-24

Table 6-24: 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.
Acoustic Disturbance			
Vessels and aircraft compliant with Santos' Protected Marine Fauna Interaction and Sighting Procedure.	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.
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 meets 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).

Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
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.	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.
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.
Engage advice of Heritage Advisor if spill response activities overlap with potential areas of cultural significance.	Reduce disturbance to culturally significant sites.	Operational costs associated with Heritage Advisor engagement services, if required.	**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.

6.8.4 Environmental Impact Assessment

The impact and consequence ranking for spill response operations are outlined in Table 6-24

Table 6-24: Impact and consequence ranking- Spill response operations

Receptor	Consequence Level
Spill Response Operations-Light Emissions	
Threatened, migratory or local fauna Physical environment or habitat Socio-economic receptors Threatened ecological communities Protected areas	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, Ningaloo), 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 I-Negligible.
Overall worst-case consequence	I-Negligible
Spill Response Operations-Acoustic Disturbance	
Threatened, migratory or local fauna Physical environment or habitat Threatened ecological communities Protected areas	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 to 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, a temporary behavioural disturbance is expected only with a consequence of I-Negligible.
Socio-economic receptors	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, Barrow Island and the Ningaloo coast. 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 I-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 I-Negligible.
Overall worst-case consequence level	I-Negligible
Spill Response Operations-Atmospheric Emissions	
Threatened, migratory or local fauna Physical environment or habitat Threatened ecological communities Protected areas Socio-economic receptors	Atmospheric emissions from spill response equipment will be localised; and impacts to even the most sensitive fauna, such as birds, are expected to be Negligible. Because of the emissions will be localised and low level, impacts to protected area values, physical environment and socio-economic receptors are predicted to be I-Negligible.
Overall worst-case consequence level	I-Negligible
Spill Response Operations-Operational Discharges and Waste	
Threatened, migratory or local fauna Physical environment or habitat Threatened ecological communities	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.

Receptor	Consequence Level
Protected areas	As a consequence of impacts to fauna, operational discharges from vessels have 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.
Socio-economic receptors	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.
Overall worst-case consequence level	I-Negligible
Spill Response Operations- Physical Presence and Disturbance	
Threatened, migratory or local fauna Physical environment or habitat Threatened ecological communities Protected areas Socio-economic Receptors	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 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 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 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 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 Physical environment or habitat	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

Receptor	Consequence Level
Threatened ecological communities	considered that the additional impact of spill response activities on affected industries would be Minor.
Protected areas	
Socio-economic receptors	
Overall worst-case consequence level	
Threatened, migratory or local fauna	II-Minor

6.8.5 Demonstration of as Low as Reasonably Practicable

A net environmental benefit analysis (NEBA) is the primary tool used during spill response to evaluate response strategies and has the goal of selecting strategies that result in the least net impact to key environmental sensitivities. The NEBA process will identify and compare net environmental benefits of alternative spill response options. The NEBA will effectively determine whether an environmental benefit will be achieved through implementing a response strategy or by undertaking no response. The NEBA will be undertaken by the relevant Controlling Agency for the activity. For those activities under the control of Santos, the Incident Management Team (IMT) Environmental Team Leader will be responsible for reviewing the priority receptors and selected response strategies identified in the OPEP and coordinating the NEBA for each operational period. This will demonstrate that, at the strategy level, the response operations reduce additional environmental impacts to ALARP.

Spill response activities will be conducted in offshore and coastal waters using vessels and aircraft. The greatest potential for additional impacts from implementing spill response is considered to be on wildlife in offshore waters from oiled wildlife response activities and to shoreline habitats and fauna receptors within shallow waters or on shorelines from nearshore booming and shoreline clean-up activities.

Given the types of activities considered appropriate for responding to a worse-case spill and the scale of operations, 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 Controlling Agency for spill response and applying the appropriate processes and standards, e.g., for oiled wildlife response as included within the WA Oiled Wildlife Response Plan and Pilbara Regional Oiled Wildlife Response Plan.

Santos considers the actions prescribed in the Recovery Plan for Marine Turtles in Australia 2017–2027 (DoEE, 2017) and approved conservation advices for other threatened fauna (Table 3-7) relevant to spill responses for the activities to minimise noise and light impacts on cetaceans and marine turtles. The proposed event will not result in significant impacts on these species, and implementation of identified control measures is in line with the relevant conservation advices and recovery plans. Pollution events (such as hydrocarbon spills) could impact on fauna (as described in Sections7.4 to 7.9), 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 6.8.3 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 disproportionate costs. It is considered therefore that the impact of the activities conducted are acceptable and ALARP.

6.8.6 Acceptability Evaluation

Is the consequence ranked as I or II?	Yes – maximum consequence is II (Minor) from planned events.
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?	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 – IUCN principles of nearby reserves are met (Table 3-4). Controls implemented will minimise the potential impacts from the activity to species identified in recovery plans and conservation advices as having the potential to be impacted by spill response operations, with the key objective to minimise extent and impact of a release scenario.

Are risks and impacts consistent with Santos' Environmental Management Policy?	Yes – aligns with Santos' Environment, Health and Safety Policy.
Are risks and impacts consistent with stakeholder expectations?	Yes – no concerns raised. During any spill response, a close working relationship with relevant regulatory bodies (e.g., DoT, DBCA, AMSA) 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 (DPAW, 2014a) and Pilbara Regional Oiled Wildlife Response Plan (DPAW, 2014b).
Are performance standards such that the impact or risk is considered to be ALARP?	Yes (see ALARP above).

The implementation of spill response activities to reduce the potential impacts from a spill are required by legislation. The spill response options selected have been demonstrated to show a net environmental benefit, are standard industry practice and are consistent with relevant standards and guidelines, including the National Plan for Maritime Environmental Emergencies (AMSA, 2019). No concerns from stakeholders have been raised regarding response activities, and the controls proposed reduce the consequences of the potential impacts to minor (B) and ALARP. The controls used during spill response activities are therefore considered to reduce additional impacts to an acceptable level.

7. Environmental Assessment for Unplanned Events

OPGGSER 2023 Requirements
Regulation 21. Environmental assessment.
Evaluation of environmental impacts and risks 21(5) The environment plan must include: a. details of the environmental impacts and risks for the activity, and b. an evaluation of all the impacts and risks, appropriate to the nature and scale of each impact or risk, and c. details of the control measures that will be used to reduce the impacts and risks of the activity to as low as reasonably practicable and an acceptable level. 21(6) To avoid doubt, the evaluation mentioned in paragraph (5)(b) must evaluate all the environmental impacts and risks arising directly or indirectly from: a. all operations of the activity, and b. potential emergency conditions, whether resulting from accident or any other reason. Environmental performance outcomes and standards 21(7) The environment plan must: a. set environmental performance standards for the control measures identified under paragraph (5)(c), and b. set out the environmental performance outcomes against which the performance of the titleholder in protecting the environment is to be measured, and c. include measurement criteria that the titleholder will use to determine whether each environmental performance outcome and environmental performance standard is being met.

Santos' environmental assessment identified eight potential sources of environmental risks associated with unplanned events for this activity. The results of the environmental assessment 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 are detailed in the following subsections.

The following unplanned event was considered to not be a credible scenario and is not discussed further in this section:

- Hydrocarbon spill due to vessel grounding.

Vessel grounding can occur due to a loss of propulsion or to navigational error resulting in the vessel running aground in shallow areas. Vessel grounding and subsequent fuel tank rupture were not considered a credible scenario for this activity because the operational area is situated in deep water and there are no charted reefs or islands that could pose a grounding hazard in the operational area.

Table 7-1: Summary of the risk assessment ranking for unplanned activities

EP Section Reference	Event	Consequence	Likelihood	Residual Risk Level
7.1	Introduction of invasive marine species	IV	a	Low
7.2	Marine fauna interaction	III	b	Low
7.3	Release of solid objects	I	e	Low
7.4	Hazardous liquid releases	I	d	Low
7.6	Surface release of condensate from wellheads at the John Brookes WHP	IV	b	Low
7.7	Subsea release of condensate from a subsea pipeline	III	a	Very Low
7.8	Subsea release of condensate from wellheads (Halyard-2/Spar-2/Spartan-2)	III	a	Very Low
7.9	Surface release of diesel (vessel collision, bunkering, dropped object)	II	a	Very Low

7.1 Introduction of Invasive Marine Species

7.1.1 Description of Event

Aspect	Introduction of invasive marine species may occur due to: • biofouling on support vessels and external/internal (e.g., sea chests, seawater systems) niches • biofouling on equipment that is routinely submerged in water (e.g., mooring lines, ROVs) • discharge of high-risk ballast water • cross contamination between vessels. Once established, IMS introduced marine species have the potential to out-compete 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 include:

- physical environment (shoals and banks, benthic habitats, offshore reefs and islands), threatened/migratory fauna (marine mammals, marine reptiles, sharks, fish and rays)
- protected and significant areas (marine parks)
- socio-economic receptors (fisheries, tourism and recreation).

Invasive marine species (IMS) are marine plants, animals and algae that have been introduced into a region that is beyond their natural range but that have the ability to survive and possibly thrive (DAFF, 2011). The majority of climatically compatible IMS to the North West Shelf 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 (DAFF, 2011; Wells et al., 2009). IMS can cause a variety of adverse effects in a receiving environment, including:

- over-predation of native flora and fauna
- displacement of native marine species
- outcompeting of native flora and fauna for food
- depletion of viable fishing areas and aquaculture stock
- reduction of coastal aesthetics.

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.

It is recognised that artificial, disturbed and/or polluted habitats in tropical regions are susceptible to invasive marine species introductions, which is why ports are often areas of higher IMS risk (Neil et al., 2005). However, in Australia there are limited records of detrimental impact from IMS compared to other tropical regions (such as the Caribbean). Following their establishment, eradication of IMS populations is difficult, limiting management options to ongoing control or impact minimisation. Case studies in Australia indicate that, from detection to eradication, this can take approximately four weeks (Bax et al., 2003). 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. 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). The potential biofouling risk presented by vessels will relate to the length of time that these vessels have already been operating in Australian waters or, if they have been operating outside Australian waters, the locations of the operations they have been undertaking, the length of time spent at these locations, and whether the vessels have undergone hull inspections, cleaning and application of new anti-foulant coating prior to returning to operate in Australia.

The risk of introducing IMS is limited by the location of the VI Hub operations in deep (45 m to 110 m), offshore waters that are not directly adjacent to any shoals or banks. IMS are generally unable to establish in deep water ecosystems (Geiling, 2014), most likely due to a lack of light or suitable habitat to sustain their growth and survival.

Most IMS are found in tidal and subtidal zones, with only a few species known to extend into deeper waters of the continental shelf (Bax et al., 2003). Further, it is known that highly disturbed environments (such as marinas and jetties) are more susceptible to colonisation than open-water environments where the number of dilutions and the degree of dispersal are high (Paulay et al., 2002).

7.1.3 Environmental Performance Outcomes and Control Measures

The EPOs relating to this event include:

- No introduction of marine pest species (EPO-VI-CW-06).

The control measures for this event are shown in Table 7-2, and the environmental performance standards and measurement criteria for the EPOs are described in Table 8-2.

Table 7-2: Control measure evaluation for the introduction of invasive marine species

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls				
VI-CW-CM-35	Implementation of the management controls within the Santos Invasive Marine Species Management Plan.	The risk of introducing IMS is reduced due to assessment procedure.	Personnel costs involved in risk assessing vessels in accordance with the management plan. Costs associating with reducing the vessel risk to 'low' (e.g., 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.
VI-CW-CM-36	Current anti-foulant system.	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 unavailability 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.
VI-CW-CM-37	Ballast water management.	Reduces the risk of introducing IMS through procedures managing ballast water exchange and identifying high-risk ballast water.	Personnel costs in producing and implementing ballast water management and in maintaining record books and logs.	**Adopted** – Minimal personnel costs are considered outweighed by the benefits of reducing the risk of IMS and it is a legislated requirement.
Additional Controls				
N/A	Heat treatment of ballast water to eliminate IMS.	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.	**Not Adopted** – 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,	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/Commonwealth	**Not Adopted** – Not feasible.

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
	State or Commonwealth waters to reduce potential for IMS.		waters; therefore, work could not be completed.	
N/A	Mandatory dry docking of vessels prior to entering field to clean vessel and/or equipment and remove biofouling.	Ensure that no IMS are present on vessel or associated equipment.	Significant cost (grossly disproportionate to the risk) would lead to scheduling delays.	**Not Adopted –** Costs disproportionately high compared to environmental benefit given other controls in place already reduce the risk.
N/A	Utilise an alternative ballast system to avoid uptake and discharge of water in vessels.	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, therefore would require modification at significant cost.	**Not Adopted** – Cost disproportionately high compared to environment benefit.
N/A	Zero discharge of ballast water.	Would reduce the potential for IMS by implementation of no ballast water exchange policy on support vessels.	Ballast water exchange required on the support vessels for stability.	**Not Adopted** – On the basis that ballast water exchange is a safety-critical activity for marine operations.

7.1.4 Environmental Impact Assessment

The impact, likelihood and consequence ranking for the introduction of IMS are outlined in Table 7-3

Table 7-3: Impact, likelihood and consequence ranking – introduction of invasive marine species

Consequence Level	
Receptors	• Physical environment (shoals and banks, benthic habitats, offshore reefs and islands) • Threatened or migratory fauna (marine mammals, marine reptiles, sharks, fish and rays) • Protected and significant areas • Socio-economic receptors (marine parks, fisheries, tourism and recreation)
Consequence	IV-Major
IMS, if they successfully establish, can outcompete native species for food or space, prey on native species or change the nature of the environment and can subsequently impact on fisheries or aquaculture. This is primarily through altering benthic habitats, which in turn may result in changes to faunal assemblages and a reduction in diversity. Any such reduction in diversity or health of the ecosystem may result in economic losses with long-term effects on industry (IV – major).	
Likelihood	a-Remote
The pathways for IMS introduction are well known; consequently, standard preventive measures are proposed. Santos has an Invasive Marine Species Management Plan that identifies an IMS Management Zone. The Santos IMS Management Zone, which has been developed based on Regulator and industry policies and standards, is defined as all waters extending 12 nm from the territorial sea boundary (including Australian territorial reefs and islands) within the IMCRA Northwest Province bioregion. This zone encompasses the general spatial extent of Santos operations within territorial waters and is complementary to existing international, Commonwealth and State maritime and biosecurity management boundaries, management strategies and legislative frameworks. While the John Brookes, Spartan, Halyard and Greater East Spar facilities are not located within the IMS Management Zone, support vessels are still managed for IMS, as they are likely to transit to and from or through the management zone before operating in the John Brookes operational area. Given the dispersive open-ocean environment of the operational area, the successful translocation to surrounding shallower habitats such as found at VI of an IMS introduced to the operational area is unlikely. With controls in place to reduce the risk of IMS introduction, the likelihood is considered remote.	

Consequence Level	
Residual Risk	The residua risk associated with this event is Low

7.1.5 Demonstration of as Low as Reasonably Practicable

The proposed management controls are considered appropriate to manage the risk of introduction of IMS to ALARP.

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), and a vessel biosecurity risk assessment in accordance with the Invasive Marine Species Management Plan 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 the Aquatic Resources Management Act 2016[4] and associated regulations prohibiting the introduction of non-endemic fish species will be met.

With adherence to the proposed management controls, the risk to the environment from IMS has been reduced to ALARP.

7.1.6 Acceptability Evaluation

Is the consequence ranked as Very Low to Medium?	Yes – introduction of IMS residual risk ranking is Low
Is further information required in the consequence assessment?	No – potential impacts and risks well understood through the information available
Are risks and impacts consistent with the principles of 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 – management consistent with Biosecurity Act 2015 and National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee, 2018). Also consistent with the Fish Resources Management Act 1994 (expected to be replaced by the Aquatic Resources Management Act 2016 in 2019).
Are risks and impacts consistent with Santos' Environmental, 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).

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).

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[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 medium and ALARP. Therefore, the residual risk associated with IMS is considered by Santos to be environmentally acceptable.

7.2 Marine Fauna Interactions

7.2.1 Description of Event

Event	There is the potential for vessels or equipment from the vessels 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 helicopter, UAV or drone collision during take-off and landing.
Extent	Within the operational area, in the immediate vicinity of support vessels, subsea equipment or helicopters, while moving.
Duration	For the operational life of the activity

7.2.2 Nature and Scale of Environmental Impacts

Potential Receptors:

- threatened or migratory fauna (marine mammals, marine turtles, sharks, fish and rays, and birds).

Marine fauna in surface waters that would be most at risk from vessel collision include marine mammals, marine turtles and whale sharks. As summarised in Table 3-6, the operational area overlaps several BIAs, including the loggerhead turtle (reproduction), green, flatback and hawksbill turtles (reproduction and critical nesting habitat) and humpback whale (migration).

Vessel strike and vessel disturbance are identified as potential threats to a number of marine fauna species in relevant recovery plans and conservation advice (Table 3-7). Incidents with marine fauna are recorded and reported by Santos as described in Section 8.9.

7.2.2.1 Marine mammals and sharks

The withdrawn Conservation Advice for Megaptera novaeangliae (humpback whale) (TSSC, 2015d) indicated that humpback whales are one of the most frequently reported whale species involved in vessel strikes worldwide (Laist et al., 2001; Jensen & Silber, 2003). The increase in vessel numbers (Silber & Bettridge, 2012) is not only a threat to humpback whales in relation to vessel strikes but also in relation to disturbance and displacement from key habitats. Similarly, vessel strike is also recognised by the Approved Conservation Advice for Rhincodon typus (whale shark) (TSSC, 2015a) as one of the threats to the recovery of whale sharks.

The most commonly sighted whale in continental shelf waters of the region is the humpback whale. The humpback whale migrates between calving grounds in the Kimberley region of Western Australia to feeding grounds in Antarctica, with the northbound migration from early June to early August (BHPB, 2005) and the peak of the northbound migration between Exmouth Gulf and the Dampier Archipelago occurring around July, concentrated inshore of the 200-m depth contour (Jenner et al., 2001). The southern migration peaks around early September, with pods travelling in shallower waters, typically at 30 m to 100 m and passing west of Barrow Island and north of the Montebello Islands. Higher numbers may be encountered in the operational area during the humpback whale southern migration. However, significant numbers are not expected given the water depths at the operational area of approximately 45 m to 110 m.

Nearly all blue whales sighted in the North West Shelf region are likely to be pygmy blue whales. 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. Passive acoustic data documented pygmy blue whales migrating along the Western

Australian shelf break (Woodside, 2012). The online national Conservation Values Atlas has identified the pygmy whale migration pathway on the continental shelf edge at a depth of 500 m to 1,000 m (McCauley & Jenner, 2010). 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).

Pygmy blue whales may also transit the operational area during their migrations. However, given the width of the blue whale migration corridor in the region (wider than 200 km) and the whale's preferred water depths (between 300 m and 850 m), significant interactions with pygmy blue whales during operational activities are highly unlikely.

The worst potential impact from vessel collision would be mortality or serious injury of an individual. Collisions between vessels and cetaceans are most frequent on continental shelf areas where high vessel traffic and cetacean habitat occur simultaneously (WDCS, 2004). Instances of cetacean deaths as a result of vessel collisions in Australian waters have been recorded (e.g., a Bryde's whale in Bass Strait in 1992) (WDCS, 2004), although the data indicates this is likely to be 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, 2004). 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).

Whale sharks are at risk from vessel strikes when feeding at the surface or in shallow waters (where options to dive are limited). Given that the operational area overlaps with whale shark foraging BIA (Figure 3-15 and Table 3-6), individuals may be encountered during operational activities. However, the whale shark presence within the operational area is not expected to comprise significant numbers given that no main aggregation area exists within the operational area; therefore, their presence would be transitory and of a short duration. No constraints within the operational area (e.g., shallow water or shorelines) would prevent whale sharks from moving away from vessels. Vessel speed has been demonstrated to be a key factor in relation to collision with marine fauna, particularly cetaceans, with faster-moving vessels posing a greater collision risk than slower vessels (Laist et.al., 2001; Jensen & Silber, 2003; Hazel, 2009). Laist et al., (2001) suggest that the most severe and lethal injuries to cetaceans are caused by vessels travelling at 14 knots or faster.

7.2.2.2 Marine turtles

It is likely that loggerhead, green, flatback and hawksbill turtles will be transient within the operational area due to the presence of reproductiong BIAs and habitat critical for nesting. Disturbance due to vessels has been flagged as a threat to marine turtles that occur within the operational area (DoEE, 2017).

Marine turtle mortality due to vessel strike has been identified as an issue in Queensland waters in the Recovery Plan for Marine Turtles in Australia (DoEE, 2017). However, turtles appear to be more vulnerable to vessel 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 vessel strike, possibly due to the relatively low human population density of the North West Shelf 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.

7.2.2.3 Birds

A number of protected species of marine birds have potential habitats or migratory routes in and around the operational area (Section 3.2.4). BIAs occur within the operational area for threatened and migratory bird species, including the wedge-tailed shearwater and Australian fairy tern (reproduction and foraging) and the white tailed tropicbird, roseate tern and lesser crested tern (breeding). In addition, the Approved Conservation Advice for Red Knot (Calidris canutus) (TSSC, 2016a) outlined bird strike as a threat through direct mortality.

Seabirds may be attracted to the John Brookes WHP due to increased opportunities to feed on pelagic fish, roosting and resting on the helideck and upper levels of the WHP. However, these behavioural changes are unlikely to alter population dynamics or significantly change the habitat use of birds.

The number of helicopter flights required to the WHP is relatively low, and flights occur in the daylight, thereby reducing potential interactions with birds.

The risk of helicopter strike is not high because helicopter noise is expected to elicit a behavioural response in birds to avoid collision and because of the relatively low speeds at which helicopters would be flying during take-off or landing.

During landing and take-off, large slow birds are at risk of strike from helicopter propellers. Ornithological technological specialists have identified no EPBC Protected species within the operation area as having a very high or extreme risk of strike. The incident of bird strike is a significant safety concern for helicopters and is classified as a major accident event (MAE) in the John Brookes Safety Case.

An additional hazard caused by the birds is the build-up of guano on the WHP, leading to:

- helideck markings and lights becoming obscured
- safety critical equipment on the WHP becoming obscured and possibly deteriorating at a quicker rate
- surfaces becoming slippery, particularly after rainfall.

To minimise the risk of bird strike and a serious safety event, bird-deterrent devices may need to be trialled before installation. This will ensure birds safely vacate the WHP prior to helicopter landing and take-off.

The potential risks and impacts of deterrents to birds is assessed in sections 6.1 and 6.6.

7.2.3 Environmental Performance Outcomes and Control Measures

The EPO relating to this event include:

- No injury or mortality to EPBC Act and WA Biodiversity Conservation Act 2016 listed marine fauna during operational activities (EPO-VI-CW-01).

The control measures for this event are shown in Table 7.4 and the environmental performance standards and measurement criteria for the EPOs are described in Table 8-2.

Table 7-4: Control measure evaluation for marine fauna interaction

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls				
VI-CW-CM-01	Protected Marine Fauna Interaction and Sighting Procedure.	Reduces risk of physical and behavioural impacts to marine fauna from vessels, helicopters and UAVs because if marine fauna are sighted, vessels can slow down or move away, and helicopters and UAVs can increase distances from sighted fauna if required.	Operational costs to adhere to marine fauna interaction restrictions, such as vessel, helicopter and UAV 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.
Additional Controls				
VI-CW-CM-26	Constant bridge watch on support vessels.	Monitoring of surrounding marine environment to identify potential collision risks (and reducing harm) to cetaceans and other marine fauna.	Monitoring of surrounding marine environment to identify potential collision risks (and reducing harm) to cetaceans and other marine fauna.	**Adopted** – Industry practice; benefits outweigh cost.
N/A	Restrict the timing of activities to operate outside of sensitive periods only.	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.	**Not Adopted** – Grossly disproportionate to the environmental benefit and would severely limit operations, which are required to occur 24 hours a day, seven days a week.
N/A	Dedicated Marine Fauna Observer on support vessels.	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.	**Not Adopted** – Cost disproportionate to increase in environmental benefit and would severely limit operations, which are required to occur 24 hours a day, seven days a week.
N/A	Activities will only occur during daylight hours.	Potential for a vessel-fauna collision occurring is decreased due to vessel being stationary when visibility is lower at night.	Lengthens duration of the activity as operations only continue for approximately 10 hours per day or less in winter. Increased cost due to increased operation time (more than double the cost and	**Not Adopted** – Substantial additional cost due to doubling of activity duration. No overall environmental benefit as results in increased impacts and risks.

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
			therefore grossly disproportionate).	
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).	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.	**Not Adopted** – 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

The impact, likelihood and consequence ranking for marine fauna interaction are outlined in Table 7-5.

Table 7-5: Impact, likelihood and consequence ranking – marine fauna interaction

<table>
<tr><th colspan="2">Descriptions</th></tr>
<tr><td>Receptors</td><td>Threatened or migratory fauna (marine mammals, marine turtles, sharks, fish and rays, and birds)</td></tr>
<tr><td>Consequence</td><td>III – Moderate</td></tr>
<tr><td colspan="2">The potential exists for death or injury of EPBC Act–listed individual species from interacting with a vessel or helicopter.
Any collision with an individual would represent a small proportion of the local population, and it is not expected that it would result in a decreased population size at a local or regional scale. It is expected that the loss of an individual turtle, whale shark, whale or bird would be a moderate (III) consequence.</td></tr>
<tr><td>Likelihood</td><td>b-unlikely</td></tr>
<tr><td colspan="2">Given the presence of a number of BIAs for turtles, whale sharks, marine mammals and birds, receptors are expected to be present in the operational area at various times of the year.
Marine fauna interaction is considered very unlikely given the small operational area (500 m around the John Brookes WHP and a narrow corridor either side of subsea infrastructure), slow-moving vessels (typically less than five knots), open-ocean environment and the ability for fauna to move away.
Helicopter operations will occur with the use of the bird-deterrent system. Noise generated from vessel engines and the bird-deterrent system is likely to deter marine fauna from coming in close proximity to vessels or helicopters. With controls in place ensuring the vessel is compliant with EPBC Regulations and with the bird-deterrent system working effectively, the risk of marine fauna interaction is further reduced and is considered unlikely (b).</td></tr>
<tr><td>Residual Risk</td><td>The residual risk associated with this event is Low.</td></tr>
</table>

7.2.5 Demonstration of as Low as Reasonably Practicable

No alternative options to the use of vessels are possible for undertaking operational activities. If the management controls are adhered to, then the risk of marine fauna interactions will have been reduced to ALARP.

The proposed management controls for marine fauna interaction are considered appropriate to manage the risk to ALARP.

7.2.6 Acceptability Evaluation

Is the consequence ranked as Very Low to Medium?	Yes – marine fauna interaction 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 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 – Management consistent with Part 8 of the EPBC Regulations. Controls implemented will minimise the potential impacts to species identified in recovery plans and conservation advices. Relevant species recovery plans, conservation management plans and management actions, including but not limited to the Recovery Plan for Marine Turtles in Australia (DoEE, 2017), Blue Whale Conservation Management Plan 2015–2025 (DoE, 2015c), National Recovery Plan for the Southern Right Whale (DCCEEW, 2024), Approved Conservation Advice for Rhincodon typus (whale shark) (TSSC, 2015a), and relevant recovery plans and conservation advices for birds.
Are risks and impacts consistent with Santos' Environmental, 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

Application of the proposed management controls and adherence to Commonwealth regulations reduces the likelihood of vessel interactions with marine fauna. While the potential exists for a collision to occur, it is considered a very unlikely (2) scenario. Vessels will be travelling at low speeds within the operational area, 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 (although it is noted that even if it is a single species, if it's a protected species the consequence will be more than minor in accordance with the Environmental Consequence Descriptors (Appendix G); 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 can be accidentally released to the marine environment, such as: • non-haza • rdous solid wastes, such as paper and packaging • hazardous solid wastes, such as batteries, fluorescent tubes and aerosol cans • equipment and materials, such as hard hats, tools, or infrastructure parts.
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 activities.

7.3.2 Nature and Scale of Environmental Impacts

Potential receptors include:

- physical environment (shoals and banks, benthic habitats, offshore reefs and islands)
- threatened or migratory fauna (marine mammals, marine reptiles, sharks, fish, rays, and birds), protected and significant areas (marine parks)
- socio-economic receptors (tourism and recreation).

7.3.2.1 Physical environment

Objects accidentally dropped to the seabed could occur during support vessel and ROV activities, such as the 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 operational area.

The seabed within the operational area is primarily soft sediments with little epifauna; this habitat type is widely distributed and well represented in the North West Shelf region. While soft sediment benthic habits will not be destroyed, disturbance of the communities on and within them (i.e., the epifauna) 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 six to 12 months, based on previous surveys from drilling impacts (URS, 2010).

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.

7.3.2.2 Threatened or migratory fauna

Solids such as plastics have the potential to harm marine fauna through entanglement or ingestion. Several BIAs for marine turtles (reproduction), whale sharks (foraging), whales (migration) and birds (reproduction) overlap the operational area; therefore, these receptors are expected to be present.

Marine turtles and seabirds are particularly at risk from entanglement. The Wildlife Conservation Plan for Seabirds (CoA 2020) lists marine debris as a key threat to seabirds. Turtles are known to be indiscriminate feeders and may mistake plastic for jellyfish (Mrosovsky et al., 2009). The Recovery Plan for Marine Turtles in Australia 2017–2027 (DoEE, 2017) identifies ingestion of marine debris as a threat to all species of marine turtles. Seabirds at the sea surface foraging on plankton may eat floating plastic. Once ingested, plastics can damage internal tissues and inhibit physiological processes, which can both potentially result in fatality. Marine debris has been highlighted as a threat to marine turtles, humpback whales, whale sharks, northern river sharks, largetooth sawfish and Australian sea lions in the recovery plans and conservation advice presented in Table 3 7. These recovery plan and approved conservation advices, 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 activity is the legislation for the prevention of garbage disposal from vessels.

Release of hazardous solids (e.g., wastes such as batteries) may result in the pollution of the immediate receiving environment, leading to very localised detrimental health impacts to marine flora and fauna. Physiological damage through ingestion or absorption may occur to individual fish, cetaceans, marine reptiles or seabirds.

Under management, only limited volumes of solid objects would be expected to be released; therefore, any impacts would be restricted to a small number of individuals.

7.3.2.3 Protected and significant areas and socio-economic receptors

The operational area intersects the Montebello Marine Park (Multiple Use Zone – IUCN Category VI). All conservation values of the marine park (as outlined in Section 3.2.3) have the potential to be impacted by non-hydrocarbon releases through impacts to the physical environment and marine fauna. Impacts to the physical environment and marine fauna are discussed in the sections above.

Other marine users within the Montebello Marine Park include tourists and recreational visitors, which are important to the socio-economic values for the marine park. Tourism activities, such as snorkelling, diving, surfing and recreational fishing, may occur around the Montebello Islands but are not expected to occur in the operational area, given the water depth (45 m to 100 m), lack of seafloor features and distance from shore. Potential impacts to tourists and recreational visitors within the Montebello Marine Park include the aesthetic impacts of buoyant waste floating into the park and potentially washing up on the shores of the Montebello Islands, as well as the aesthetic impacts of any damage to reefs, shoals and banks.

With appropriate management measures in place, solid non-hydrocarbon releases are not expected to occur frequently or to a scale that may cause significant pollution that would impact the conservation or socio-economic values of the Montebello Marine Park.

7.3.3 Environmental Performance Outcomes and Control Measures

The EPO relating to this event include:

- No unplanned objects, emissions or discharges to sea or air (EPO-VI-CW-07).

The control measures for this event are shown in Table 7-6, and the environmental performance standards and measurement criteria for the EPOs are described in Table 8-2.

Table 7-6: Control measure evaluation for the release of solid objects

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls				
VI-CW-CM-31	Waste (Garbage) Management Plan.	Reduces probability of garbage being discharged to sea, reducing potential impacts to marine fauna. Stipulates putrescible waste disposal conditions and limitations. Marine Order 95 (Marine pollution prevention – garbage).	Personnel cost of premobilisation 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.
VI-CW-CM-05	Facilities Planned Maintenance System.	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.
VI-CW-CM-17	Planned subsea and offshore maintenance.	Reduces likelihood of dropped objects because lifting equipment is operating within its parameters.	Operational costs and labour or access requirements of undertaking equipment	**Adopted** – Benefits of operating equipment within operational parameters will help

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
			maintenance on vessels.	reduce the likelihood of dropped objects.
VI-CW-CM-13	Vessels Planned Maintenance System.	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.
Additional Controls				
VI-CW-CM-18	Dropped object prevention (LEMS).	Impacts to environment are reduced by preventing dropped objects.	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.
VI-CW-CM-19	Dropped object recovery.	Requires dropped objects are recovered (where safe and practicable to do so unless the environmental consequences are negligible).	Additional personnel and vessel costs to plan and undertake if safe and practicable to do so.	**Adopted** – Benefits of recovering dropped objects where safe and practicable to do so, outweigh the costs.
N/A	Eliminate lifting in field.	Eliminate the risk of release of non-hydrocarbon solid to the marine environment due to dropped object.	Operational activities may require lifting from a vessel to the John Brookes WHP, and this cannot be eliminated.	**Not Adopted** – Not feasible.

7.3.4 Environmental Impact Assessment

The impact, likelihood and consequence ranking for a non-hydrocarbon release (surface, solid) are outlined in Table 7-7

Table 7-7: Impact, likelihood and consequence ranking – release of solid objects

Description	
Receptors	• Physical environment (shoals and banks, benthic habitats, offshore reefs and islands) • Threatened or Migratory Fauna (marine mammals, marine reptiles, sharks, fish, rays and birds) • Protected and significant areas and Socio-economic receptors (marine parks, tourism and recreation)
Consequence	I – Negligible
Physical Environment (Shoals and Banks, Benthic Habitats, Offshore Reefs and Islands) 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. Any area of the seabed impacted through dropped objects would be expected to recover. Buoyant dropped objects have the potential to smother benthic habitats, including shoals, banks and reefs, 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 negligible (I) reduction in habitat area or function. *Threatened or Migratory Fauna (Marine Mammals, Marine Reptiles, Sharks, Fish, Rays and Birds)* In the event of a loss of solid waste, the quantities would be expected to be limited. However, entanglement with or ingestion of solid wastes by marine fauna could still occur, which is a particular risk for marine turtles and birds. 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 are not expected to result in a decrease of the local population size. The consequence level is therefore negligible (I). *Protected and significant Areas and Socio-economic Receptors (Marine Parks, Tourism and Recreation)*	

Description	
Impacts to the Montebello Marine Park have the potential to occur through buoyant objects floating into the park, adversely impacting conservation 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. The consequence level is therefore assessed as negligible (I).	
Likely	e-Likely
Control measures proposed ensure that the risk of dropped objects, lost equipment or release of non-hydrocarbon solid waste to the environment has been minimised. Given the controls in place, the likelihood of releasing non-hydrocarbon solids to the environment resulting in a negligible consequence is considered likely (e).	
Residual Risk	The residual risk associated with this event is Low.

7.3.5 Demonstration of as Low as Reasonably Practicable

Solid waste will be generated during the activity, it cannot be omitted. Equipment loss and dropped objects, which might occur during vessel to vessel transfers in the field, will be managed through lifting procedures. It is considered that the management controls proposed are sufficient to reduce the risk of non-hydrocarbon solid releases to a level that is ALARP. There are no additional management strategies that would reduce the chance of a loss of solid objects.

7.3.6 Acceptability Evaluation

Is the consequence ranked as Very Low to Medium?	Yes – the release of solid objects 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 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 – 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. The WHP activities are not inconsistent with relevant plans of management and conservation advice for seabirds. 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' Environmental, 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.

Potential environmental impacts from a dropped object would most likely be extremely minor and related to indents in the soft sediment habitat assumed to be within the operational area. Given the sediment habitat is expected to recover relatively rapidly (within six to 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 negligible (A) impact predicted from entanglement or ingestion with solid waste material by marine fauna, the low risk of a non-hydrocarbon release to the environment is considered to be ALARP and environmentally acceptable.

7.4 Hazardous Liquid Release

7.4.1 Description of Event

Event	The John Brookes WHP and umbilical lines store chemicals for subsea injection, including MEG, hydraulic fluid and corrosion inhibitor. Storage of chemicals and hydrocarbons is limited to the small amounts of diesel, hydraulic oil, MEG and corrosion inhibitor required for operation of the facility (see **Section 2.8**). Further information on inventories of hydraulic oil, chemical and waste oil is provided below. <u>Hydraulic Fluids and Lube Oils</u> Hydraulic fluids are used on the John Brookes WHP in hydraulic power units for the crane and pig launcher and to control valves in subsea John Brookes, Spartan-2, Halyard-1, Halyard-2 and Spar-2 wellheads. Hydraulic oil tanks of 870 L, 3,233 L and 2,337 L are located on the John Brookes WHP. Hydraulic fluid for Halyard-1, Halyard-2 and Spar-2 well control is provided through the Halyard electro-hydraulic umbilical. Hydraulic fluid for Spartan-2 well control is provided through the Spartan electro-hydraulic umbilical. Hydraulic and lube oils are also used on support vessels within the operational area to carry out subsea inspection and maintenance activities (e.g., dive support vessels, IMMR activities, ROV support vessels, work boats). Hydraulic fluid is used on ROVs during subsea inspection activities. An unplanned leak of hydraulic fluid could occur from the ROV hydraulic system. Such leaks are typically small, and combined simultaneous leaks would likely be less than 50 L. Small unplanned release of hydraulic fluids could occur from damage to or corrosion of hydraulic oil tanks, loss of integrity of or damage to hydraulic hoses, damage to or loss of integrity of the electro-hydraulic umbilical, or in the event hot-tapping is used to assist in the flushing of lines with seawater or inert gases. Cleaning of bunded areas for maintenance, or suspension of activities are another source of potential unplanned release of hydrocarbons during high-pressure or steam cleaning. Small releases of hydraulic fluids could also occur during transfer of fluid between a support vessel and the John Brookes WHP (i.e., dropped objects that lose integrity and release to the marine environment). Hydraulic fluid transfer between a support vessel and the John Brookes WHP will occur in drums. Given the safe working load of the WHP crane is 4 tonnes, the maximum volume of hydraulic fluid that could be transferred would be less than 4 m^3. <u>Chemicals</u> Corrosion inhibitor for the John Brookes wellheads is supplied in a three-compartment (1,600-L capacity each) stainless steel tank on the mezzanine deck. The Halyard subsea wells are supplied by a corrosion inhibitor tank located on the main deck. Tanks are replenished by vessel and tanks from VI as required. The only continuously used chemical is corrosion inhibitor, which is injected at the wellheads. Other chemicals, including biocide, may be used as required for operations such as pigging or biocide runs. Other hazardous liquids that may be onboard for transfer to or from the operating facilities include cleaning and cooling agents, recovered solvents, stored or spent chemicals, leftover paint materials, used greases and biocide for treating the John Brookes WHP open drains system. These materials may be present on support vessels for the day-to-day operation of the vessels and for carrying out maintenance and inspection within the operational area. Production chemicals are preferentially delivered to the WHP in transportable tote tanks by a support vessel. Volumes transferred per lift are typically less than 4 m3, given the safe working load of the WHP crane is 4 tonnes. The transportable tanks are lifted onto the upper deck by the WHP crane from where the chemicals are transferred to the fixed storage tanks by hoses fitted with quick connect/disconnect couplings. Corrosion inhibitor can also be pumped from portable tanks on a support vessel to the WHP via a dedicated pumping and hose transfer facility. Corrosion inhibitor can also be pumped between the Halyard and John Brookes tanks as needed, reducing the frequency of re-supply to the WHP. Release of the chemicals to the sea could also occur via: tank or pipework corrosion damage on the John Brookes WHP or to control umbilicals severe rainfall event causing the open drains sump to overflow, releasing deck drainage water potentially containing biocide used to treat the open drain system. Release could also occur from transport of chemicals between support vessels and the John Brookes WHP (i.e., dropped objects that may result in a leak/release or a leak or spill from a transfer hose). Cleaning for routine maintenance or mothballing of topsides pressure vessels, piping and equipment is undertaken with a zero marine discharge philosophy. Waste is contained and transported back to VI. Options at this stage are then to dispose of it by sending it onshore to a third-party licensed waste disposal facility or through the VI processing facilities. <u>Waste Oil from Drainage</u> Oily water collected from the open-drain system is stored in a 1,600 L atmospheric sump. Hydrocarbons collected from the closed-drainage system (draining liquid knock out from the instrument gas–drying system and gas-powered pump exhausts, drainage of lowliness during maintenance, drainage from the production header during maintenance and pig launcher drainage) are collected in a 2,200 L closed-drain sump. The

	hydrocarbons collected in both the atmospheric and closed sump are pumped into the production stream by gas-driven sump pumps connected to high/low level controllers to prevent any overflow. Maximum Credible Spill Volume The worst-case credible scenarios for spill of hazardous liquid materials (not including diesel or condensate) to the marine environment, in terms of volume of liquids released, are considered to be those resulting from transfer of chemicals or hydraulic oils between a support vessel and the John Brookes WHP. Spills originating from storage tanks on the John Brookes WHP are considered to be small in volume and contained within barriers inherent in the design of these facilities (i.e., bunding or enclosed spaces with drainage systems). Bulk chemical or hydraulic oil transfer is limited to less than 4 m3 based on the crane safe working load, and this provides a conservative guide to the volume that could be released to the marine environment if a tote tank or any other transportable vessel was ruptured. With respect to the hose transfer of corrosion inhibitor to John Brookes WHP from a support vessel, the AMSA (2013b) guidelines for calculating a maximum credible volume during offshore refuelling (continuous supervision) have been used. These calculate the spill volume based on 15 minutes of flow and on a typical transfer rate of 10 m3/hr. This equates to a maximum credible spill of 2.5 m3. The maximum credible spill for any liquid hazardous material is therefore considered to be less than 4 m^3.
Extent	The maximum volume of hazardous liquids that could be released during routine operations is likely to be small (less than 4 m^3) and realistically limited to the volume of individual containers (e.g., drums) stored on deck at the John Brookes WHP and on support vessels.
Duration	For the operational life of the activity.

7.4.2 Nature and Scale of Environmental Impacts

Potential receptors include:

- physical environment (water and sediment quality, shoals and banks, benthic habitats, offshore reefs and islands)
- threatened or migratory fauna (marine mammals, marine reptiles, sharks, fish, rays and birds), protected and significant areas (marine parks)
- socio-economic receptors (tourism and recreation).

7.4.2.1 Physical environment

Environmentally hazardous chemicals, hydrocarbon and liquid wastes lost to the marine environment may lead to contamination of the water column in the vicinity of the support vessel or the John Brookes WHP. In the event of a hazardous liquid release, the quantities would be limited to less than 4 m^3. The small volumes, dilution, and dispersion from natural weathering processes such as ocean currents indicate that the extent of exposure will be limited in area and duration.

Hydraulic fluids and lubricating oils behave similarly to diesel when spilt in the marine environment (for information on diesel behaviour in the marine environment refer to Section 7.9), although lubricating oils are more viscous and so the spreading rate of a slick of these oils would be slightly slower. Hydraulic fluids are medium oils of light to moderate viscosity and have a relatively rapid spreading rate and, like diesel, will dissipate quickly, particularly in high sea states.

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 shoals and banks, reefs, and offshore islands.

7.4.2.2 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 in Table 3-6, the operational area overlaps several BIAs, including the loggerhead turtle (reproduction); green, flatback and hawksbill turtles (reproduction and critical nesting habitat) and humpback whale (migration).

Recovery plans and conservation advice for numerous bird species identify marine pollution and contamination impacts as a threat to the species. This includes the following marine species identified as potentially occurring within the operational area: red knot, southern giant petrel and eastern curlew. In addition, the Recovery Plan for the Grey Nurse Shark (Carcharias taurus) (DoE, 2014) identifies pollution as a threat to the species; and the Recovery Plan for Marine Turtles in Australia 2017–2027 (DoEE, 2017) identifies chemical discharge as a threat to all species of marine turtles in Australia. These species are expected to be transient within the operational area.

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.

7.4.2.3 Protected and significant areas and socio-economic receptors

The operational area intersects the Montebello Marine Park (Multiple Use Zone – IUCN Category VI). The conservation values of the marine park (as outlined in Section 3.2.3) have the potential to be impacted by hazardous liquid releases through impacts to the physical environment and marine fauna. Impacts to the physical environment and marine fauna are discussed in the sections above.

Other marine users within the Montebello Marine Park include tourists and recreational visitors, which are important to the socio-economic values for the marine park. Given the localised and temporary impacts of an unplanned hazardous liquid spill, any impact to tourism and recreation activities, such as snorkelling, diving, surfing and recreational fishing, that predominantly occur within the Montebello Islands is considered unlikely. There may be the potential for limited aesthetic impacts, such as a hydrocarbon sheen occurring on the ocean surface.

7.4.3 Environmental Performance Outcomes and Control Measures

The EPOs relating to this event include:

- No unplanned objects, emissions or discharges to sea or air (EPO-VI-CW-07).

The control measures for this event are shown in Table 7.8, and the environmental performance standards and measurement criteria for the EPOs are described in Table 8-2.

Table 7-8: Control measure evaluation for hazardous liquid releases

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls				
VI-CW-CM-17	Planned subsea and offshore maintenance.	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.
VI-CW-CM-18	Dropped object prevention procedure (LEMS).	Impacts to the environment are reduced by preventing dropped objects. 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.
VI-CW-CM-38	Inspection of platform structures and hydrocarbon-containing equipment.	Reduces likelihood of leaks from equipment on offshore platforms reaching the marine environment.	Personnel and operational costs associated with visiting the offshore platform for an inspection and to check on equipment.	**Adopted** – Benefit of the inspection to determine operational integrity outweighs the cost to undertake the inspection.
VI-CW-CM-30	Offshore platform deck drain system and bunding.	Reduces the likelihood of any oily or chemical content reaching the marine environment from the offshore platform.	Personnel and operational costs associated with construction and maintenance of offshore bunding and maintenance of bunding procedure.	**Adopted** – Benefit of the inspection to determine operational integrity outweighs the cost to undertake the inspection.
VI-CW-CM-39	Hazardous chemical management procedures.	Reduces the risk of spills and leaks (discharges) to the sea by controlling the storage, handling and clean-up of hazardous chemicals.	Cost associated with permanent or temporary storage areas.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh the costs of personnel time.

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
VI-CW-CM-40	General chemical management procedures.	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 inspections.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh the costs of personnel time.
VI-CW-CM-42	Spill Response Equipment on producing offshore platforms.	Provides a means to prevent any deck spills of hazardous liquids reaching the sea.	Costs associated with stocking spill response equipment on vessels and offshore platforms.	**Adopted** – Benefits of stocking, using and maintaining spill response equipment outweigh the costs of personnel time.
VI-CW-CM-43	Vessel spill response plan (SOPEP/SMPEP).	Implements response plans on board vessels to deal with unplanned hydrocarbon releases and spills quickly and efficiently to reduce impacts to the marine environment.	Administrative costs of preparing documents. Generally undertaken by vessel contractor so time for Santos personal to confirm and check SOPEP/SMPEP is in place.	**Adopted** – Benefits considered to outweigh costs.
Additional Controls				
VI-CW-CM-44	Remotely operated vehicle (ROV) inspection and maintenance procedures.	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

The impact, likelihood and consequence ranking for a hazardous liquid release (surface) are outlined in Table 7-9

Table 7-9: Impact, likelihood and consequence ranking – Hazardous Liquid Release

Description	
Receptors	• Physical environment (water and sediment quality, shoals and banks, benthic habitats, offshore reefs and islands) • Threatened or migratory fauna (marine mammals, marine reptiles, sharks, fish, rays and birds) • Protected and significant areas and Socio-economic receptors (marine parks, tourism and recreation)
Consequence	I – Negligible
As the operational area overlaps with a number of BIAs (turtle reproduction, whale shark foraging, whale migration, seabird reproduction) threatened or migratory marine fauna have the potential to be exposed to a hazardous liquid spill at the sea surface. The susceptibility of marine fauna to chemicals depends on the type and exposure duration; and given that exposures would be limited, impacts to marine fauna from this hazard are not expected to result in a fatality. Impacts to water quality from small volumes (less than 4 m3) discharged to the marine environment would be short term and localised, due to the nature and behaviour of the chemicals or liquid wastes identified as being at risk of spilling; only pelagic fauna present in the immediate vicinity of the unplanned event would likely be at risk of impact. As this 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 (I) consequence.	
Likelihood	D-occasional
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 (less than 4 m^3), 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 hazardous 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.	

Description	
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 negligible consequence, is considered to be occasional (d).	
Residual Risk	The residual risk associated with this event is Low.

7.4.5 Demonstration of as Low as Reasonably Practicable

Hazardous liquids and chemicals are required to undertake the activity, so their removal from the operation is not viable. Dangerous chemicals used during the activity will be managed and appropriately stored. Procedures are in place for the transfer of bulk liquids, reducing the risk of unplanned releases to sea due to equipment failure, operational error, or overflows and leaks. No beneficial additional control measures were identified to further reduce the risk of this hazard. The control measures proposed align with applicable actions described in relevant recovery plans and conservation advice to reduce risk of habitat degradation and deteriorating water quality (e.g., from pollution) to a level considered ALARP by Santos. The assessed residual risk for this impact is low and cannot be reduced further. It is considered therefore that the risk of the activities is ALARP.

7.4.6 Acceptability Evaluation

Is the consequence ranked as Very Low to Medium?	Yes – maximum hazardous liquid release (surface) 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 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 – management consistent with Marine Order 91 (Marine pollution prevention – oil) and Marine Order 94 (Marine pollution prevention – packaged harmful substances) and with relevant recovery plans and conservation advices (Table 3-7). IUCN principles of nearby reserves (Montebello Marine Park) (Multiple Use Zone – IUCN Category VI) are met (Table 3-4).
Are risks and impacts consistent with Santos' Environmental, 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.

With the controls in place to prevent an accidental release of small volumes of hazardous liquid and the negligible impacts predicted from an unplanned release of such material, the risk to the marine environment is considered low. Potential risks are unlikely to be greater than those caused by other commercial marine vessels or offshore petroleum activities in deep water.

The materials will be managed in accordance with relevant legislation and standards and Santos' procedures. The small volumes negate 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 controls in place to prevent accidental spills and the negligible (I) impacts predicted from a spill of this size, the environmental risk of using and handling the required chemicals is considered ALARP and environmentally acceptable.

7.5 Overview of Unplanned Release of Hydrocarbons

7.5.1 Credible Spill Scenario

A number of accidental events may occur during the operation of the John Brookes, Spartan and Greater East Spar 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 Table 7-10

Table 7-10: Summary of largest credible hydrocarbon spill scenarios

Maximum Credible Scenario	Hydrocarbon Type	Maximum Credible Volume	EP Section
Loss of well control or damage to infrastructure causing condensate with gas release from John Brookes wellheads at surface (worst-case).	John Brookes condensate	39,011 m^3	Sections 7.6
Loss of integrity or damage causing condensate with gas release from a subsea pipeline in Commonwealth waters.	John Brookes condensate, Spartan condensate and Halyard condensate	John Brookes: 210 m^3 Halyard-1 or 2: 161 m^3 Spartan: 35 m^3	Section 7.7
Loss of integrity or damage to infrastructure causing condensate with gas release from Halyard-1 subsea wellhead, Halyard-2 subsea wellhead, Spar-2 subsea wellhead or Spartan-2 well.	Halyard condensate Spartan condensate	5,637 m^3 1,269 m^3 (based on 13 47 m^3 per day)	Section 7.8
Surface spill – Release of diesel from support fuel tank (due to vessel collision or dropped object) in Commonwealth waters.	Diesel	329 m^3	Section to 7.9
Surface spill – Release of diesel fuel from bunker transfer in Commonwealth waters.	Diesel	15 m^3	Section to 7.9

7.5.2 Spill Scenario Selection

7.5.2.1 Surface Release of Condensate from Wellheads at John Brookes WHP

A workshop was held on 11 March 2019 with drilling representatives to assess the credibility of a subsea loss of well control from the John Brookes WHP. For the active producing wells associated with the WHP (John Brookes 2, 3, 5, 6 (ST 1)), given there is no subsea wellhead, the platform substructure and surface conductor protect the primary and secondary barrier envelopes from direct contact. Preventive barriers also include barrier monitoring and testing as per the well operations management plans (WOMPs). Therefore, a subsea loss of well control is not considered credible in the event of a loss of platform integrity.

There are currently four production wells (John Brookes 2, 3, 5 and 6) at the WHP. In the event of a vessel collision with the WHP that results in significant damage to the WHP, the fail-safe close actuated wing valves on the production trees will shut in, and the subsurface safety valves in each well will fail-safe close upon loss of control line pressure. Accordingly, a loss of well control at surface is not considered credible in the event of a vessel collision.

The maximum credible spill scenario at the WHP is a loss of well control at the surface at the WHP from well intervention activities. This is discussed in Sections 7.6

7.5.2.2 Subsea Release of Condensate from Subsea Wellheads

Spill scenarios were considered for all producing subsea wells and temporarily abandoned or plugged and abandoned subsea wells (**Table 2-3**).

For currently producing wells (Halyard-1, Spar-2 and Spartan-2) and the new Halyard-2 production well, it was assessed that causes of potential subsea releases from wells fell into two categories, being:

- external influence, such as anchor or chain drag
- internal influence, such as loss of integrity from corrosion or erosion, fatigue cracking, over- or under pressure and cementing or seal failures.

The most severe external impact damage would come from a MODU anchor or chain snagging the wellhead. In field MODUs are not considered, as no MODU will be used to undertake activities for this EP. If a MODU being used in an adjacent field were to break loose from its mooring, it is possible that it could drag anchors or chains. If one of these anchors or chains were to snag a wellhead, considerable force would be applied to the well casings and/or completion. A MODU chain or anchor only has sufficient tensile strength to bend a well completion, not to pull or separate it; therefore, the worst credible result would be a bent wellhead or casing assembly at the mudline with release through holes or cracks. A 100% full-bore blowout is not considered credible.

When considering the worst-case scenario due to internal influences an assessment of the barrier and risk for the producing wells was undertaken (Table 7-11)Well integrity failure can occur through a number of causal factors with the most severe of these being internal failure mechanisms as a result of corrosion, erosion, stress or fatigue cracking, over- or under pressure, over- or under temperature, and cementing or seal failures. Internal well integrity failures do not result in simultaneous failure of all barriers. Rather they present through ongoing, sometimes latent, failures that compound over time. The resultant worst-case release would therefore result from a leak due to impairment across multiple barriers, with release through holes or cracks. A 100% full-bore blowout is not considered credible.

A Technical File Note (TFN) – Greater Eastern Spar Worst Credible Hydrocarbon Spill Scenarios: Spar-2 has been developed to outline the worst case credible release from a loss of well integrity at Spar-2. The TFN outlines the loss of integrity calculations for the Spar-2 well given this well has been historically a higher producer than Halyard-1 and therefore release volumes are seen as conservative. The TFN was reviewed and updated to include the new Halyard-2 production well and confirmed that the worst-case credible scenario for the Halyard-2 and Spartan-2 production wells is expected to be less, but similar to that of Spar-2. A wellhead blowout scenario is not considered a credible scenario for this well during operations (as discussed above).

Therefore, the Spar-2 worst-case credible scenario is considered representative of a worst-case release from the Halyard-1, Halyard-2 and Spartan-2 wells during operations.

For the temporarily abandoned and plugged and abandoned wells a risk assessment of the well integrity and planned management activities was completed to inform the assessment of credible events (Table 7.11). Events considered were:

- Loss of well containment due to barrier damage: Two barriers are in place for all abandoned and plugged and abandoned wells (Table 7-11), so if a wellhead was inadvertently damaged or removed through dropped objects or anchor drag, no loss of containment would occur. Therefore, the scenario of loss of well control from temporarily abandoned wellheads due to external damage is not considered credible and is not assessed further.
- Well leak: Given the leak path the gas would need to travel through the barriers in any of the subsea wells the likelihood of a gas flow to the seabed is assessed as rare but possible however under exceptional circumstances. Any leak would be slow as it would result from impairment across multiple barriers (not a full loss of containment) and duration limited through detection as part of monitoring undertaken in accordance with the WOMPs (Table 7-11). Therefore, any impacts would be less than the scenarios considered for the Spar-2 worst-case outlined above so no additional modelling was undertaken.

The subsea release of condensate from a wellhead is considered in Section 7.8

Table 7-11: Well risk and ongoing management

Infrastructure	Status	Well Integrity and Risk Assessment	Ongoing Management
Halyard-2 Well	Expected online in Q3/Q4 2024	Full two-barrier envelope to the reservoir. All risks classified as medium or better.	Maintenance and monitoring activities as described in Section 2 of this EP. Ongoing monitoring and management in accordance with the proposed WOMP.
Spartan-2 Well	Active production well	Full two-barrier envelope to the reservoir. All risks classified as medium or better.	Maintenance and monitoring activities as described in Section 2 of this EP. Ongoing monitoring and management in accordance with the proposed WOMP.

Infrastructure	Status	Well Integrity and Risk Assessment	Ongoing Management
Spar-2 Well	Active production well	Full two-barrier envelope to the reservoir. Well integrity review undertaken in 2016 and all risks classified as medium risk or better.	Maintenance and monitoring activities as described in Section 2 of this EP. Ongoing monitoring and management in accordance with the WOMP.
Halyard-1 Well	Active production well Will become inactive once the production spool is removed.	Well integrity review undertaken in 2017 and all risks classified as medium risk or better. Once the production spool is removed, the status of the well will become 'inactive' (with live monitoring).	No intrusive well activities planned. Maintenance and ongoing operational activities as described in Section 2 covered under this EP. Ongoing monitoring and management in accordance with the WOMP).
Rosella-1 (ST 2) Well	Plugged and temporarily abandoned with confirmed double barrier in place. Corrosion cap in place.	Well integrity review undertaken in 2022; well accepted as abandoned. Final Activity Report being prepared.	Maintenance and monitoring as described in Section 2 of this EP. Ongoing monitoring and management in accordance with the WOMP. Any future well activities which involve contacting or entering the pressure envelope of this well will be covered by revisions to both the current WOMP and the EP.
East Spar-3 well	Reservoir permanently abandoned. Two verified permanent barriers installed to the reservoir. Well classified as temporarily abandoned due to XT and wellhead remaining in place. HXT protected by HXT debris cap.	Well integrity review undertaken in 2022; well accepted as abandoned. Final Activity Report being prepared.	Ongoing monitoring and management in accordance with the WOMP. Any future well activities which involve contacting or entering the pressure envelope of this well will be covered by revisions to both the current WOMPs and the EP.
East Spar-4A (ST 1) well	Well temporarily abandoned. Confirmed double barrier: wellhead corrosion caps and guide base protection frame and abandoned.	Well integrity review undertaken in Well integrity review undertaken in 2022; well accepted as abandoned. Final Activity Report being prepared.	Maintenance and monitoring as described in Section 2 of this EP. Ongoing monitoring and management in accordance with the WOMP. Any future well activities which involve contacting or entering the pressure envelope of this well will be covered by revisions to both the current WOMPs and the EP.
East Spar 6 Well	Reservoir permanently abandoned. Two verified permanent barriers installed to the reservoir. Well classified as temporarily abandoned due to XT and wellhead remaining in place. HXT protected by HXT debris cap.	Well integrity review undertaken in 2023; well accepted as abandoned. Final activity Report being prepared.	Ongoing monitoring and management in accordance with the WOMP. Any future well activities which involve contacting or entering the pressure envelope of this well will be covered by revisions to both the current WOMPs and the EP.
East Spar-7 Well	Well temporarily abandoned – XT remains in place (valves closed). Confirmed double barrier. Protected by wellhead	Well integrity review undertaken in 2022; well accepted as abandoned. Final Activity Report being prepared.	In accordance with this EP. Ongoing monitoring and management in accordance with the WOMP. Any future well activities which involve contacting or entering the pressure envelope of this well will

Infrastructure	Status	Well Integrity and Risk Assessment	Ongoing Management
	corrosion caps installed and guide-base structure.		be covered by revisions to both the current WOMPs and the EP.
East Spar-9 Well	Well temporarily abandoned. Confirmed double barrier – protected by wellhead corrosion caps installed and guide-base structure.	Well integrity review undertaken in 2022; well accepted as abandoned. Final Activity Report being prepared.	In accordance with this EP. Ongoing monitoring and management in accordance with the WOMP. Any future well activities which involve contacting or entering the pressure envelope of this well will be covered by revisions to both the current WOMPs and the EP.

7.5.2.3 Subsea release of condensate from a subsea pipeline

It is considered credible that an unplanned release of condensate and gas could occur from the John Brookes or East Spar subsea pipelines, or the Spartan flowline. 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 scenario was determined as being a complete loss of the volume of condensate in the John Brookes pipeline (largest hydrocarbon storage capacity of 210 m3), due to an automatic detection of the leak and the safety valves at the WHP end and the DCGP end of the pipeline being automatically closed. A subsea release of condensate from a subsea pipeline in Commonwealth waters is considered in Section 7.7.

7.5.2.4 Vessel release

It is considered credible that a release of diesel to the marine environment could occur from a support vessel collision with the John Brookes WHP or 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 that fuel tank ruptures leading to hydrocarbon release have occurred before. Support vessels also regularly load and unload supplies to the WHP; it is possible that a dropped object during this 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 329 m3 based on the largest single fuel tank capacity. This scenario would result in a spill of diesel at the sea surface.

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. 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 m3/hr) x 15 minutes of flow, resulting in a potential 15 m3 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.

7.5.3 Spill Modelling Information

To assess the potential risks of exposure to hydrocarbons, stochastic spill risk modelling was completed by Asia-Pacific Applied Science Associates (APASA) during 2013/2014 to support the original EP submission (APASA, 2013a to f; APASA, 2014a, b). In 2019, the spill modelling results for these scenarios were reprocessed to reflect revised impact thresholds using a purpose-developed three-dimensional oil spill trajectory and weathering model (SIMAP) (RPS 2019). This model is designed to simulate both the physical transport and weathering processes that affect the outcomes of hydrocarbon spills to the sea. The model also accounts for the interaction between weathering and transport processes. For sub-surface releases, the SIMAP model is used in conjunction with the Oilmap model which predicts the centreline velocity, buoyancy, width and trapping depth (if any) to supply the rising gas and oil plume dimensions.

Stochastic modelling was performed based on the following inputs:

- Current drift based on 1997-2006 hindcast BRAN outputs (24 hour averaged, 0.1o horizontal spatial resolution).
- Tidal circulation based on a variable resolution HYDROMAP model with 15 km, 7.5 km, 3.75 km and 1.88 km cell size. Bathymetric data based on CMAP and AHO chart data and Topex/Poseidon global tidal data

use tidal forcing data. The model was validated with a very good match for tidal behaviour in terms of amplitude and diurnal and semi-diurnal signals.

- Spatial wind fields sourced from the National Centre for Environmental Prediction (NCEP) for 1997–2006.
- Vertical profiles of sea temperature and salinity at the spill location were retrieved from a data point in the World Ocean Atlas 2013 closest to the John Brookes pipeline with monthly averages used as the input.
- A horizontal dispersion coefficient of 10 m2/s at the surface and 1 m2/s in the water column was used to account for dispersive processes that are below the model resolution based on empirical data for the North West Shelf.

Seasonal periods were defined as: Summer (October to March), winter (May to August) and combined transition (April and September). For each scenario, 100 replicate simulations are undertaken for each season giving a total of 300 replicate simulations per scenario.

Each run is initialised at different, randomly selected points in time for that seasonal period and hence under a different time series of environmental conditions. This stochastic sampling approach provides an objective measure of the possible outcomes of a spill because environmental conditions will be selected at a rate that is proportional to the frequency that these conditions occur over the study area. More simulations will tend to use the most commonly occurring conditions, while conditions that are more unusual will be represented less frequently. This gives the widest possible extent of oil dispersion.

During each simulation the SIMAP model records the location (by latitude, longitude and depth) of each particle (representing a given mass of oil) on or in the water column, at regular steps. For any particulars that contact a shoreline, the model records the accumulation of oil mass that arrives on each section of shoreline over time, less any mass that is lost to evaporation and/or subsequent removal by current and wind forces. The collective records from all simulations are then analysed by dividing the study region into a three-dimensional grid (minimum resolution 0.4 km).

The concentrations of oil may then be analysed to determine whether concentration estimates exceed defined threshold concentrations over time. Risks are then summarised as follows (noting similar treatments for entrained and dissolved aromatic hydrocarbons):

- The probability of exposure to a location is calculated by dividing the number of spill simulations where any instantaneous contact occurred above a specified threshold at that location by the total number of replicate spill simulations (for example, if contact occurred at a location (above a specified threshold) during 21 out of 100 simulations, a probability of 21% is indicated.
- The minimum potential time to a shoreline location is calculated by the shortest time over which oil at a concentration above a threshold was calculated to travel from the source to the locations in any of the replicate simulations.

The stochastic modelling results provides an objective indication of all locations that may be exposed or contacted by oil above the impact thresholds, however it does describe a larger potential area of influence than can be expected from any one single spill event.

7.5.4 Hydrocarbon Characteristics

A summary of the representative hydrocarbon characteristics, as assessed in this EP, is provided in Table 7-12

Table 7-12: Summary of hydrocarbon characteristics

Oil Type	Initial Density (g/cm^3)	Viscosity (cP)	Component	Vola-tiles (%)	Semi-vola-tiles (%)	Low Volatility (%)	Residual (%)	Aromatics (%)
			Boiling Points (°C)	<180 C4 to C10	180-265 C11 to C15	265-380 C16 to C20	>380 >C20	Of whole oil <380
				Non-persistent			Persistent	
Diesel	0.8368 @ 15°C	4 @ 15°C	% of total	6	34.6	54.4	<5	3.0
John Brookes condensate	0.785	1.229		64.0	24.3	9.7	2.0	23.6
Halyard condensate	0.781	1.26		86.4.	10.7	2.8	0.1	15.2

Oil Type	Initial Density (g/cm^3)	Viscosity (cP)	Component	Vola-tiles (%)	Semi-vola-tiles (%)	Low Volatility (%)	Residual (%)	Aromatics (%)
			Boiling Points (°C)	<180 C4 to C10	180-265 C11 to C15	265-380 C16 to C20	>380 >C20	Of whole oil <380
				Non-persistent			Persistent	
East Spar condensate	0.726	1.26		74.7	19.3	6.0	0.0	6
Spartan condensate	0.797	0.62		73.2	16.8	6.7	3.3	14.9

Note: < = less than; > = greater than.

Source: RPS (2019, 2021).

Further hydrocarbon characteristics for the John Brookes condensate include:

- water cut = 20%
- asphaltene content (% mass) = <0.50 resulting in low tendency for the hydrocarbons to take up water to form water-in-oil emulsions
- wax Content (% mass) = <5
- pour point (oC) = -36oC ensuring the hydrocarbon will remain in a liquid state over the annual temperature range observed on the North West Shelf.
- condensate to gas ratio = 187.15 scf/bbl.

Santos has confirmed the John Brookes condensate hydrocarbon properties through hydrocarbon testing conducted in 2014 (Intertek Commodities, 2014), with these properties used to inform the spill modelling in this EP. The John Brookes condensate properties measured in 2014 are considered to be representative of current condensate properties. There have been no new wells commissioned since the time of testing and the relative contribution of wells to production has been consistent over time from when the assay was conducted.

A series of model weather tests were conducted to illustrate the potential behaviour of John Brookes condensate when exposed at the water surface to different wind conditions. The results indicate that wind conditions will have an impact on the proportion of condensate, with higher winds leading to increased entrainment. The weathering profile for a subsea John Brookes condensate release (Figure 7-1) indicated evaporation would be the major mechanism for reducing the volume of condensate. Approximately 70% of the total volume of John Brookes condensate is predicted to evaporate within one day of release. The portion of John Brookes condensate that is predicted to entrain (5 to 12%) would be subject to dissolution and natural decay within the water column with further resurfacing and evaporation possible, depending on wind and wave conditions.

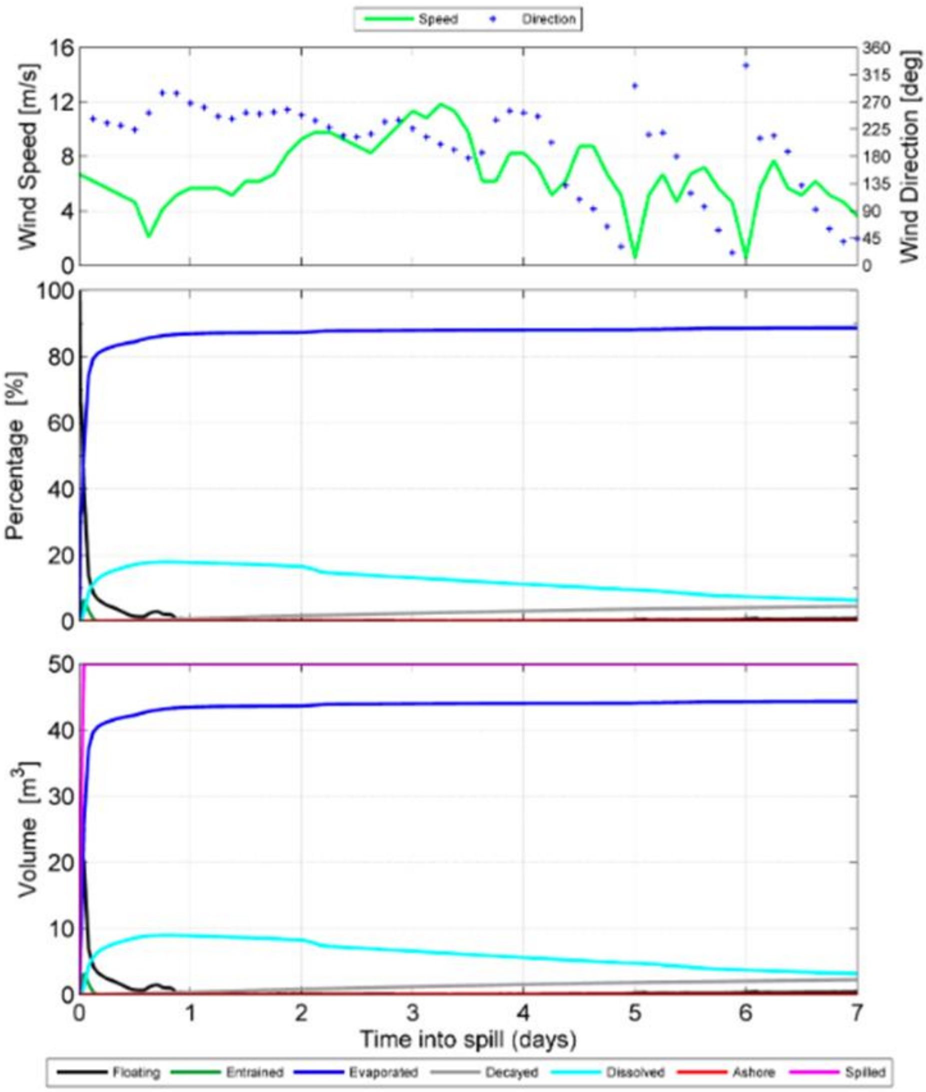


Figure 7-1: Mass balance plot representing, as proportion (middle panel) and volume (bottom panel) the weathering of John Brookes condensate

Note: This represents spill into the water column as a single release (50 m3 over one hour) and subject to variable wind at 27oC water temperature and 25oC air temperature.

7.5.5 Hydrocarbon Exposure Values

The EMBA identified in Figure 3-1 was identified using low exposure values, identifying receptors which might be contacted by hydrocarbons in the highly unlikely event of an oil spill. These low thresholds are not considered environmentally significant (e.g., not representative of a biological impact (NOPSEMA, 2019).

The moderate and high hydrocarbon 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. These exposure values then identify predicted levels of contact that are relevant to environmental impact and spill response concentrations.

The determination of environmentally meaningful impact levels is complex since the degree of impact will depend on the sensitivity of the biota contacted, the duration of the contact (exposure) and the toxicity of the hydrocarbon type making the contact. The toxicity of a hydrocarbon will change over time, due to weathering processes altering the composition of the hydrocarbon.

In addition to environmental impact and risk assessment, exposure values meaningful to oil spill response planning have been developed to determine the conditions in which response strategies would be effective (refer to the OPEP).

The selected hydrocarbon exposure values are consistent with NOPSEMA Bulletin #1 Oil Spill Modelling (April 2019) and are discussed further in Table 7-13 to Table 7-16.

Table 7-13: Floating hydrocarbons exposure values

Floating Oil Concentration (g/m^2)	Exposure Value	Description
1	Low	**Risk Evaluation (EMBA)** 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 for when ecological impacts would commence 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 estimated minimum threshold for commencing operational and/or scientific monitoring components.
25	High	**Risk Evaluation** At greater thicknesses the potential for impact of floating oil to wildlife increases. Studies have indicated that a concentration of surface oil 25 g/m^2 or greater would be harmful for all birds that contacted the hydrocarbon slick (Scholten et al., 1996; Koops et al., 2004). This was chosen as a conservative threshold for high impacts due to the foraging (sooty tern), breeding and foraging (lesser frigatebird); and breeding (wedge-tailed shearwater, Australian fairy tern, lesser crested tern, white-tailed tropicbird and roseate tern) that overlap the operational area. **Response Planning** Contact at 25 g/m^2 is not specifically used for spill response planning.

Table 7-14: Shoreline hydrocarbon accumulation exposure values

Shoreline Accumulation (g/m^2)	Exposure Value	Description
10	Low	**Risk Evaluation (EMBA)** 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 accumulations at this concentration cannot 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 shorelines is assumed as

Shoreline Accumulation (g/m²)	Exposure Value	Description
		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/m² has been applied to impacts from shoreline accumulation of hydrocarbons. **Response Planning** A shoreline concentration of 100 g/m², 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 metre 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/m² 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 7-15: Dissolved aromatic hydrocarbon exposure values

Dissolved hydrocarbon (ppb)	Exposure Value	Description
6	Low	**Risk Evaluation (EMBA)** 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 ppb to 410 ppb with an average of 50 ppb (French-McCay, 2002). Further research by Woodside (Woodside 2019) for Balnaves-3 crude undertook laboratory-based ecotoxicology tests across a range of water accommodated fraction to determine the point of 'no observed effect concentrations' (NOECs). The lowest NOEC reported is 123 ppb, from the amphipod acute toxicity tests. All other toxicity tests indicated NOECs ranging from 610 to 6640 ppb, with a median value of 2,695 ppb. Based on these ecotoxicology tests, the selected dissolved aromatic hydrocarbon threshold of 6 ppb is considered highly conservative. The DAH modelling results used to inform the EMBA and risk assessment outlined within this EP considers instantaneous exposure and therefore applying the literature concentration data for PAH exposure over 96 hours is considered highly conservative. Nevertheless, a lower threshold of 6 ppb has been used to inform the EMBA as the lowest concentration documented in research that could have some potential negative effect on marine organisms. This is considered to be sublethal, with most marine organisms a concentration of between 50 and 400 ppb is considered to be more appropriate for risk assessment. **Response Planning** Contact at 6 ppb (as predicted by oil spill trajectory modelling) is used as a trigger for activating scientific monitoring plans as detailed in the OPEP.

Dissolved hydrocarbon (ppb)	Exposure Value	Description
		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). **Response Planning** Encompassed by response to 6ppb. There is nothing different for higher exposure values.
400	High	**Risk Evaluation** Approximates toxic effects including lethal effects to sensitive species (NOPSEMA, 2019). **Response Planning** Encompassed by response to 6 ppb. There is nothing different for higher exposure values.

Table 7-16: Entrained hydrocarbon exposure values

Entrained hydrocarbons (ppb)	Exposure Value	Description
10	Low	**Risk Evaluation (EMBA)** Entrained hydrocarbons, as opposed to DAHs, are oil droplets suspended in the water column and insoluble. Entrained hydrocarbons are not as bioavailable to marine organisms compared to DAHs and on that basis are considered to be a less toxic, especially over shorter exposure time frames. Entrained hydrocarbons still have potential effects on marine organisms through direct contact with exposed tissues and ingestion (NRC, 2005); however. the level of exposure causing effects is considered to be considerably higher than for DAHs. Much of the published scientific literature does not provide sufficient information to determine if toxicity is caused by entrained hydrocarbons, but rather the toxicity of total oils which includes both dissolved and entrained components. Variations in the methodology of the total water accommodated fraction (TWAF (entrained and dissolved)) may account for much of the observed wide variation in reported threshold values, which also depend on the test organism types, duration of exposure, oil type and the initial oil concentration. Total oil toxicity acute effects of total oil as LC50 for molluscs range from 500 to 2,000 ppb (Clark et al., 2001; Long and Holdway, 2002). A wider range of LC50 values have been reported for species of crustacea and fish from 100 to 258,000,000 ppb (Gulec et al., 1997; Gulec and Holdway, 2000; Clark et al., 2001) and 45 to 465,000,000 ppb (Gulec and Holdway, 2000; Barron et al., 2004), respectively. The 10 ppb threshold represents the very lowest concentration and corresponds generally with the lowest trigger levels for chronic exposure for entrained hydrocarbons in the ANZECC (2019) water quality guidelines. This is consistent with NOPSEMA (2019) guidance. **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).
100	Moderate	**Risk Evaluation** The 100 ppb exposure value is considered to be more representative of sublethal impacts to most species and lethal impacts to sensitive species based on toxicity testing as described above. This is considered conservative as toxicity to marine organisms from oil is likely to be driven by the more bioavailable dissolved aromatic fraction, which is typically not differentiated from entrained oil in toxicity tests using water accommodated fractions (WAFs). Given entrained oil is expected to have lower toxicity than dissolved aromatics, especially over time periods where these soluble fractions have dissoluted from entrained oil, the higher Moderate exposure

Entrained hydrocarbons (ppb)	Exposure Value	Description
		value for entrained oil over dissolved aromatic hydrocarbons (100 vs 50 ppb) is considered appropriate. **Response Planning** Encompassed by response to 10 ppb. There is nothing different for higher exposure values.

7.5.6 Spill Risk Assessment Approach

The spill risk assessment approach adopted is based on Santos' Oil Spill Risk Assessment and Response Planning Procedure.

A consistent risk assessment approach is applied to unplanned hydrocarbon release scenarios. The spill risk assessment approach is based on Santos' Oil Spill Risk Assessment and Response Planning Procedure . The procedure describes the spill risk assessment process as follows:

- Identify the spatial extent of the EMBA. This has been completed for this revision to the Varanus Island Hub Operations 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 3.2 and Appendix C.
- Identify areas of high environmental value (HEV) within the EMBA (HEVs are described in Section 7.5.6.2).
- Identify and then risk assess hotspots. Hotspots are effectively a subset of HEVs, and their determination is described in Section 7.5.6.3
- identify priorities for protection (for consideration of spill response strategies in the OPEP).

7.5.6.1 Spill environment that may be affected

Defining the EMBA by an oil spill is the first step in oil spill risk and impact 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 is used to define the overall EMBA for the activity. The EMBA is further described in Section 3.1. To determine the potential impact to receptors within the EMBA, the MEVA is used to determine them as described in Section 3.1.

7.5.6.2 Areas of high environmental value

Santos has predetermined areas of HEV (Figure 7-2) 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 reproduction, 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.

7.5.6.3 Hotspots

While the entire MEVA 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 – considered by Santos to be HEV areas ranked 1 to 3
- highest probability of contact by oil (either floating, entrained or dissolved aromatic)
- greatest potential concentration or volume of oil arriving at the area.

These areas are termed 'hotspots'. Defining hotspots is typically the first step in undertaking detailed spill risk assessment and spill response planning. Hotspots are a subset of HEV areas that:

- have the highest probability of contact (at least higher than 5%) above the impact assessment exposure value 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 DAH above contact exposure values described in Section 7.5.5.

A workshop was held to review the hotspots for the Varanus Island Hub operations activities worst case oil spill scenario. During the workshop, additional hotspots may be included through discretion of workshop attendees where they do not strictly meet all of the above criteria. E.g., an HEV ranked 1 to 3 with <5% probability, or an HEV ranked 4 or 5 with >5% probability, depending on the concentrations and volumes presented in the modelling report.

During a hotspot workshop, an environment consequence assessment is conducted against each of the hotspots identified using the Santos risk assessment process identified in Section 5, the outcome of this is provided in Appendix H.

7.5.6.4 Priorities for protection

For the purposes of a spill response preparedness strategy, it is not necessary for all hotspots to have detailed planning. For example, wholly submerged hotspots may only be contacted by entrained oil, and the response would be largely to implement scientific monitoring to determine impact and recovery. Hotspots with features that are not wholly submerged (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 exposure value concentrations.

Further detail on selection of Protection Priority Areas process is detailed in the Oil Spill Risk Assessment and Response Planning Procedure.

The following hotspot locations have been identified as Priorities for Protection areas for oil spill response planning within the Varanus Island Hub Operations OPEP and are based on the worst-case estimate of surface oil concentration, shoreline loading and minimum contact time at exposure value concentrations for the Varanus Island Hub operations activities:

- Muiron Islands
- Barrow and Montebello Islands Surrounds
- Montebello Islands
- Barrow Island.

The oil spill response strategies for Priority for Protection areas are undertaken within the Varanus Island Hub Operations OPEP. 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.

7.5.7 Spill Response Strategies

Numerous oil spill response strategies are available to be implemented in the event of a spill. These are generally strategies that have been implemented in the past or are considered good industry practice. Section 7 of the OPEP describes in detail the applicable response strategies for this activity, which include, depending on the type and size of the spill:

- source control
- monitor and evaluate
- mechanical dispersion

- shoreline protection and deflection
- shoreline clean-up
- oiled wildlife
- scientific monitoring

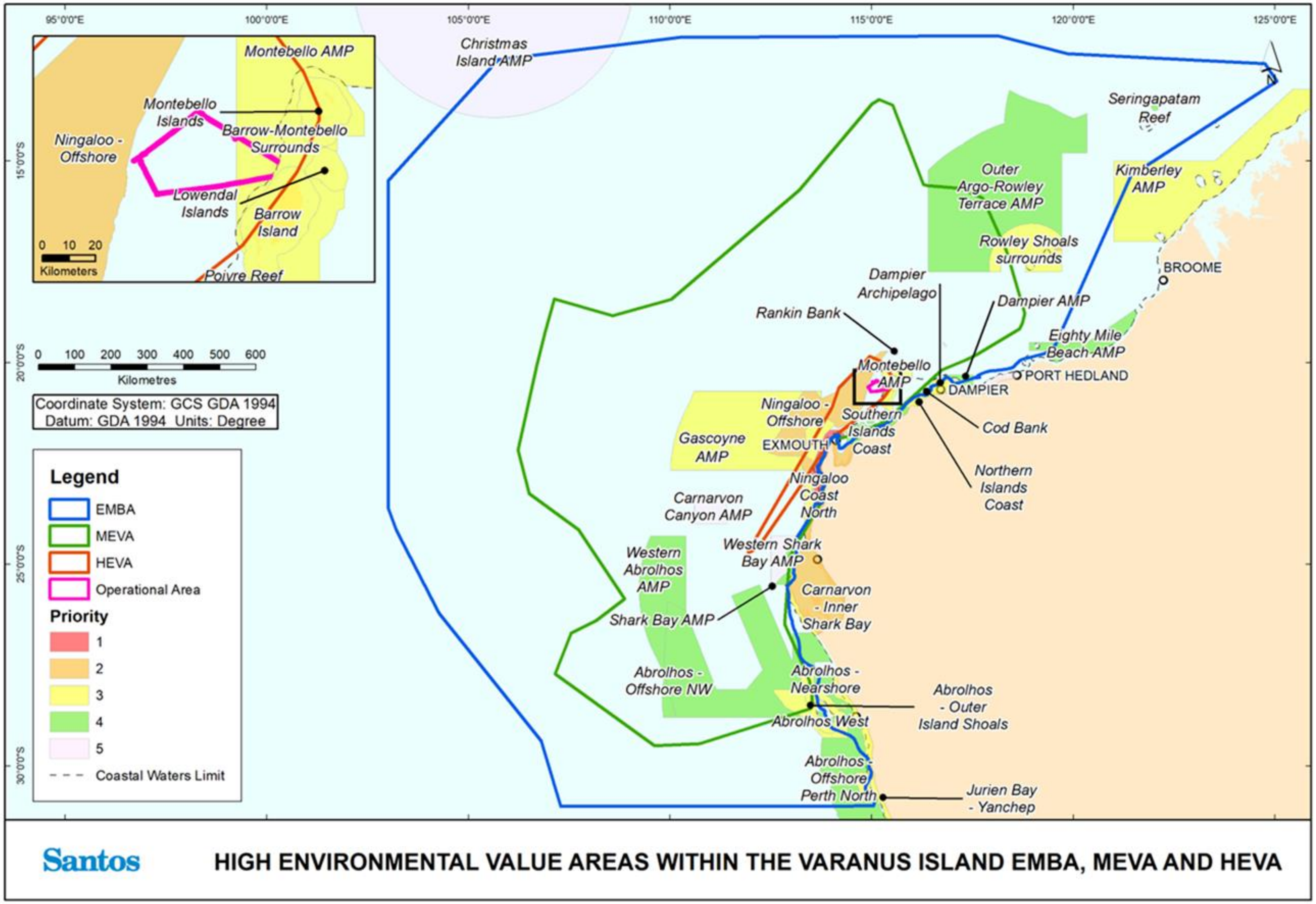


Figure 7-2: High environmental value areas

7.5.8 Potential Hydrocarbon Impact Pathways

To help inform the hydrocarbon spill risk assessment generic receptors and potential impact pathways have been defined (Table 7.17). The potential impact pathways considered physical and chemical affects. 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 7.17 and the information is drawn upon within the hydrocarbon risk assessment for each spill scenario (Sections 7.6 to 7.9).

Table 7.18 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 contour.

Table 7-17: Physical and chemical pathways for hydrocarbon exposure and potential impacts to 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 is dependent upon the energy of the shoreline area, the type of the rock formation and continual biodegradation 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 surf zone. Degree of loading is dependent upon 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 flats	Shoreline loading and water movement may allow hydrocarbon residue to filter down into sediments (e.g. within wetlands) or continue to biodegrade on the surface or remobilise into surf zone. 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 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.
Mangroves	Coating of root system reducing air and salt exchange. Degree of coating is dependent upon the energy and tidal reach of the shoreline, the type of the substrate and continual weathering of the oil.	• Yellowing of leaves. • Defoliation. • Increased sensitivity to stressors. • Tree death. • Reduced growth. • Reduced reproductive output. • Reduced seed viability.	• External contact by oil and adsorption across cellular membranes.	• Yellowing of leaves. • Defoliation. • Increased sensitivity to stressors. • Tree death. • Reduced growth. • Reduced reproductive output. • Reduced seed viability. • Growth abnormalities.
Algae and seagrasses	Coating of leaves/thalli reducing light availability and gas exchange. Degree of coating depends upon the energy and tidal reach of the shoreline, the type of the receptor and continual weathering of the 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/propagule viability.

Receptor	Physical Pathway	Potential Impacts	Chemical Pathway	Potential Impacts
Hard corals	Coating of polyps, shading resulting in reduction on light availability. Degree of coating is dependent upon the metocean conditions, dilution, if corals are emergent at all and continual weathering of the 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/larval success. • Growth abnormalities.
Invertebrates	Coating of adults, eggs and larvae. Degree of coating is dependent upon the energy and tidal reach of the shoreline, the type of the receptor and continual weathering of the oil.	• Mortality. • Behavioural disruption. • Impaired growth.	• Ingestion and inhalation. • External contact and adsorption across exposed skin and cellular membranes. • Uptake of DAH across cellular membranes. • Reduced mobility and capacity for oxygen exchange.	• Mortality. • Cell damage. • Reduced metabolic capacity. • Reduced immune response. • Disease. • Reduced growth. • Reduced reproductive output. • Reduced egg/larval success. • Growth abnormalities. • Behavioural disruption.
Fish, including sharks and rays	Coating of adults but primarily eggs and larvae – reduced mobility and capacity for oxygen exchange.	• Mortality. • Oxygen debt. • Starvation. • Dehydration. • Increased predation. • Behavioural disruption.	• Ingestion. • External contact and adsorption across exposed skin and cellular membranes. • Uptake of DAH across cellular membranes (for example, gills).	• Mortality. • Cell damage. • Flesh taint. • Reduced metabolic capacity. • Reduced immune response. • Disease. • Reduced growth. • Reduced reproductive output. • Reduced egg/larval success. • Growth abnormalities. • Behavioural disruption.
Birds (seabirds and shorebirds)	Degree of coating is dependent upon 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:	Ingestion (during feeding or preening). External contact and adsorption across exposed skin and membranes.	• Mortality. • Cell damage, lesions. • Secondary infections.

Receptor	Physical Pathway	Potential Impacts	Chemical Pathway	Potential Impacts
		• Physical restriction of flight and swimming movement. • Mortality. • Hypothermia / impairing the waterproofing of feathers. • Disruption to feeding / starvation. • Disruption to breeding. • Disruption to migration.		• Reduced metabolic capacity. • Reduced immune response. • Disease. • Reduced growth. • Reduced reproductive output. • Growth abnormalities. • Behavioural disruption.
Marine reptiles	Degree of coating is dependent upon 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 (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.

Table 7-18: Nature and scale of hydrocarbon spills on environment and socio-economic receptors

Receptor	Nature and Scale of Hydrocarbon Spills
Marine Fauna	
Marine mammals	• Fourteen migratory or threatened marine mammal species were identified by the EPBC Protected Matters search for the EMBA (Section3.2.4). Of these, two are listed as endangered (blue whale and southern right whale) and three as vulnerable (Australian sea lion, fin whale and sei whale). • The blue whale and humpback whale BIAs (Figure 7-8) and a dugong BIA for foraging and reproduction (Figure 3-9) are within the extent of the moderate exposure value described in Section 7.5.5 • Other migratory marine mammals may encounter either surface or water-column hydrocarbons within the extent of the moderate exposure value; however, in the absence of any known feeding, resting or breeding areas, significant numbers are unlikely to be contacted.
Marine reptiles	• Eight species of threatened marine reptile were identified as possibly being contacted by a spill. Short-nosed and leaf-scaled seasnakes and 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 four turtle species (flatback, green, hawksbill and loggerhead) are found within the extent of the moderate exposure value. • Significant green turtle and flatback turtle rookeries are located, respectively, on the western side of Barrow Island and on the Montebello Islands within the extent of the moderate exposure value. • Other important nesting beaches for other species are present within the extent of the moderate exposure value including accumulation on shorelines.
Seabirds and shorebirds	• Sixty seven threatened species of seabirds and shorebirds were identified by the EPBC Protected Matters database search (Table 3-6**).** The Australian lesser noddy, lesser crested tern and Australian fairy tern (all vulnerable status) have BIAs for foraging that overlap the extent of the moderate exposure value. • The fairy tern has a BIA for reproduction within the EMBA and moderate exposure threshold value (Table 7-13). Therefore, the species may be contacted by surface, entrained or dissolved aromatic hydrocarbons while foraging (dive and skim feeding), with higher numbers expected during the breeding period of August to February. • 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 or entrained hydrocarbons or dissolved aromatic hydrocarbons while foraging.
Fish, sharks and rays	• Threatened species identified by the EPBC Protected Matters search include the white shark, whale shark, grey nurse shark and green and dwarf sawfish, which may be present in the EMBA. However, given the absence of critical habitat for most of these species, significant numbers are not expected to be exposed to hydrocarbons in the event of a spill. • Grey nurse sharks and white sharks could be present at low densities all year round within the operational area and EMBA; with no known feeding, resting or breeding areas. • The operational area and therefore the hydrocarbon moderate exposure value overlaps the whale shark foraging BIA (Figure 3-15). However, the main whale shark aggregation location (Ningaloo Marine Park) is 129 km southwest of the operational area. • While the BIA is for foraging, it is not for high-density prey where congregations are expected, so hydrocarbon contact is expected to be limited to transient migrating individuals.
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.

Receptor	Nature and Scale of Hydrocarbon Spills
	• Given the duration of fish spawning periods, lack of suitable habitat for aggregating fish populations near the surface, and the quick evaporation and dispersion of condensate and diesel, contact to overall fish populations are not expected to be significant. • Contact will be greatest in the upper 10 m of the water column and in areas close to the spill source where hydrocarbon concentrations are likely to be highest.
Socio-economic	
Protected areas	Protected areas within the moderate hydrocarbon exposure value are listed in Section 3.2.3, described in Appendix C and summarised below. Ningaloo Coast World Heritage Area • Includes important and significant natural habitats for in-situ conservation of biological diversity, including threatened species. Significant geomorphic features, natural phenomena and areas of exceptional natural beauty. Shark Bay, Western Australia • The Shark Bay region represents a meeting point of three major climatic regions and contains abundant marine flora and fauna. In particular, it has extensive seagrass meadows that support a large dugong population. Australian Marine Parks: Montebello Marine Park, Ningaloo Marine Park, Gascoyne Marine Park, Carnarvon Canyon Marine Park, Shark Bay Marine Park, Abrolhos Marine Park, Argo-Rowley Terrace Marine Park. • Include habitat for foraging and migratory seabirds and foraging or breeding areas for marine turtles and dugongs. State Marine Parks and Marine Management Areas: Barrow Island Marine Park, Barrow Island Marine Management Area, Montebello Islands Marine Park, and Muiron Islands Marine Management Area. • Includes foraging and nesting areas for marine turtles and feeding, resting and breeding areas for seabirds and migratory shorebirds.
KEFs	One KEF is within the moderate hydrocarbon exposure value: Glomar Shoals • The Glomar Shoals are a submerged feature situated at a depth of 33 to 77 m, approximately 150 km north of Dampier on the Rowley Shelf. Modelling predicted entrained oil at Glomar Shoals reaching the moderate exposure value. • A surface release of hydrocarbons to the marine environment would result in a localised reduction in water quality in the upper surface waters of the water column (particularly the top 10 m). Therefore, hydrocarbon contact to the habitats of the KEFs from a surface release is not considered likely. However, a subsea release from a wellhead may cause a reduction in water quality with exposure to entrained and/or dissolved aromatic hydrocarbons extending for up to several hundred kilometres for the worst-case credible spill scenario (loss of well control). Potential contact to values and sensitivities within the above KEFs are described above for the specific receptor groups (e.g., fish, marine mammals). Are described in Section 3.2.3 and Appendix C and are summarised below.
Fisheries	• Several commercial and state fisheries are found within the EMBA (captured in Table 3-10) and moderate hydrocarbon exposure value described in Section 7.5.4.
Tourism	• There are many sources of marine-based tourism within the EMBA (Table 3-10), and moderate hydrocarbon exposure value described in Section 7.5.4. • Aquatic recreational activities, such as boating, diving and fishing, do occur around the Montebello Islands but are predominantly concentrated in the vicinity of the population centres, such as Exmouth, Dampier and Onslow. In particular, tourism is expected in the Ningaloo region. • In the waters within and immediately surrounding the operational area, tourism activities are expected to be low. However, 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.

Receptor	Nature and Scale of Hydrocarbon Spills
Shipping	• Three shipping fairways intersect the EMBA (Table 3-10**;** Figure 3-22**)** Hydrocarbons in the water column will have no effect on shipping. • Exclusion zones surrounding a spill may 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	• The level of defence activities carried out in the vicinity of the operational area is low, if any; therefore, interference with defence activities due to a hydrocarbon spill is expected to be minimal (Table 3-10**)**.
Shipwrecks	• The closest historic shipwreck (the *Trial*) is located approximately 15 km on the western side of the Montebello Islands. Shipwrecks may be of important heritage value and/or act as dive sites (Table 3-10). • 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. The level of activities undertaken by indigenous users is expected to be low; therefore, interference due to a hydrocarbon spill is expected to be minimal (Table 3-10).
Existing oil and gas activity	• Exclusion zones surrounding spills will reduce access, potentially resulting in delays to work schedules with possible subsequent financial implications. 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).

7.6 Surface Release of Condensate from Wellheads at the John Brookes Wellhead Platform

7.6.1 Description of Event

Event	During well intervention activities (e.g., wire-line activities), the pressure envelope of the well is entered via fit-for-purpose pressure control equipment at surface, and a loss of well control at surface through the completion string is considered credible (although very unlikely) and represents the worse-case discharge scenario for the wells during the production lifecycle phase. The maximum credible spill volume from a loss of well control at surface is estimated at 39,011 m^3 released over 100 days (rate of 16.25 m^3/hr). The 16.25 m^3/hr flow rate represents the maximum possible 100% flow rate estimated for these wells.
Extent	At the surface-concentration environmental impact threshold of 10 g/$m^{2,}$ the potential extent of floating surface oil is approximately 26.5 km west from the release site. Surface oil may be visible 160 km from the release site at concentrations above the 1 g/m^2 threshold. Direct contact of shorelines with slicks (greater than 10 g/m^2) was not predicted. However, there was a potential for thinner sheens (at or below 1 g/m^2) to reach shorelines, and accumulations were predicted for a number of shoreline sections. In terms of the volumes of oil that could accumulate on shorelines, the worst-case estimate is predicted for shorelines of the Montebello Islands (33 m^3) within 171 hours (approximately seven days). Entrained oil in the water column above the impact threshold of 100 ppb is predicted to occur within a region up to 1,143 km from the release site. Dissolved aromatic hydrocarbons in the water column above an impact threshold of 6 ppb are predicted to occur up to 1,370 km from the release site.
Duration	In determining the worst-case volume that could be released from a John Brookes production well loss of containment, the guidance provided in the AMSA Technical Guideline for the Preparation of Marine Pollution Contingency Plans for Marine and Coastal Facilities (AMSA, 2015) has been used. Specifically, the calculations presented in Table 10 of the AMSA guideline for a production platform blowout have been considered. AMSA (2015) determines the volume released from a production platform blowout as the predicted flow rate per day times by days estimated to get a relief rig on site + 20 days to cap a well. A maximum 100% flow rate of 390.11 m^3/d for 100 days has been determined to yield a total release volume of 39,011 m^3 of condensate. Rather than using the AMSA assumption of mobilisation time + 20 days to cap a well, the release period herein (100 days) is based on a conservative rig mobilisation and relief-well drilling schedule. The longest duration blowouts in recent history (Montara at 75 days and Macondo at 86 days) have been capped in less time than this. Further information on the spill modelling is provided in the relevant spill risk sections **(Section 7.7 and Section 7.8).**

7.6.2 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 include:

- physical environment (water and sediment quality, shoals and banks, benthic habitats, offshore reefs and islands)
- threatened or migratory fauna (marine mammals, marine reptiles, sharks, fish, rays and birds), protected and significant areas (marine parks, heritage areas, KEFs)
- socio-economic receptors (fisheries, tourism, recreation and other third-party operators).

A surface release of John Brookes condensate to the marine environment would result in a localised reduction in water quality in the upper surface waters of the water column. There is a low probability (less than 14%) that condensate will contact shorelines. However, a worst-case shoreline accumulation was predicted at the Montebello Islands (29 m3). The potential impact pathways (physical and chemical) of hydrocarbon exposure to relevant habitat and marine fauna receptors are summarised in Table 7-17

Based on similarities in density and persistence if spilled in the marine environment, potential impacts to relevant receptors that may interact with hydrocarbon spills within the EMBA are further described in Table 7-18.

7.6.2.1 Modelled scenario

To determine the spatial extent of impacts from a potential surface release of condensate from a John Brookes production well blowout and the dispersion characteristics over time, stochastic modelling was completed by APASA (APASA, 2014a). The representative hydrocarbon characteristics used to inform the model are described in Section 7.5.4 with a summary of the parameters used is described in Table 7-19.

Table 7-19: Loss of well control or damage to infrastructure causing condensate with gas release from John Brookes wellheads at surface scenario parameters

Condensate Characteristics Modelled	Released Volume (m^3)	Discharge Rate (m^3/day)	Release Location	Release Depth	Spill Duration
John Brookes condensate	39,011	390.11	John Brookes WHP	At surface	100 days

Spill modelling was performed using a number of simulated environmental conditions from all seasons, thus providing a range of realistic spill trajectories with which to determine the spatial extent of potential impacts and receptors that might be impacted from a spill.

7.6.2.2 Spill Modelling Results

Weathering profiles generated under a range of representative wind conditions indicated that, for a surface release, evaporation would be by far the major mechanism for reducing the volume of condensate released on the sea surface, with entrainment and dissolution accounting for a lower proportion of the volume left on the sea surface. Approximately 70% of the total volume of John Brookes condensate is predicted to evaporate within one day of release. The portion of John Brookes condensate that is predicted to entrain (5 to 12%) would be subject to dissolution and natural decay within the water column with further resurfacing and evaporation possible, depending on wind and wave conditions.

The modelling results are summarised below for the fate of hydrocarbon (floating, entrained, dissolved and accumulated) at the exposure values described in Section 7.5.4. Appendix H includes the full results and has been provided for the purposes of risk evaluation.

Further parameters required to inform spill response strategies are described further in the OPEP.

7.6.2.2.1 Floating oil

Low (1 g/m^2)

Floating oil above the low exposure value of ≥1 g/m² are most likely to occur to the southwest or northeast of the hypothetical blowout site, with the outer contours of probability indicating that floating oil concentrations could potentially occur up to 150 km southwest. Modelling results indicate that the buffer zone around the Montebello Islands has 5% probability of contact by floating oil ≥1 g/m². A probability of 1% is forecasted for contact greater than or equal to the exposure threshold for the buffer zones around Barrow-Montebello shallows, Barrow Island, Lowendal Islands, Muiron Islands and Ningaloo Coast. Probabilities of <1% are forecasted for all other receptors.

Moderate (10 g/m^2)

Stochastic modelling determined that surface oil at the 10 g/m2 the moderate exposure value would be limited to approximately 26.5 km west of the release location. The modelling reported that floating oil at concentrations greater than or equal to 10 g/m² is unlikely (probability less than 1%) to reach any shoreline.

High (25g/m^2)

Floating hydrocarbon above the high exposure threshold is predicted to be limited to the vicinity of the release only.

7.6.2.2.2 Shoreline accumulation

The highest estimates of potential shoreline accumulation is forecasted for shorelines among the Montebello Islands (1.5 kg/m²), with a total accumulation volume of 33 m³. Potential for thinner sheens to reach shorelines and accumulate to concentrations ≥1 g/m2 is indicated for a number of shoreline sections.

Low (10 g/m^2)

The modelling predicted that the highest probability of contact at 10g/m2 may occur at Barrow Island (21%). Other location that are predicted to be contacted include: Muiron Islands (2%), Ningaloo Coast North (5%), Barrow-Montebello surrounds (19%), Montebello Islands (20%), Middle Islands Coast (2%), Southern Islands Coast (5%), Thevenard Islands (7%) and Barrow Island (8%).

Moderate (100 g/m^2)

The modelling reported indicates the shoreline loading above 100 g/m2 at multiple locations, including: Muiron Islands (1%), Ningaloo Coast North (2%), Barrow-Montebello surrounds (8%), Montebello Islands (13%), Barrow Island (8%).

High (1,000 g/m^2)

No receptors have a probability of greater than 1% contact at this threshold.

7.6.2.2.3 Entrained oil

Worst-case estimates of entrained concentrations greater than 1,000 ppb, are forecast for the buffer zones around the Barrow-Montebello shallows, Montebello Islands and Barrow Island (1,077 to 1,216 ppb).

Low (10 ppb)

Entrained oil above the 10 ppb threshold is predicted to potentially occur at: Outer Ningaloo Coast North (64%), Muiron Islands (25%), Ningaloo Coast Norther (31%), Abrolhos West (3%) Jurien AMP (2%), Barrow Montebello Surrounds (43%), Montebello Islands (34%, Barrow Island (35%, Lowendal Islands (25%) Outer NW Ningaloo (95%), Outer Shark Bay Coast (3%), Outer Abrolhos Islands – Shoals (4%), Montebello AMP (84%), Offshore Ningaloo (100%), Dampier Archipelago (2%), Dampier AMP (2%), Eighty Mile Beach AMP (2%), Rowley Shoals and surrounds (7%), Shark Bay AMP (5%) Offshore Abrolhos NW (23%), Offshore Abrolhos – Perth North (2%), Middle Islands Coast (7%), Rankin Bank (62%), Northern Islands Coast (3%), Southern Islands Coast (26%) Thevenard Islands (8%) and Glomar Shoals (10%).

Moderate (100 ppb)

Entrained oil above the exposure threshold of 100 ppb is predicted to occur due to wind and wave mixing of sea surface condensate. The probability contours calculated for entrained oil indicate that concentrations greater than or equal to 100 ppb are most likely to occur in waters southwest and east of the release site and may move up to 1,000 km from the release site. Entrained oil concentrations of more than 100 ppb are predicted to potentially contact a number of locations including the buffer zones around Barrow/Montebello shallows (5%), Montebello Islands (9%), Barrow Island (11%) and Ningaloo Coast (5%). Probabilities of contact greater than 1% are also forecast for Lowendal Islands, Middle Island Coast, Southern Island Coast, Thevenard Islands and Muiron Islands.

7.6.2.2.4 Dissolved aromatic hydrocarbons

The maximum instantaneous DAH concentration is forecasted for nearshore waters of Barrow Island (414 ppb).

Low (6 ppb)

Modelling results indicated concentrations of dissolved aromatic hydrocarbons could exceed the low exposure threshold of 6 ppb up to approximately 1,370 km from the release site. Dissolved aromatic hydrocarbon concentrations higher than 6 ppb are predicted to potentially contact a number of locations, most notably offshore Ningaloo Reef (100%), outer northwest Ningaloo (82%), Montebello AMP (87%), the Barrow Montebello shallows (38%), Barrow Island (24%) and Montebello Islands (9%).

Moderate (50 ppb)

Results indicate that dissolved aromatic hydrocarbons could occur at instantaneous concentrations ≥50 ppb up to 350 km to the southwest of the release site. The highest probability of instantaneous DAH concentrations ≥50 ppb is forecast for nearshore waters of Barrow Island (7%). Probabilities of 4% or less are also forecast to potentially contact the buffer zones around Barrow-Montebello shallows, Montebello Islands, Lowendal Islands, Southern Islands Coast, Muiron Island and Ningaloo Coast. It is unlikely (probabilities <1%) that DAH at concentrations ≥50 ppb would reach nearshore waters of all other receptors.

High (400 ppb)

Instantaneous DAH concentrations >400 ppb are only forecast at Offshore Ningaloo (7%). All other receptors have a probability of 1% or less.

7.6.3 Environmental Performance Outcomes and Control Measures

The EPOs relating to this hazard include:

- No loss of containment of hydrocarbon to the marine environment (EPO-VI-CW-07).

Control measures applied to prevent an oil spill are shown in Table 7-20 and corresponding EPOs 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.

Operational controls that would be implemented to guide and effective response after a spill has occurred are provided within relevant sections of the OPEP, together with corresponding EPSs and measurement criteria.

Table 7-20: Control measure evaluation for the surface release of condensate from wellheads at the John Brookes wellhead platform

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls				
VI-CW-CM-17	Planned subsea and offshore maintenance.	Reduces likelihood of leaks from equipment and ensures ongoing integrity of infrastructure	Personnel and operational costs associated with undertaking regular inspections of all equipment.	**Adopted** – Benefit of the inspection to determine operational integrity outweighs the cost to undertake the inspection.
VI-CW-CM-45	NOPSEMA-accepted WOMP in place.	Includes control measures for well integrity and well control as well as ongoing inspection requirements.	Costs associated with personnel time in writing, reviewing and implementing the WOMP.	**Adopted** – Benefits considered to outweigh costs. Regulatory requirement must be adopted.
VI-CW-CM-46	Well services procedures and criteria.	Includes control measures for well integrity, well operations and well control.	Costs associated with personnel time in writing, reviewing and implementing the procedures.	**Adopted** – Benefits considered to outweigh costs.
VI-CW-CM- 38	Inspection of platform structures and hydrocarbon-containing equipment.	Regular inspections reduce the risk of leaks from platform structures and hydrocarbon-containing equipment by confirming appropriate integrity.	Costs associated with personnel time in performing the inspection, reporting of inspections and follow up actions.	**Adopted** – Benefits considered to outweigh costs.
VI-CW-CM-53	Inspection and corrosion monitoring of pipelines.	Regular inspections reduce the risk of leaks from subsea pipelines and risers by confirming appropriate integrity.	Costs associated with personnel time in performing the inspections, monitoring, reporting of inspections and follow up actions.	**Adopted** – Benefits considered to outweigh costs.
VI-CW-CM-49	Emergency power equipment is provided on John Brookes WHP to secure secondary power source for safety integrity system.	Provides backup power for the offshore safety integrity system for control of emergency shutdowns in abnormal operation situations.	Costs associated with personnel time in performing the testing and maintenance.	**Adopted** – Benefits considered to outweigh costs.
VI-CW-CM-47	Testing and maintenance of emergency shutdown systems and shutdown/ safety valves.	Maintenance and testing of emergency systems and shutdown valves enables potential spill volumes to be minimised.	Costs associated with personnel time in performing the testing and maintenance.	**Adopted** – Benefits considered to outweigh costs.
VI-CW-CM-48	Incident Response Plan detailing the requirements for preparedness and response to emergencies and crises to protect people and the environment.	Provides detail to ensure the ESD system is activated quickly and efficiently if it has not automatically activated, to reduce the extent of impacts to the marine environment.	Administrative costs of preparing documents.	**Adopted** – Benefits considered to outweigh costs.

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
VI-CW-CM-19	WHP petroleum safety zone and cautionary area.	A petroleum safety zone applies around the John Brookes WHP and is on Australian nautical charts. The presence of the petroleum safety zone reduces the potential for vessels to collide with the WHP resulting in a loss of well control.	No additional costs to Santos. Other marine users may be temporarily excluded from areas, disrupting their activities.	**Adopted** – Regulatory requirement must be adopted. Risk of excluding other marine users within a 500-m radius of the John Brookes WHP is unlikely to significantly impact upon the marine user. The benefits to safety of the activity (thus reducing risk of environmental impacts due to vessel collisions) outweigh potential costs.
VI-CW-CM-23	Navigational charting of infrastructure.	Provides a means for other marine users to be aware of the presence of the WHP and support vessels.	Costs associated with personnel time in issuing notifications.	**Adopted** – Benefits considered to outweigh costs.
VI-CW-CM-24	Navigational lighting and aids.	Reduces risk of environmental impact from vessel collisions by ensuring safety requirements are fulfilled.	Negligible costs of operating navigational equipment.	**Adopted** – The benefits to safety of the activity (thus reducing risk of environmental impacts due to vessel collisions) outweigh potential costs.
VI-CW-CM-50	Oil pollution emergency plan (OPEP).	Implements response plans to deal with an unplanned hydrocarbon release quickly and efficiently to reduce impacts to the marine environment.	Administrative costs of preparing documents and large costs of preparing for and implementing response strategies.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented and that the vessels are compliant outweigh the costs. Regulatory requirement must be adopted.
VI-CW-CM-54	Operational monitoring of low flow well leak.	Ensures potential leaks from wells are investigated and monitored until negligible risk to the environment is confirmed and there is no risk of escalation.	Costs associated with personnel time undertaking risk assessments. Costs of monitoring, including ROV and vessel hire.	**Adopted** – Benefits considered to outweigh costs.
Additional Controls				
VI-CW-CM-18	Dropped object prevention procedure (LEMS).	Impacts to the environment are reduced by preventing dropped objects. Requires lifting equipment is certified and inspected.	Costs associated with personnel time in implementing procedures and in incident reporting.	**Adopted** – Benefits considered to outweigh costs.
VI-CW-CM-51	Support vessel positioning.	Allows the vessel to maintain accurate positioning and reduces potential to impact the WHP.	Costs associated with requiring vessels have appropriate positioning systems; however, these are standard on certain classes of vessel.	**Adopted** – The benefits to safety and the environment (thus reducing risk of environmental impacts due to vessel collisions) outweigh potential costs.

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
VI-CW-CM-55	Santos' strategy..	Ensures an appropriate level of planning for the eventual permanent plug and abandonment of all wells and removal of property. Ensures Santos has plans in place to meet its regulatory obligation to remove property in accordance with the requirements of s.572 of the OPGGS Act.	Organisational costs to prepare plans prior to EOFL.	**Adopted** – Benefits considered to outweigh costs. Regulatory obligation to remove property.
N/A	Dedicated resources (e.g., dedicated spill response facilities) on location in the event of loss of hydrocarbons to allow rapid response.	Limited benefit as no applicable response strategies that require immediate application at the release site and existing resources (personnel, vessels and equipment) are located nearby at Varanus Island – closer to shorelines that may need protection.	Large costs associated with dedicated resources.	**Not Adopted** – Costs grossly disproportionate to environmental benefit and resources already positioned at Varanus Island.
N/A	Standby vessel in situ 24 hours/day at unmanned WHP.	Monitor the WHP 500-m petroleum safety zone and be equipped with an automatic identification system to aid in its detection at sea and with radar to aid in the detection of approaching third-party vessels. Reduces risk of vessel collision and subsequent unplanned release of hydrocarbons causing potential harm to the marine environment.	High cost associated with contracting standby vessel. Negligible costs of operating navigational equipment.	**Not Adopted** – The costs associated with having a vessel on location 24/7 are considered infeasible, particularly given the WHP and infrastructure are marked on charts and navigational aids are present.
N/A	Source control plans in place for all wells.	May allow for quicker response to a 'loss of well control' scenario, thereby limiting potential spill extent and volume.	Costs associated with personnel time in writing and reviewing relief well plans.	**Not Adopted** – Santos only has relief well plans in place for wells undergoing intervention activities, and it is part of the intervention planning process. Given the low risk presented by wells and the standards used to manage well integrity, it is not considered an effective control.

7.6.4 Environmental Impact Assessment

The below environmental impact assessment follows the risk assessment approach detailed in Section 7.5.6.

7.6.4.1 Identification of hotspots for consequence assessment

As described in Section 7.5.6, all HEVs within the EMBA for the surface release of hydrocarbons from WHP (low exposure threshold) are listed in Table 7-21. The values and sensitivities associated with these HEVs have been described in Appendix C. Further to this, Table 7-21 filters the HEV to identify the hotspots where they meet the criteria.

Table 7-21: Identified high environmental value and hotspot receptors

Receptor	HEV Value	Exposure Threshold			Hotspot
		Low	Moderate[1]	High[1]	
Montebello Islands	3	✓	✓	✓	✓
Barrow Island	3	✓	✓	✓	✓
Outer Ningaloo Coast North (submerged)	2	✓	✓	✓	✓
Ningaloo Coast North (Emergent)	1	✓	✓	✓	✓
Muiron Islands	2	✓	X	X	X
Exmouth Gulf Coast	2	✓	X	X	X
Abrolhos West	2	✓	X	X	X
Abrolhos Islands Wallabi Group	2	✓	X	X	X
Abrolhos Islands Easter Group	2	✓	X	X	X
Jurien AMP	2	✓	X	X	X
Barrow-Montebello Surrounds	3	✓	X	X	X
Lowendal Islands	3	✓	X	X	X
Outer NW Ningaloo	3	✓	X	X	X
Ningaloo Coast South	3	✓	X	X	X
Outer Shark Bay Coast	3	✓	X	X	X
Outer Abrolhos Islands - Shoals	3	✓	X	X	X
Montebello AMP	4	✓	X	X	X
Offshore Ningaloo	4	✓	X	X	X
Dampier Archipelago	4	✓	X	X	X
Dampier AMP	4	✓	X	X	X
Rowley Shoals surrounds	4	✓	X	X	X
Shark Bay AMP	4	✓	X	X	X
Offshore Abrolhos NW	4	✓	X	X	X
Nearshore Abrolhos	4	✓	X	X	X
Offshore Abrolhos – Perth North	4	✓	X	X	X
Middle Islands Coast	5	✓	X	X	X
Northern Islands Coast	5	✓	X	X	X
Southern Islands Coast	5	✓	X	X	X
Rankin Bank	5	✓	X	X	X
Thevenard Islands	5	✓	X	X	X
Glomar Shoals	5	✓	X	X	X

1 >5% probability of contact at the medium/high exposure value for consideration for further hotspot assessment.

This process identified the hotspots of:

- Montebello Islands
- Barrow Island
- Outer Ningaloo Coast North

- Ningaloo Coast North.

Appendix H 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 aromatic hydrocarbons (DAHs). For each hotspot area, the consequence to the key values were assessed using the methodology described in Section 5.2.5.

The impact, likelihoods and consequence ranking for a subsea release of condensate from wellheads are outlined in Table 7-22.

Table 7-22: Impacts, likelihood and consequence ranking – subsea release of condensate from surface release of condensate from John Brookes wellhead platform

<table>
<tr><th colspan="2">Description</th></tr>
<tr><td>Receptors</td><td>Marine fauna (plankton, fish, cetaceans, marine mammals, marine reptiles, seabirds/shorebirds)
Physical environment or habitats
Protected areas
Socio-economic receptors</td></tr>
<tr><td>Consequence</td><td>IV-Major</td></tr>
<tr><td colspan="2">
The detailed consequence assessment for each priority area is provided in Section 7.6.4. A summary of the consequence assessment for each receptor category is presented below.
Physical Environment or Habitat
In the event of a condensate spill at the John Brookes WHP, hydrocarbons that reach nearshore environments in the Montebello Islands, Barrow Island and Ningaloo Coast hotspots have the potential to impact benthic coral reefs and mangrove areas at these sites, which may result in a long-term decrease in ecological values given toxicity impacts associated with hydrocarbon exposure (Table 7-18)
Threatened or Migratory Fauna
A surface release of John Brookes condensate to the marine environment would result in a localised reduction in water quality in the upper surface waters of the water column. There is a low probability (less than 1%) of condensate contacting shorelines. However, a worst-case shoreline accumulation was predicted at the Montebello Islands (33 m^3). The potential pathways and impacts to shoreline receptors through hydrocarbon exposure and potential toxicity effects are summarised in Table 7-18. Marine fauna present in the area may be potentially impacted by a spill through exposure to floating oil, entrained oil, or dissolved aromatic hydrocarbons.
There is potential for impact via these pathways to important marine turtle sites at the hotpots with one of the most significant rookery for the Green turtle on the western side of Barrow Island. Significant flatback turtle rookeries are also located on the Montebello Islands which is a hotspot.
In the unlikely event that a surface release of condensate did occur within the operational area, the potential impacts to the environment would be greatest within several kilometres of the spill location, when the toxic aromatic components of the fuel will be at their highest concentration and when the hydrocarbon is at its thickest on the surface of the receiving waters. Upon release to the marine environment, the condensate will rapidly lose toxicity with time and will spread thinner at the surface as evaporation continues or will become entrained within the water column. The potential sensitive receptors in the surrounding areas of the spill will include fish, marine mammals, marine reptiles and seabirds at the sea surface, as discussed in Table 7-18.
Habitat modification, degradation, disruption or loss; chemical discharge; and marine pollution are identified as potential threats to a number of marine fauna species in relevant recovery plans and conservation advice (Section 3.2.4). In line with the relevant actions prescribed in Recovery Plan for Marine Turtles in Australia 2017–2027 (DoEE, 2017) and conservation advice for fin (TSSC, 2015b), sei (TSSC, 2015c) and blue (TSSC, 2015c) whales and whale sharks (TSSC, 2015a), the activity will be conducted in a manner that reduces potential impacts to ALARP and acceptable levels. In addition, the Management Plan for the Montebello/Barrow Islands Marine Conservation Reserves 2007 – 2017 (DEC, no date) states that DPaW should ‘Ensure that important seabird and shorebird breeding and feeding areas are not significantly affected by human activities. It has also been identified that Barrow Island has predominantly migratory waders but few breeding seabirds (Surman 2003), which means population scale impacts given the low volumes and limited breeding are expected to be minimal. The potential impacts of a hydrocarbon release on seabird breeding and feeding areas are discussed in Table 7-18 Impacts in relation to human activities from responding to a spill are described in Section 6.8
Protected Areas
The EMBA intersects several protected areas and Australian marine parks and marine management areas (Section 3.2.3). Combined, these areas support all the habitats and faunal groups described above. The Ningaloo World Heritage Area has been identified as a hotspot, with impacts to the habitat or fauna receptors described above therefore have an impact on the listed values. The Montebello Islands CP and Barrow Island NR have also been identified as impact hotspots. Sub-tidal and marine values surrounding these reserves could be impacted. This 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 moderate-term effects to 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 (Table 3-10).
</td></tr>
</table>

Description	
Entrained oil at greater than 100 ppb could reach pearl farming activities at the Montebello Islands. Pearl oysters are filter feeders; therefore, entrained oil droplets could create negative impacts through ingestion and accumulation of hydrocarbon compounds in oyster tissues or interference with respiratory structures. Ecotox (2009) reported that no observable effect concentration levels from weathered condensates for a comparable oyster species ranged from approximately 9,000 to 28,000 ppm. Significant impacts on aquaculture would therefore be unlikely, as predictive modelling reported that the maximum entrained hydrocarbon concentration for the worst replicate at the Montebello Islands as 1,198 ppb. Additionally, pearling leases identified in the region are currently inactive; and no stakeholder concerns have been raised. However, if these leases were to become active within the life of this EP, then some loss of value to the local industry could occur in the event of a loss of well control or a vessel collision that results in a condensate spill at the John Brookes WHP. A number of oil and gas operators operate within the EMBA with existing projects and infrastructure in place, as well as continuing drilling and exploration programs. A condensate spill at the John Brookes WHP has the potential to disrupt these activities, with associated economic impact, albeit on a temporary basis. 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 as described in Table 7-18. Marine habitats may also be impacted with relatively small volumes (worst case 33 m^3) of condensate 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 condensate surface release at the John Brookes WHP from a loss of well control has the potential to impact an array of receptors. Given the extent, the worst-case consequence is considered to be Major (IV).	
Likelihood	b-unlikely
Given the management controls in place, a loss of well control as a result of an accident during planned well intervention activities is considered to be very unlikely (2). The low shipping and fishing activity expected in the operational area and the management controls in place are considered to result in a low risk of a collision occurring between the John Brookes WHP and an errant vessel. This assessment of likelihood (for a loss of well control event occurring during the well intervention) is further supported when considering industry statistics, Santos statistics and the preventive control measures in place. Wells are designed with essential engineering and safety control measures to prevent a loss of containment occurring. Production well blowout events (not including external causes) have been reported at a frequency of 7.2 x 10-5 for gas wells (IOGP, 2019; normal operations on deep, normal wells of North Sea standard). This frequency is based on 11 blowout incidents (gas and oil wells) occurring in the UK, Norway and the Gulf of Mexico between 1980 and 2014 during development well drilling (IOGP, 2019) and supports the likelihood of 'has occurred elsewhere OR could occur within decades'. Management controls in place to control the flow of hydrocarbons include construction design, safety shutdown systems, regular inspection and maintenance, and competent personnel. Additional industry-standard and activity-specific control measures to reduce the chance of a loss of containment event have also been implemented, including (but not limited to) procedures such as the WOMP, safety case, crew training and awareness, and a spill response plan (the OPEP). In conjunction with controls to prevent vessel collisions, the control measures are considered to reduce the risk of a loss of containment (and minimise impacts) occurring to a level that is acceptable. The likelihood of a worst-case surface release at the John Brookes WHP resulting in a Major (IV) consequence is considered to be unlikely (b).	
Residual Risk	The residual risk associated with this event is Low.

7.6.5 Demonstration of as Low as Reasonably Practicable

7.6.5.1 Preventive controls

Well intervention is required for the ongoing safe and efficient operation of the John Brookes production wells and is a standard industry activity. Removing well intervention and other well maintenance activities is therefore not a practicable option to reducing spill risk.

It is considered that there are no controls additional to those outlined in Table 7-20 that would reduce the likelihood of a loss of containment further in terms of equipment and practices, given that industry standards are adhered to in terms of well design (i.e., provision of subsea safety valves), well equipment certification, well integrity testing and trained and competent personnel. Ongoing monitoring and management of the active production and plugged and abandoned wells are stipulated within the John Brookes WOMP, which has regulatory acceptance from NOPSEMA. It is therefore considered that the risk of a loss of containment occurring has been reduced to ALARP.

The controls in place for preventing vessel impact to the WHP are consistent with those provided in the John Brookes Safety Case and are considered to reduce risk of a collision to ALARP. The John Brookes WHP is an unmanned platform, and while the manning of the WHP or a permanently stationed support vessel as a means of communicating with collision threats could be considered, the cost and effort of these measures are grossly disproportionate to their possible benefit and carry other environmental and safety risks. Unmanned navigation hazards (but which are marked on nautical charts as per the Varanus Island Hub facilities) are commonplace on the North West Shelf, and the likelihood of a collision with the John Brookes WHP is no more likely than a collision with one of these other hazards.

The primary mechanism to immediately respond to a release of hydrocarbon from the subsea production system is via the emergency shutdown system managed through the Varanus Island Emergency Response Plan (SO-00-ZF-00044). 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 are 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). The performance criteria specified in PS-06 include:
- 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-07 ESD and Blowdown: Reservoir Isolation (including Surface-controlled Subsurface Safety Valves and XT valves (SCSSVs). The performance criteria specified in PS-07 include:
- SCSSV and XT valves actuation, SCSSV and XT failure, SCSSV and XT close timings, SCSSV acceptable leakage rates, SCSSV and XT valve position indication.
- PS-08 ESD and Blowdown: Safety Instrumented Systems. The performance criteria for Safety instrumented Systems in PS-08 include:
- sensor for emergency shutdown events, ESD, PSD pushbuttons, electrical tripping device.
- PS-10 ESD and Blowdown: Pressure Safety Valves (QE-00-RG-00222). The performance criteria specified in PS-10 include:
- relief system designed and operated in accordance with American Petroleum Institute, set PSV relief pressure, PSV function testing and examinations, safe relief through critical manual valve position.

The relevant PSAPs are listed as control measures with relevant performance standards in Table 7-20.

The maintenance and regular testing of the shutdown systems and the subsea valves managed through the PSAPs ensures an 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 John Brookes condensate and gas from a production well at the John Brookes WHP.

The ongoing general inspection and maintenance regime that is completed in accordance with the NOPSEMA accepted WOMPs and Santos procedures, ensures that property is maintained in good condition and repair until the point in time when the property is removed from the title. Well integrity risks will continue to be managed in accordance with the WOMPs until they are permanently plugged and abandoned. The WOMPs require wellhead monitoring for leak detection. Santos will undertake any necessary actions, potentially in advance of EOFL, should the well integrity risk level or risk tolerance change on any of these wells. It is through the implementation of this monitoring regime that Santos will meet its obligations under the OPGGS Act (s.572(2)) to ‘maintain in good condition and repair all structures that are, and all equipment and other property that is, in the title area and used in connection with the operations’.

Also, through the development and eventual implementation of the Decommissioning Plan, Santos will meet its obligations under s. 572 (3) of the OPGGS Act ‘to remove from the title area all structures that are, and all equipment and other property that is, neither used nor to be used in connection with the operations’.

7.6.5.2 Source control

A number of source control options have been evaluated for the activity (refer to OPEP). Of these source control options; the drilling of a relief well is considered the primary means of controlling the source in the event of an unplanned well release. Spill response and impact assessment for this activity has been based on the relief well taking 77 days (11 weeks) to execute. A breakdown of the key tasks and their timeframe to drill a relief well in 11 weeks have been included in Section 8.3.3 of the OPEP.

Supporting controls to allow the relief well schedule to be met include:

- “Assurance Review 4: Readiness to Spud” is conducted under the Drilling & Completions Management Process (DCMP).

- Rig capability register is maintained.

A well-specific Source Control Plan is prepared in accordance with the Santos Source Control Planning and Response Guidelines. The Source Control Plan contains information and considerations for relief well operations, including but not limited to:

- relief well surface locations (primary and secondary)
- relief well trajectory and interception target point
- dynamic well kill modelling calculations for controlling a worst-case discharge (e.g., kill mud weight, kill pump rate/pressure and kill mud volume required)
- status of relief well tangible equipment
- Australian Energy Producers (AEP) Memorandum of Understanding (MoU) provides for access to other operator rigs.
- Contracts and MoUs for third-party independent well control specialist personnel are in place.

The implementation timeframe of this control is key to its effectiveness. A second MODU positioned on standby in the vicinity of the activity during the drilling activity was considered as an additional control that could reduce the length of time taken to drill a relief well. This would involve hiring an additional rig for the duration of the activity. If adopted, this may reduce the timeframe for stopping a blowout by up to two weeks, although planning/approval/set-up requirements mean the reduction would likely be less. The cost of having a MODU and personnel/equipment on standby (at a rate of ca. $250,000/day) would double the cost of the activity and introduce additional safety and environmental risks due to presence of an additional MODU and support vessels/equipment being on standby. This is considered grossly disproportionate to the environmental benefit (a potential reduction of two weeks to stop the loss of well control (LOWC), particularly considering the likelihood of a LOWC and the existing preventative control measures in place to prevent a well blowout. Having a dedicated second MODU on standby for the purpose of relief well drilling was therefore was not asopted as a control measure.

To minimise lead times, a rig with a NOPSEMA approved Safety Case will be preferred. These rigs are tracked on the Rig Capability Register and access is covered under the AEP MoU. For the water depths at this location, it is possible that a semi-submersible MODU may be feasible to drill the relief well instead of a jack-up, but this would also depend on the exact circumstances of the LOWC scenario and therefore feasibility is not guaranteed. The well-specific Source Control Plan will assess the feasibility and availability of suitable MODUs prior to each drilling activity occurring.

Direct surface intervention (i.e., deployment onto the jack-up rig) using specialised well control personnel is a strategy that could be adopted and supported through contractual arrangements with well control vendors. This strategy is contingent on technical aspects of the LOWC event and safety considerations which could only be assessed at the time of a spill event. For this reason, the current preparedness measures for well intervention experts are considered ALARP.

Santos has access to a subsea first response toolkit (SFRT) and deployment personnel through contract to AMOSC and Oceaneering respectively. Deployment of a capping stack is not feasible for jack-up wells. Consequently, the majority of items in the SFRT are of no use in a LOWC event. However, some items can be used to gather information or increase situation awareness. Additionally, the SFRT can be used to inject dispersant subsea which may have an environmental benefit in reducing the volume of hydrocarbons reaching shorelines. Notwithstanding the above, the use of SFRT is considered unlikely due to safety and technical constraints (i.e., shallow water depths and high predicted gas release rates).

In the unlikely event SFRT was required, SFRT equipment can be mobilised to Dampier from the Jandakot storage yard in two days, under existing arrangements. Locating this equipment in Dampier could potentially reduce deployment time by two days providing a suitable vessel was on standby for immediate mobilisation. However, the equipment is a shared resource across AMOSC SFRT subscription members so relocating for a drilling campaign is not considered viable. Providing a vessel on standby for SFRT deployment could reduce deployment time but, given SFRT deployment may not be suitable or feasible, a potential reduction in deployment time due to a vessel being on standby is not seen to offer sufficient environmental benefit given crewed vessel standby costs would be tens of thousands of dollars each day over the drilling period.

7.6.5.3 Spill mitigation controls

Santos considers that through the resourcing arrangements outlined within the OPEP (including spill response equipment and personnel from internal and external sources including Santos, AMOSC, AMSA, other operators, OSRL, and other national and international suppliers) the spill response strategies and control measures reduce potential risk and impacts from 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.

The combination of the standard prevention control measures (Section 7.6.3) (which reduce the likelihood of the event happening) and the spill response strategies outlined in the OPEP (which may reduce the consequence) together reduce the overall hydrocarbon spill risk.

7.6.6 Acceptability Evaluation

Is the risk ranked between Very Low to Medium?	Yes – maximum credible hydrocarbon spill volume from John Brookes wells (39,011 m^3 of condensate) residual risk is ranked as 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 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 – management consistent with OPGGS(E)R 2023 Regulations, including safety case and WOMP. 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 Marine Park (AMP), the Barrow Island Marine Park Management Area, Montebello Islands Marine Park (State Marine Park), Muiron Island Marine Management Area, and Ningaloo Marine Park • relevant species recovery plans, conservation management plans and management actions, including but not limited to Recovery Plan for Marine Turtles in Australia (DoEE, 2017), Approved Conservation Advice for Balaenoptera physalus (fin whale) (TSSC, 2015b), National Recovery Plan for the Southern Right Whale (DCCEEW, 2024), Approved Conservation Advice for Rhincodon typus (whale shark) (TSSC, 2015a), and relevant recovery plans and conservation advices for birds. Management is also consistent with the zoning of the Australian marine parks, in that risks have been reduced to ALARP, e.g., implementation of spill response activities will limit impacts, thereby conserving the marine park values.
Are risks and impacts consistent with Santos' Environmental, 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. DoT has been consulted during the development of the OPEP and strategic NEBA and raised no concerns.
Are performance standards such that the impact or risk is considered to be ALARP?	Yes (see ALARP above)

The likelihood of a loss of well control event is extremely low (unlikely) 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 a loss of well control event (and minimise impacts) have also been implemented, including (but not limited to) procedures such as the WOMP, 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 Medium and ALARP. The proposed control measures will reduce the risk of impacts from a loss of well control event to a level that is considered acceptable.

7.7 Subsea Release of Condensate from Subsea Pipeline

7.7.1 Description of Event

Event	It is considered credible that an unplanned release of condensate and gas could occur from either the John Brookes or East Spar pipeline, or the Spartan flowline. Dropped objects, anchor drag or loss of pipeline integrity causing a loss of containment is considered 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. The maximum credible spill is therefore calculated based on the entire condensate volume within the pipeline between isolation points. Based on the respective pipeline inventories, the John Brookes pipeline would result in a release volume of 210 m^3, and the East Spar pipeline would result in a release volume of 161 m^3. The Spartan flowline would result in a release volume of approximately 35 m^3 of Spartan condensate.
Extent	The spill scenario is credible anywhere along the pipelines in Commonwealth waters. Due to the larger pipeline inventory of the John Brookes pipeline, predictive oil spill modelling for a subsea release of 210 m^3 of John Brookes condensate at the State waters boundary has been modelled. This modelling is considered appropriate for both pipeline release scenarios in terms of the similarities in hydrocarbon type, water depth and environmental conditions. A 210 m^3 subsea release of John Brookes condensate predicted floating oil concentrations at the sea surface above the impact threshold of 10 g/m^2 extending for 22 km from the release site. The locations at the highest risk of contact by floating oil are predicted to be the waters of the Montebello Marine Park with an 81% probability of more than 10 g/m^2 and the Barrow and Montebello Shallows with a 48% probability of more than 10 g/m^2. Concentrations of shoreline hydrocarbons above the 100 g/m^2 impact threshold were predicted for three locations: Barrow Island (1,110 g/m^2), the Lowendal Islands (860 g/m^2) and the Montebello Islands (764 g/m^2) with maximum accumulations of 20 m^3, 6 m3 and 12 m^3 respectively. Times for floating hydrocarbons to contact shorelines ranged from 11 to 16 hours. Entrained oil in the water column above the impact threshold of 100 ppb is predicted to occur within a region up to 190 km southwest of the release site, with the highest concentrations predicted at the Montebello Marine Park (2,394 ppb) with a 23% probability, the Barrow and Montebello Shallows (2,010 ppb) with a 20% probability and Barrow Island (803 ppb) with a 10% probability. Dissolved aromatic hydrocarbons in the water column above an impact threshold of 6 ppb is predicted to occur up 409 km southwest of the release site, with the highest concentrations predicted at the Montebello Marine Park (1,181 ppb) with an 81% probability, the Barrow and Montebello Shallows (978 ppb) with an 81% probability.
Duration	Release over 5.4 hours.

7.7.2 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 include:

- physical environment (water and sediment quality, shoals and banks, benthic habitats, offshore reefs and islands)
- threatened or migratory fauna (marine mammals, marine reptiles, sharks, fish, rays and birds)
- protected and significant areas (marine parks, KEFs)
- socio-economic receptors (fisheries, tourism and recreation).

A subsea release of condensate from the John Brookes pipeline or the East Spar pipeline 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 and may result in condensate contacting shorelines. The zone of impact from a subsea pipeline release is smaller spatially than the zone of impact from a surface release of condensate from wellheads. Therefore, the potential impacts provided in Section 7.6 and the scale of impact described provides a conservative assessment of potential impacts.

Potential impact pathways (physical and chemical) of hydrocarbon exposure for receptors are summarised in Table 7-17, and potential impacts to receptors found within the EMBA are further described in Table 7-18.

A detailed risk assessment of impacts to the Lowendal Islands, which was ranked as a HEV/hotspot for the pipeline release scenario only, is described in Appendix H.

7.7.2.1 Modelled scenario

To determine the spatial extent of impacts from a potential surface release of condensate from a subsea pipeline and the dispersion characteristics over time, stochastic modelling was completed by RPS in 2019. The modelled scenario was based on the largest credible spill scenario (Section 7.5.1) with a summary of the parameters used is described in Table 7-23

Table 7-23: Scenario parameters for modelling loss of integrity or damage causing condensate with gas release from a subsea pipeline in Commonwealth waters

Condensate Characteristics Modelled	Released Volume (m^3)	Discharge Rate	Release Location	Release Depth (BMSL)	Spill Duration	Simulation Duration
John Brooke condensate	210	38.9	20º36'33.60"S 115º23'11.20"E	20 m	5.4 hrs	21 days

The modelling for this scenario assumed no mitigation efforts are undertaken to collect or otherwise affect the natural transport and weathering of the oil.

7.7.2.2 Spill modelling results

During a subsea release, the low discharge velocity and turbulence generated by the expanding gas plume is predicted to generate large sized oil droplets (<9,000 µm). These large droplets have the potential to reach the surface within minutes of the release, with floating slicks likely to be formed under typical wind conditions.

The modelling results are summarised below for the fate of hydrocarbon (floating, entrained, dissolved and accumulated) at the exposure values described in Section 7.5.4. Appendix H provides the full modelling results for the purposes of risk evaluation.

Further parameters required to inform spill response strategies are described further in the OPEP.

7.7.2.2.1 Floating Oil

Low (1 g/m^2)

The stochastic modelling results indicates that floating oil is expected to remain localised around the release site, with the maximum distance travelled at 1 g/m2 exposure threshold 58 km. The greatest probability of floating oil contact at the 1 g/m2 threshold is predicted at Montebello Marine Park (91%). Contact at this threshold is also precited at: Barrow-Montebello surrounds (71%), Barrow Island (10%), Lowendal Islands (8%) and Montebello Islands (8%).

Moderate (10 g/m^2)

The maximum distance travelled at the 10 g/m2 exposure threshold is 23 km. The highest probability of contact at this exposure value across all seasons is at Montebello AMP (81%). Contact is also predicted at Barrow Montebello surrounds (48%).

High (~~50~~25 g/m^2)

The greatest probability of floating oil contact at 25 g/m2 is predicted at Montebello AMP (65%) in summer with contact probabilities also predicted at this exposure level at Barrow-Montebello surrounds (26%).

7.7.2.2.2 Shoreline accumulation

Low (10 g/m^2)

Summer represented the worst-case potential volume of oil accumulating on a shoreline at concentrations greater than 10 g/m^2 is forecast at Barrow Island as 20 m^3. Predicted probability of contact at this exposure value is Montebello Islands (18%), Lowendal Islands (10%) and Barrow Island (5%).

Moderate (100 g/m^2)

Shoreline accumulation at the moderate threshold is expected at multiple locations including Barrow Island (2%), Lowendal Island (7%) and Montebello Island (7%).

High (1,000 g/m^2)

There is no probability of contact greater than 1% at this exposure level.

7.7.2.2.3 Entrained oil

The maximum entrained oil concentration is predicted at the Montebello Marine Park as 2,394 ppb.

Low (10 ppb)

Entrained oil concentrations exceeding 10 ppb may potentially occur 449 km from the spill site. The probability of contact at concentrations equal to or greater than 10 ppb is predicted to be greatest at the Montebello AMP (65-71%) and Barrow-Montebello Surrounds (55-67%). The shortest time for entrained oil at or above 10 ppb to contact any receptor is forecast for the Montebello MP as one hour.

Moderate (100 ppb)

Entrained oil concentrations exceeding 100 ppb may potentially occur 319 km from the spill site.

7.7.2.2.4 Dissolved aromatic hydrocarbons

The worst-case instantaneous concentration of dissolved aromatic hydrocarbons is predicted at Montebello Marine Park as 1,181 ppb.

Low (6 ppb)

Dissolved aromatic hydrocarbons concentrations at or above 6 ppb may potentially occur 410 km from the spill site. The highest potential contact to receptors by dissolved aromatic hydrocarbons at or above 6 ppb is expected to occur at Montebello Marine Park (76-84%) and Barrow-Montebello Surrounds (70-81%). The highest probability across all seasons of contact at this threshold is predicted to be: Muiron Islands (8%), Ningaloo Coast North (5%), Barrow Island (78%), Lowendals (19%), Montebello Islands (55%), Outer NW Ningaloo (12%), Offshore Ningaloo (29%), Southern Islands Coast (3%), Thevenard Islands (2%) and Outer Ningaloo Coast North (3%).

Moderate (50 ppb)

Across all seasons the highest potential contact to receptors by dissolved aromatic hydrocarbons at or above 50 ppb is expected to occur at Barrow-Montebello surrounds (35%), Barrow Island (16%), Lowendal Islands (5%), Montebello Islands (13%), Montebello AMP (32%), Outer Ningaloo (2%) and Offshore Ningaloo (4%).

High (400 ppb)

Dissolved aromatic hydrocarbons concentrations at or above 400 ppb may potentially occur 49 km from the spill site. The highest predicted contact across all seasons at or above 400 ppb are Barrow-Montebello surrounds (3%) and Montebello AMP (3%).

7.7.3 Environmental Performance Outcomes and Control Measures

The EPOs relating to this event include:

- No loss of containment of hydrocarbon to the marine environment (EPO-VI-CW-08).
- Implement monitoring programs to assess and report on the impact, extent, severity, persistence and recovery of sensitive receptors contacted by a spill [EPO-RE- OPEP-09].

Control measures applied to prevent an oil spill are shown in Table 7-24, and corresponding EPSs and measurement criteria for the EPO 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 7-24: Control measure evaluation for the subsea release of condensate from subsea pipeline

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls				
VI-CW-CM-17	Planned subsea and offshore maintenance.	Reduces likelihood of leaks from equipment and ensures ongoing integrity of infrastructure.	Personnel and operational costs associated with undertaking regular inspections of all equipment.	**Adopted** – Benefit of the inspection to determine operational integrity outweighs the cost to undertake the inspection.
VI-CW-CM-52	NOPSEMA-accepted safety case.	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.
VI-CW-CM-53	Inspection and corrosion monitoring of pipelines.	Regular inspections reduce the risk of leaks from subsea	Costs associated with personnel time in performing the	**Adopted** – Benefits considered to outweigh costs.

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
		pipelines by confirming appropriate integrity.	inspection, monitoring and reporting of inspections and follow-up actions.	
VI-CW-CM-49	Emergency power equipment is provided on John Brookes WHP to secure secondary power source for safety integrity system.	Provides backup power for the offshore safety integrity system for control of Emergency shutdowns in abnormal operation situations.	Costs associated with personnel time in performing the testing and maintenance.	**Adopted** – Benefits considered to outweigh costs.
VI-CW-CM-47	Testing and maintenance of emergency shutdown systems and shutdown/ safety valves.	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.
VI-CW-CM-48	Incident Response Plan detailing the requirements for preparedness and response to emergencies and crises to protect people and the environment.	Provides detail to ensure the ESD system is activated quickly and efficiently if it has not automatically activated, to reduce the extent of impacts to the marine environment.	Administrative costs of preparing documents.	**Adopted** – Benefits considered to outweigh costs.
VI-CW-CM-23	Navigational charting of infrastructure.	Provides a means for marine users to be aware of the presence of the WHP and subsea infrastructure.	Costs associated with personnel time in issuing notifications.	**Adopted** – Benefits considered to outweigh costs.
VI-CW-CM-18	Dropped object prevention procedure (LEMS).	Impacts to the environment are reduced by preventing dropped objects. Requires lifting equipment is certified and inspected.	Costs associated with personnel time in implementing procedures and in incident reporting.	**Adopted** – Benefits considered to outweigh costs.
VI-CW-CM-50	Oil pollution emergency plan (OPEP).	Implements response plans to deal with an unplanned hydrocarbon release quickly and efficiently to reduce impacts to the marine environment.	Administrative costs of preparing documents and large costs of preparing for and implementing response strategies.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented and that the vessels are compliant outweigh the costs. Regulatory requirement must be adopted.
Additional Controls				
VI-CW-CM-20	Anchoring and equipment deployment management.	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.

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
VI-CW-CM-55	Santos' strategy.	Ensures an appropriate level of planning for the eventual removal of property. Ensures Santos has plans in place to meet its regulatory obligation to remove property in accordance with the requirements of s.572 of the OPGGS Act.	Organisational costs to prepare plans prior to EOFL.	**Adopted** – Benefits considered to outweigh costs. Regulatory obligation to remove property.
N/A	Flyover inspection of pipelines during helicopter transfers.	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.	**Not Adopted** – A safe distance above sea level needs to be maintained by the helicopter. To observe any bubbles at the sea surface, weather conditions and sea state would need to be perfect. Based on these limitations, this is not considered an effective standalone control.

7.7.4 Environmental Impact Assessment

The below environmental impact assessment follows the risk assessment approach detailed in Section 7.5.6.

7.7.4.1 Identification of hotspots for consequence assessment

As described in Section 7.5.6, all HEVs within the EMBA (low exposure threshold) for the subsea release of condensate from a subsea pipeline were previously described in Table 7-21. One new hotspot was identified for this scenario (Table 7-25).

Table 7-25: Identified high environmental value and hotspot receptors

Receptor	HEV Value	Exposure Threshold			Hotspot
		Low	Moderate[1]	High[1]	
Lowendal Islands	3	✓	✓	✓	✓

Appendix H provides a simplified summary of the consequence assessment results for this hotspot.

The impact, likelihoods and consequence ranking for a subsea release of condensate from a subsea pipeline are outlined in Table 7-26.

Table 7-26: Impacts, Likelihood and Consequence Ranking – Subsea Release of Condensate from Subsea Pipeline

Description	
Receptors	• Physical environment (water and sediment quality, shoals and banks, benthic habitats, offshore reefs and islands) • Threatened or migratory fauna (marine mammals, marine reptiles, sharks, fish, rays and birds) • Protected and significant areas (marine parks and KEFs) • Socio-economic receptors (fisheries, tourism and recreation)
Consequence	III-Moderate
Physical Environment In the event of a subsea pipeline release, hydrocarbons will likely reach both subsea and shoreline habitats (Barrow Island, Lowendal Islands and Montebello Islands), which may result in a long-term decrease in ecological values given the toxicity impacts associated with hydrocarbon exposure (Table 7-17 and Table 7-18).	

Description	
Threatened or Migratory Fauna In the event of a pipeline release, the volume of hydrocarbons released would be the entire condensate volume within the pipeline between isolation points, that is, either 35 m^3 from Spartan flowline, 161 m^3 from East Spar or 210 m^3 from John Brookes of condensate based on the pipeline inventories. Given the nature of condensate (light oil) 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 depends on hydrocarbon type and exposure duration; however, given that exposures would be limited in extent and duration, exposure of marine fauna to this hazard is not expected to result in a fatality. Potential impacts to marine fauna from a larger condensate release are described in detail in Section 7.6 Habitat modification, degradation, disruption or loss, chemical discharge and marine pollution are identified as potential threats to a number of marine fauna species in relevant recovery plans and conservation advices (Table 3-7). With controls in place that align 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 will 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 (Table 7-17 and Table 7-18). Potential impacts to these receptors from a larger condensate release are described in detail in Section 7.6 *Protected Areas* Impacts to the habitat/ and fauna receptors described above have an impact on the values of Australian marine parks 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. Potential impacts to these receptors from a larger condensate release are described in detail in Section 7.6. *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 (Table 3-10). Entrained oil at concentrations greater than 100 ppb could reach pearl farming activities at the Montebello Islands. Potential impacts to these receptors from a larger condensate release are described in detail in Section 7.6. 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 as described Table 7-17 and Table 7-18. Potential impacts to these receptors from a larger condensate release are described in detail in Section 7.6 On the basis of the above assessments, a condensate release from a pipeline rupture has the potential to impact receptors in the water column. Given the moderate extent, the worst-case consequence is considered to be Moderate (III).	
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, the 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 (DoEE, 2017), and some bird and shark species (Table 3-7). Habitat modification, degradation, disruption, pollution and/or loss 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 caused by dropped object are not expected to significantly impact the receiving environment with 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 hydrocarbon release occurring due to pipeline rupture caused by a dropped object is limited given the set of mitigation and management controls in place. Consequently, the likelihood of a pipeline rupture releasing hydrocarbons to the environment that results in a moderate consequence is considered to be remote (a).	
Residual Risk	The residual risk associated with this event is Very Low.

7.7.5 Demonstration of as Low as Reasonably Practicable

It is considered that there are no additional practicable risk reduction measures further to those described in Section 7.7.3 that would provide benefit to the environment, as detailed below.

Since transferring condensate and gas to VI Hub 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 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 for dropped objects and anchoring is not feasible since vessel activity is also inherent in the operational activities (e.g., inspection and maintenance activities using ROVs or divers) and equipment or materials are required to be loaded onto the John Brookes WHP.

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, which ensure that the system operates within its design requirements and that there is no unacceptable degradation of the system (e.g., materials, emergency shutdown valve shutdown time or leakage) including when pipelines are suspended.

The primary mechanism to immediately respond to a release of hydrocarbon from the subsea production system is via the emergency shutdown system managed through the Varanus Island Incident Response Plan. 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 are 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, 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. The performance criteria specified in PS-06 include:

- 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-07 ESD and Blowdown: Reservoir Isolation (including Surface-controlled Subsurface Safety Valves and XT valves (SCSSVs)). The performance criteria specified in PS-07 include:

- SCSSV and XT valves actuation, SCSSV and XT failure, SCSSV and XT close timings, SCSSV acceptable leakage rates, SCSSV and XT valve position indication

PS-08 ESD and Blowdown: Safety Instrumented Systems. The performance criteria for Safety instrumented Systems in PS-08 include:

- sensor for emergency shutdown events, ESD, PSD pushbuttons, electrical tripping device.

PS-10 ESD and Blowdown: Pressure Safety Valves. The performance criteria specified in PS-10 include:

- relief system designed and operated in accordance with American Petroleum Institute, set PSV relief pressure, PSV function testing and examinations, safe relief through critical manual valve position.

The relevant PSAPs are listed as control measures with relevant performance standards in Table 7-24.

The maintenance and regular testing of the shutdown systems and the subsea valves managed through the PSAPs ensures a functional, available, reliable, survivable 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 major leak/rupture scenario.

The ongoing general inspection and maintenance regime that is completed in accordance with Santos' procedures, ensures Santos will meet its obligations under the OPGGS Act (s.572(2)) to 'maintain in good condition and repair all structures that are, and all equipment and other property that is, in the title area and used in connection with the operations'.

Also, through the development and eventual implementation of the Decommissioning Plan, Santos will meet its obligations under s. 572 (3) of the OPGGS Act 'to remove from the title area all structures that are, and all equipment and other property that is, neither used nor to be used in connection with the operations'.

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 Demonstration of Acceptability

Is the risk ranked between Very Low to Medium?	Yes –maximum credible spill volume from a subsea pipeline (210 m3) 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 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 – management consistent with OPGGS (E)R 2023 Regulations, including safety case and WOMP. 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 Marine Park, the Barrow Island Marine Park Management Area, Montebello Marine Park, Muiron Island Marine Management Area, and Ningaloo Marine Park • relevant species recovery plans, conservation management plans and management actions, including but not limited to Recovery Plan for Marine Turtles in Australia 2017–2027 (DoEE, 2017), Approved Conservation Advice for Balaenoptera physalus (fin whale) (TSSC, 2015b), National Recovery Plan for the Southern Right Whale (DCCEEW, 2024), Approved Conservation Advice for Rhincodon typus (whale shark) (TSSC, 2015a), and relevant recovery plans and conservation advices for birds.
Are risks and impacts consistent with Santos' Environmental, 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

The likelihood of a subsea condensate release from a pipeline is extremely low (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, WOMP, 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 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 Subsea Release of Condensate from Wellheads

7.8.1 Description of Event

Event	Credible spill scenarios were considered for all producing subsea wells and temporarily abandoned or plugged and abandoned subsea wells (Section 7.5.1**)** This assessment determined that the worst case credible subsea wellhead release would occur from an active producing subsea well (Spartan-2, Halyard 1 and 2 or Spar-2) and would result from a leak due to impairment across multiple barriers, with release through holes or cracks. A 100% full-bore blowout is not considered credible. The assessment detailed in Section 7.5.2 concluded that any leak event from the temporarily abandoned wells would have an impact less than the worst case leak modelled here for Spartan-2, Halyard-1 and 2, and Spar-2. A worst case leak of 5,637 m^3 was determined from Halyard-1 and 2 and Spar-2. Spar-2 was selected for the event as Spar-2 well has been historically a higher producer than Halyard-1 and therefore release volumes are seen as conservative for the Halyard-1 and 2 wells. The Spartan-2 scenario is expected to be similar (smaller) than Spar-2, and therefore the Spar-2 scenario is seen as representative for Spartan-2 and Halyard-1 and 2. The existing model was based on a total subsea release volume of 3,393 m^3 (28.3 m3 per day for 120 days). While the modelled volume is less than the credible spill volume of 5,637 m^3, use of this modelling is considered reasonable in the overall context of this EP given that a much larger loss of well control event has been assessed at the nearby John Brookes WHP (Section 7.6) and it is this event that has the major influence on the overall EMBA, exposure value contours and spill response planning in this EP. Furthermore, given the light and volatile nature of this condensate, which is considered to have no persistent components, the difference in volume between modelled and credible volumes is considered to have a low influence on the spatial extent of impact from a subsea release from wellheads.
Extent	The East Spar condensate is wholly volatile, with approximately 75% of the oil, by mass, expected to evaporate within the first 12 hours if exposed to the atmosphere. A further 19% has moderate volatility and will evaporate over the first 24 hours, while the remaining 6% will evaporate over a few days. The condensate does not contain persistent components, and it is therefore not expected to linger in the marine environment for an extended period. As the discharge is released at the seabed, the oil will only be exposed to atmospheric conditions and evaporative processes if it reaches the surface. Concentrations of floating oil on the sea surface were not predicted for any season (less than 2% probability for either 1 g/m^2 or 10 g/m^2 thickness), and no shoreline accumulation was predicted. As shown in Table 7-12**,** properties of condensates across the fields are similar in nature. For the purpose of impact assessment, the East Spar condensate is considered representative of all the fields. At the surface-concentration environmental impact threshold of 10 g/m^2, there was no contact predicted at any receptor. The potential extent of visible floating surface oil (below 10 g/m^2) is approximately 8 km from the release site. Entrained oil in the water column, above the impact threshold of 100 ppb, is predicted to occur within a region up to 420 km southwest of the release site, with the highest concentration predicted offshore Ningaloo (3,579 ppb) with a 100% probability. Dissolved aromatic hydrocarbons in the water column above an impact threshold of 6 ppb are predicted to occur up to 440 km southwest of the release site, with the highest concentration predicted offshore Ningaloo (640 ppb) with a 100% probability.
Duration	Rather than using the AMSA assumption of mobilisation time + 20 days to cap a well, the release period of 100 days has been selected based on a conservative rig mobilisation and relief-well drilling schedule. The longest duration blowouts in recent history (Montara at 74 days and Macondo at 87 days) have been capped in less time than this.

7.8.2 Nature and Scale of Environmental Impacts

Potential receptors include:

- physical environment (water and sediment quality, shoals and banks, benthic habitats, offshore reefs and islands)
- threatened or migratory fauna (marine mammals, marine reptiles, sharks, fish, rays and birds), protected and significant areas (marine parks, KEFs)
- socio-economic receptors (fisheries, tourism and recreation).

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. A subsea release of condensate from wellheads (Halyard-1 and Spar-2) 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. Based on modelling from a larger spill volume than the 3,393 m3 predicted for this scenario, condensate contacting shorelines was not predicted to occur. Potential impact pathways (physical and chemical) of hydrocarbon exposure for receptors are summarised in Table 7-17, and potential impacts to receptors found within the EMBA are further described in Table 7-18.

7.8.2.1 Modelled scenario

The modelled scenario was based on the credible spill scenario (Section 7.5.1), with a summary of the parameters used is described in Table 7-27. Oil spill modelling of East Spar condensate was used to assess the above identified spill scenarios from the Halyard-1, Spar-2 and Spartan-2 wells, The characteristics of all three condensates are similar, with all being highly volatile and the majority of surface oil (< 90%) is predicted to evaporate in the first 24 hours (Table 7-12). The existing model was based on a total subsea release volume of 3,393 m3 (28.3 m^3 per day for 120 days).

Spill modelling was performed using a number of simulated environmental conditions from all seasons, thus providing a range of realistic spill trajectories from which to determine the spatial extent of potential impacts and receptors that might be impacted from a spill.

Table 7-27: : Loss of well control or damage to infrastructure causing condensate with gas release from the Halyard-1 or Spar-2 subsea wellhead

Condensate Characteristics Modelled	Released Volume (m^3)	Discharge Rate ($m^{3/}$day)	Release Location	Release Depth	Spill Duration
East Spar condensate	3,393	28.3	East Spar-2	115m	120 days

7.8.2.2 Spill Modelling Results

The condensate does not contain persistent components, and it is therefore not expected to linger in the marine environment for an extended period of time. As the discharge is released at the seabed, the oil will only be exposed to atmospheric conditions and evaporative processes if it reaches the surface.

During a subsea release, the low discharge velocity and turbulence generated by the expanding gas plume is predicted to generate large sized oil droplets (<9,000 µm). These large droplets have the potential to reach the surface within minutes of the release, with floating slicks likely to be formed under typical wind conditions.

The modelling results are summarised below for the fate of hydrocarbon (floating, entrained, dissolved and accumulated) at the exposure values described in Section 7.5.5. Appendix H provides the full modelling results for the purposes of risk evaluation.

Further parameters required to inform spill response strategies are described further in the OPEP.

7.8.2.2.1 Floating Oil

Low (1 g/m^2)

Floating oil concentrations are not forecast to exceed 1 g/m^2, so no receptors are forecast to have ≥1% probability of contact. Potential for thinner sheens to reach shorelines and accumulate to concentrations ≥1 g/m^2 is indicated for Montebello Islands and Barrow Island.

Moderate (10 g/m^2)

No contact at greater than 1% probability predicted at this exposure level.

High (25 g/m^2)

No contact at greater than 1% probability predicted at this exposure level.

7.8.2.2.2 Shoreline Accumulation

No shoreline accumulation was predicted for this scenario.

Low (10 g/m^2)

No contact at greater than 1% probability predicted at this exposure level.

Moderate (100 g/m^2)

No contact at greater than 1% probability predicted at this exposure level.

High (1000 g/m^2)

No contact at greater than 1% probability predicted at this exposure level.

7.8.2.2.3 Entrained Oil

Worst-case estimates of entrained concentrations greater than 1,000 ppb, at any depth, are forecast for the buffer zones around the Southern Island Coast and Ningaloo Coast (1,204 ppb and 1,720 ppb, respectively).

Low (10 ppb)

The modelling indicates that Outer Ningaloo Coast Norther, Ningaloo Coast North, Offshore Ningaloo, Outer NW Ningaloo are all predicted to be contacted at this exposure level with 100% probability. Also predicted to be contacted include: Muiron Islands (80%), Exmouth Gulf Coast (20%), Lowendal Islands (14%), Ningaloo Cost South (50%), Montebello MP (55%), Southern Islands Coast (50%), Thevenard Islands (52%), Northern Islands Coast (6%), Rankin Bank (48%) and Glomar Shoals (8%). All other receptors have a probability of 2% or less.

Moderate (100 ppb)

The probability contours calculated for entrained oil indicate that concentrations ≥100 ppb are most likely to occur in waters to the southwest and the east of the blowout site. The outer contours of probability indicate the potential for transport of entrained oil at concentrations >100 ppb as far as 600 km southwest of the blowout site. Entrained oil concentrations >100 ppb are predicted to potentially contact the buffer zones around Barrow-Montebello shallows, Montebello Islands, Barrow Island, Lowendal Islands and Southern Islands Coast with probabilities between 19% and 25%. Probabilities of contact greater than 1% are also forecast for Thevenard Islands, Muiron Islands and Ningaloo Coast. For all other receptors, probabilities of ≤1% are predicted for a blowout commencing during any month.

7.8.2.2.4 Dissolved Aromatic Hydrocarbons

Low (6 ppb)

Offshore Ningaloo has a 100% probability of contact at this exposure value as predicted by the modelling. Contact is also predicted for: Outer Ningaloo Reef (62%), Muiron Islands (18%), Ningaloo Coast North (46%), Barrow-Montebello Surrounds (10%, Barrow Island (6%), Montebello Island (10%), Outer NW Ningaloo (80%), Ningaloo Coast South (4%), Montebello AMP (34%), Southern Islands Coast (8%), Thevenard Islands (8%) and Rankin Bank (18%).

Moderate (50 ppb)

Results indicate that dissolved aromatic hydrocarbons could occur at instantaneous concentrations ≥50 ppb up to 400 km to the southwest of the blowout site. The highest probability of instantaneous DAH concentrations ≥50 ppb is forecast for nearshore waters of Barrow Island and Southern Islands Coast (17%). Probabilities between 3% and 13% are forecast to potentially contact the buffer zones around Barrow-Montebello shallows, Montebello Islands, Lowendal Islands, Thevenard Islands, Muiron Island and Ningaloo Coast.

High (400 ppb)

All receptors have a less than 2% contact probability predicted at this exposure level.

marine fauna or lethal/sub-lethal toxicity effects from any accidentally released hydrocarbons, is considered unlikely given the expected low concentrations and short exposure times.

7.8.3 Environmental Performance Outcomes and Control Measures

The EPOs relating to this event include:

- No loss of containment of hydrocarbon to the marine environment (EPO-VI-CW-08).
- Control measures applied to prevent an oil spill are shown in Table 7-28 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 7-28: Control measure evaluation for the subsea release of condensate from wellheads

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls				
VI-CW-CM-45	NOPSEMA accepted WOMP in place.	Includes control measures for well integrity and well control as well as ongoing inspection	Costs associated with personnel time in writing, reviewing and implementing the WOMP.	**Adopted** – Benefits considered to outweigh costs. Regulatory

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
		requirements, including for permanently and temporarily abandoned wells prior to their decommissioning.		requirement must be adopted.
VI-CW-CM-46	Well services procedures and criteria.	Includes control measures for well integrity, well operations and well control.	Costs associated with personnel time in writing, reviewing and implementing the procedures.	**Adopted** – Benefits considered to outweigh costs.
VI-CW-CM-38	Inspection of WHP structures and hydrocarbon-containing equipment.	Regular inspections reduce the risk of leaks from WHP structures and hydrocarbon-containing equipment by confirming appropriate integrity.	Costs associated with personnel time in performing the inspection, reporting on the inspection and follow-up actions.	**Adopted** – Benefits considered to outweigh costs.
VI-CW-CM-17	Planned subsea and offshore maintenance.	Reduces likelihood of leaks from equipment and ensures ongoing integrity of infrastructure.	Personnel and operational costs associated with undertaking regular inspections of all equipment.	**Adopted** – Benefit of the inspection to determine operational integrity outweighs the cost to undertake the inspection.
VI-CW-CM-53	Inspection and corrosion monitoring of pipelines.	Regular inspections reduce the risk of leaks from subsea pipelines and risers 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.
VI-CW-CM-49	Emergency power equipment is provided on John Brookes WHP to secure secondary power source for safety integrity system.	Provides backup power for the offshore safety integrity system for control of emergency shutdowns in abnormal operation situations.	Costs associated with personnel time in performing the testing and maintenance.	**Adopted** – Benefits considered to outweigh costs.
VI-CW-CM-47	Testing and maintenance of emergency shutdown systems and shutdown/ safety valves.	Maintenance and testing of emergency systems and shutdown valves enables potential spill volumes to be minimised.	Costs associated with personnel time in performing the testing and maintenance.	**Adopted** – Benefits considered to outweigh costs.
VI-CW-CM-48	Incident Response Plan detailing the requirements for preparedness and response to emergencies and crises to protect people and the environment.	Provides detail to ensure the ESD system is activated quickly and efficiently if it has not automatically activated, to reduce the extent of impacts to the marine environment.	Administrative costs of preparing documents.	**Adopted** – Benefits considered to outweigh costs.
VI-CW-CM-18	Dropped object prevention procedure (LEMS).	Impacts to the environment are reduced by preventing dropped objects. Ensures lifting	Costs associated with personnel time in implementing procedures and in incident reporting.	**Adopted** – Benefits considered to outweigh costs.

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
		equipment is certified and inspected.		
VI-CW-CM-51	Oil pollution emergency plan (OPEP).	Implements response plans to deal with an unplanned hydrocarbon release quickly and efficiently to reduce impacts to the marine environment.	Administrative costs of preparing documents and large costs of preparing for and implementing response strategies.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented and that the vessels are compliant outweighs the costs. Regulatory requirement must be adopted.
VI-CW-CM-23	Navigational charting of infrastructure.	Provides a means for marine users to be aware of the presence of the WHP and subsea infrastructure.	Costs associated with personnel time in issuing notifications.	**Adopted** – Benefits considered to outweigh costs.
VI-CW-CM-54	Operational monitoring of low flow well leak.	Ensures potential leaks from wells are investigated and monitored until negligible risk to the environment is confirmed and there is no risk of escalation.	Costs associated with personnel time undertaking risk assessments. Costs of monitoring, including ROV and vessel hire.	**Adopted** – Benefits considered to outweigh costs.
VI-CW-CM-55	Santos' decommissioning plan .	Ensures an appropriate level of planning for the eventual permanent plug and abandonment of wells and removal of property. Ensures Santos has plans in place to meet its regulatory obligation to remove property in accordance with the requirements of s.572 of the OPGGS Act. Santos proposes to submit a decommissioning plan to NOPSEMA by Q2 2025 .	Organisational costs to prepare plans prior to EOFL.	**Adopted** – Benefits considered to outweigh costs. Regulatory obligation to remove property.
Additional Controls				
N/A	Relief-well plans in place for all wells.	May allow for quicker response to a loss of well control scenario, thereby limiting potential spill extent and volume.	Costs associated with personnel time in writing and reviewing relief-well plans.	**Not Adopted** – Santos only has relief well plans in place for wells undergoing intervention activities, and it is part of the intervention planning process. Given the low risk presented by wells and the standards used to manage well integrity, it is not considered an effective control.

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
N/A	Standby vessel in situ 24 hours/day at unmanned WHP.	Monitor the WHP 500-m petroleum safety zone and be equipped with an automatic identification system to aid in its detection at sea, and radar to aid in the detection of approaching third-party vessels. Reduces risk of vessel collision and subsequent unplanned release of hydrocarbons causing potential harm to the marine environment.	High cost associated with contracting standby vessel. Negligible costs of operating navigational equipment.	**Not Adopted** – The costs associated with having a vessel on location 24/7 are considered infeasible, particularly given the WHP and infrastructure are marked on charts and navigational aids are present.

7.8.4 Environmental Impact Assessment

The below environmental impact assessment follows the risk assessment approach detailed in Section 7.5.6

7.8.4.1 Identification of hotspots for consequence assessment

As described in Section 7.5.6 the process to identify any HEVs within the EMBA (low exposure threshold) for the subsea release of condensate from wellheads was followed. No new hotspots were identified.

The impact, likelihoods and consequence ranking for a subsea release of condensate from wellheads are outlined in Table 7-29.

Table 7-29: Impact, likelihoods and consequence ranking – subsea release of condensate from wellheads

Description	
Receptors	• Physical environment (water and sediment quality, shoals and banks, benthic habitats, offshore reefs and islands) • Threatened or migratory fauna (marine mammals, marine reptiles, sharks, fish, rays and birds) • Protected and significant areas (marine parks and KEFs) • Socio-economic receptors (fisheries, tourism and recreation)
Consequence	III-Moderate
Physical Environment and Threatened or Migratory Fauna In the event of a subsea release from wellheads (Halyard-2 or Spar-2 and temporarily abandoned wells described in Section 7.5.1), the volume of condensate released would result in a localised reduction in water quality with the potential to impact marine fauna. Any release from a temporarily abandoned well would be slower and less volume than that considered above, thus the consequences would be less. A description of impacts to marine fauna from exposure to condensate is provided in Table 7-18 and in Section 7.6 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 advices (Table 3-7). With controls in place that align 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. Impacts from a subsea condensate release would be greatest within several kilometres from the spill when the toxic aromatic components of the fuel will be at their highest concentration. Therefore, potential sensitive receptors include those in the water column, such as fish, marine mammals, marine reptiles and submerged habitats. As no surface slick is predicted larger than 10 g/m^2 for a larger spill volume, no impacts to receptors at the sea surface are predicted, and no impacts to shoreline receptors are expected. *Protected Areas* Impacts to the habitat and fauna receptors described above have an impact on the values of Australian marine parks 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. Potential impacts to these receptors are described in detail in Section 7.6. *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 (Table 3-11). Entrained oil at more than 100 ppb could reach pearl farming activities at the Montebello Islands. Potential impacts to these receptors from a larger condensate release are described in detail in Section 7.6	

Description	
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 as described in Table 7-17 and Table 7-18. Potential impacts to these receptors from a larger condensate release are described in detail in Section 7.6 On the basis of the above assessments, a condensate release from subsea wells has the potential to impact receptors predominantly in the water column only. As such, the worst-case consequence is considered to be Moderate (III).	
Likelihood	a-Remote
The likelihood of a loss of well control event occurring either due to well integrity failure or due to anchor or chain drag is extremely low when considering industry statistics, Santos' statistics and the preventive control measures in place. Wells are designed with essential engineering and safety control measures to prevent a loss of containment occurring. Management controls in place to control the flow of hydrocarbons include construction design, safety shutdown systems, regular inspection and maintenance, and competent personnel. Additional industry-standard and activity-specific control measures to reduce the chance of a loss of containment event have also been implemented including (but not limited to) procedures such as the WOMP, safety case, crew training and awareness, and an OPEP. In conjunction with controls to prevent vessel collision and anchoring incidents, the control measures are considered to reduce the risk of a loss of containment (and minimise impacts) occurring to a level that is acceptable. The likelihood of a worst-case subsea release at the Spartan-2, Halyard-1 (or Halyard-2 once it replaces Halyard-1) or Spar-2 wellheads resulting in a Moderate (III) consequence is considered to be remote (a). For temporarily abandoned wells, the key well integrity risk is related to a failure of well barriers resulting in a leak. Given the leak path the gas would need to travel through as described above, the likelihood (during the period for the current WOMP in force) of a gas flow to the seabed is assessed as remote (a).	
Residual Risk	The residual risk associated with this event is Very Low.

7.8.5 Demonstration of as Low as Reasonably Practicable

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, as detailed below.

Since the purpose of operational activities is to extract, process, store and offload condensate oil, the risk of a condensate oil spill cannot be completely eliminated from the operational area.

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 emergency shutdown valve shutdown time or leakage).

The primary mechanism to immediately respond to a release of hydrocarbon from the subsea production system is via the emergency shutdown system managed through the Varanus Island Incident Response Plan. 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's 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, 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). The performance criteria specified in PS-06 include:

- 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-07 ESD and Blowdown: Reservoir Isolation (including Surface-controlled Subsurface Safety Valves and XT valves (SCSSVs)) (QE-00-RG-00219). The performance criteria specified in PS-07 include:

- SCSSV and XT valves actuation, SCSSV and XT failure, SCSSV and XT close timings, SCSSV acceptable leakage rates, SCSSV and XT valve position indication.

PS-08 ESD and Blowdown: Safety Instrumented Systems. The performance criteria for Safety instrumented Systems in PS-08 include:

- sensor for emergency shutdown events, ESD, PSD pushbuttons, electrical tripping device.

PS-10 ESD and Blowdown: Pressure Safety Valves. The performance criteria specified in PS-10 include:

- relief system designed and operated in accordance with American Petroleum Institute, set PSV relief pressure, PSV function testing and examinations, safe relief through critical manual valve position.

The relevant PSAPs are listed as control measures with relevant performance standards in Table 7-28.

The maintenance and regular testing of the shutdown systems and the subsea valves managed through the PSAPs ensures a functional, available, reliable, survivable 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 release of condensate from a wellhead.

The likelihood of a loss of production well control event occurring during the operations is rare when considering industry statistics and the preventive controls in place. 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.

The listed wells are currently managed in accordance with NOPSEMA-accepted WOMPs. According to the WOMPs, all well integrity risks are ALARP. Well integrity risks will continue to be managed in accordance with the WOMPs until they are permanently plugged and abandoned. The WOMPs require wellhead monitoring for leak detection. Santos will undertake any necessary actions, potentially in advance of EOFL, should the well integrity risk level or risk tolerance change on any of these wells. It is through the implementation of this monitoring regime that Santos will meet its obligations under the OPGGS Act (s.572(2)) to 'maintain in good condition and repair all structures that are, and all equipment and other property that is, in the title area and used in connection with the operations'.

There are no current material environmental impacts or risks associated with the abandoned and suspended subsea wells. This will be regularly verified through well integrity monitoring, as required by WOMPs. Given the additional financial cost to permanently plug and abandon the wells (millions of dollars) prior to EOFL and the current low environmental risks, the difference between the high additional costs and low environmental risks is considered to be grossly disproportionate. To this end, permanently plugging and abandoning the wells post EOFL is considered to be environmentally acceptable and as soon as reasonably practicable.

Santos propose to submit a Decommissioning Plan to NOPSEMA by Q2 2025 for infrastructure reaching EOFL by 2030. It is through the development and eventual implementation of the Decommissioning Plan that Santos will meet its obligations under s. 572 (3) of the OPGGS Act 'to remove from the title area all structures that are, and all equipment and other property that is, neither used nor to be used in connection with the operations'.

For temporarily abandoned subsea wells, given the controls in place and the assessed risk profile for each of these wells, taking the additional step of accelerating a standalone MODU intervention scope to permanently abandon any of the wells ahead of the full field abandonment was seen as disproportional to any improvement in the current risk profile.

7.8.6 Acceptability Evaluation

Is the consequence ranked as Very Low to Medium?	Yes – maximum credible spill volumes from Halyard-1 (or Halyard-2 once it replaces Halyard-1) or Spar-2 wellheads (5,637 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 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 – management consistent with OPGGS(E)R 2023, including safety case and WOMP. 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 Marine Park, the Barrow Island Marine Management Area, Montebello Islands Marine Park, Muiron Island Marine Management Area, and Ningaloo Marine Park relevant species recovery plans, conservation management plans and management actions, including but not limited to Recovery Plan for Marine Turtles in Australia 2017–2027 (DoEE, 2017), Approved Conservation Advice for Balaenoptera physalus (fin whale) (TSSC, 2015b), National Recovery Plan for the Southern Right Whale (DCCEEW, 2024), Approved Conservation Advice for Rhincodon typus (whale shark) (TSSC, 2015a), and relevant recovery plans and conservation advices for birds.

Are risks and impacts consistent with Santos' Environmental, 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.

The likelihood of a loss of well control event is extremely low (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 a loss of well control event (and minimise impacts) have also been implemented, including (but not limited to) procedures such as the WOMP, 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 loss of well control event to a level that is considered acceptable.

7.9 Surface Release of Diesel (Vessel Collision, Bunkering, Dropped Object)

7.9.1 Description of Event

Event	It is considered credible that a release of diesel to the marine environment could occur from a support vessel collision with the John Brookes WHP or another vessel within the operational area. Such a collision could have sufficient impact to result in rupture of a diesel tank. This is considered credible given that the diesel tanks may not be protected or double-hulled and that fuel tank ruptures leading to hydrocarbon release have occurred before. Support vessels also regularly load and unload supplies to the John Brookes WHP; it is possible that a dropped object during this process could damage the hull of a support vessel leading to a release of diesel from a tank. The maximum credible spill volume is 329 m^3, based on the largest single fuel-tank capacity released at the sea surface at the John Brookes WHP in Commonwealth waters. 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 AMSA (2015) Technical Guidelines for Preparing Contingency Plans for Marine and Coastal Facilities 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) x 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.
Extent	A surface release (329 m^3) of diesel was modelled at the John Brookes WHP to represent a worst-case spill from a vessel collision. The surface slick is predicted to spread rapidly out to form a thin film on the sea surface, and a large proportion of it (50%) is predicted to evaporate within several days of release. Over time, the diesel will also 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. Spill modelling predicted a low probability (less than 0.5%) of floating oil at more than 10 g/m^2 or 1 g/m^2 thickness. The locations at the highest risk of contact by floating oil are predicted to be the waters of the Montebello Marine Park with a 4% probability of more than 10 g/m^2 and offshore Ningaloo with a 2.5% probability of more than 10 g/m^2. No volumes of oil were predicted to accumulate on shorelines, above the moderate exposure value. At the surface-concentration environmental impact threshold of 10 g/m^2, the potential extent of floating surface oil is approximately 101 km southwest from the release site. Surface oil may be visible 112 km northeast from the release site at concentrations above the 1 g/m^2 threshold. Entrained oil concentrations greater than 100 ppb were predicted, with low probability (less than 2%) for all locations except the waters of the Montebello Marine Park (20.5%) and offshore Ningaloo reef (12.5 %) with minimum time to contact reported as nine hours and six hours respectively. The maximum concentrations of entrained hydrocarbon exposure were predicted to be at the Montebello Marine Park (2,218 ppb) and offshore Ningaloo Reef (1,857 ppb). The probability of exposure to dissolved aromatic hydrocarbons above the 6 ppb impact threshold was low for all locations (at or below 0.5%) with the exception of the Montebello Marine Park (6.5%) with a maximum predicted concentration of 57 ppb and offshore Ningaloo (3.5%) with a maximum predicted concentration of 39 ppb.
Duration	Following the AMSA (2015) guidelines for 'Other Vessel Collision', for conservatism, the largest single tank inventory for any of the support vessels known to potentially be contracted by Santos was assumed to be released from a vessel collision (largest potential tank volume of 329 m^3). It was assumed that this volume would be released over one hour, at the sea surface.

7.9.2 Nature and Scale of Environmental Impacts

Potential receptors include:

- physical environment (water and sediment quality)
- threatened or migratory fauna (marine mammals, marine reptiles, sharks, fish, rays and birds), protected and significant areas (marine parks and KEFs)
- socio-economic receptors (fisheries, tourism and recreation).

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. 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. Based on modelling results, no volumes of oil were predicted to accumulate on shorelines, with a maximum concentration reported as 2 g/m^2 at Thevenard Island. Waters of the Montebello Marine Park and offshore Ningaloo are predicted to be exposed to surface concentrations of more than 10 g/m^2 with reported probabilities of 4% and 2.5% respectively. 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 7-17 and potential impacts to receptors found within the EMBA are further described in Table 7-18.

7.9.2.1 Spill modelling information

The John Brookes WHP has the greatest risk of a diesel spill since this is the most frequented part of the operational area in terms of vessel activity. Support vessels undertake routine personnel and equipment transfer trips to the WHP on a fortnightly basis on average. The John Brookes WHP is also a fixed collision hazard and a potential source of dropped objects that could damage a vessel hull. Therefore, this was chosen as the release location for the modelling study.

Weathering studies predicted that approximately 40% of the spill volume would evaporate within 35 hours, depending on the prevailing conditions. The heavier (low-volatility) components of diesel have a tendency to entrain into the upper water column due to wind-generated waves but can subsequently resurface if wind waves abate.

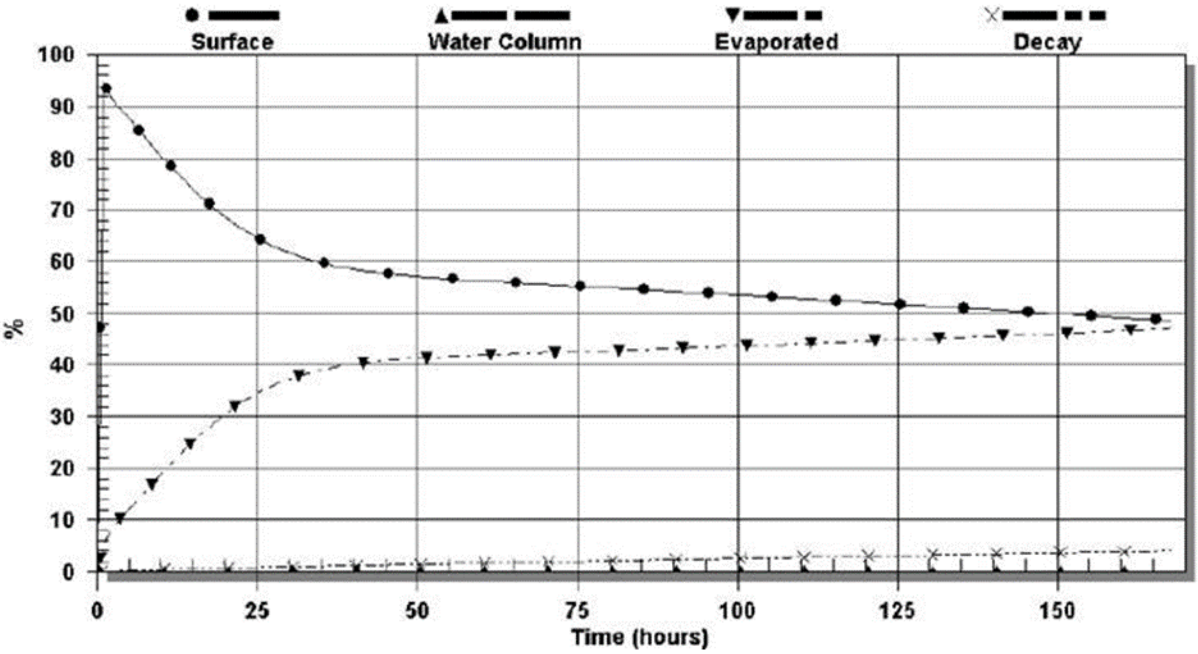
ITOPF (2011) and the AMOSC (2011) categorise diesel as a light ‘group II’ hydrocarbon. In the marine environment, a 5% residual of the total quantity of diesel spilt will remain after the volatilisation and solubilisation processes associated with weathering.

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 to 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.

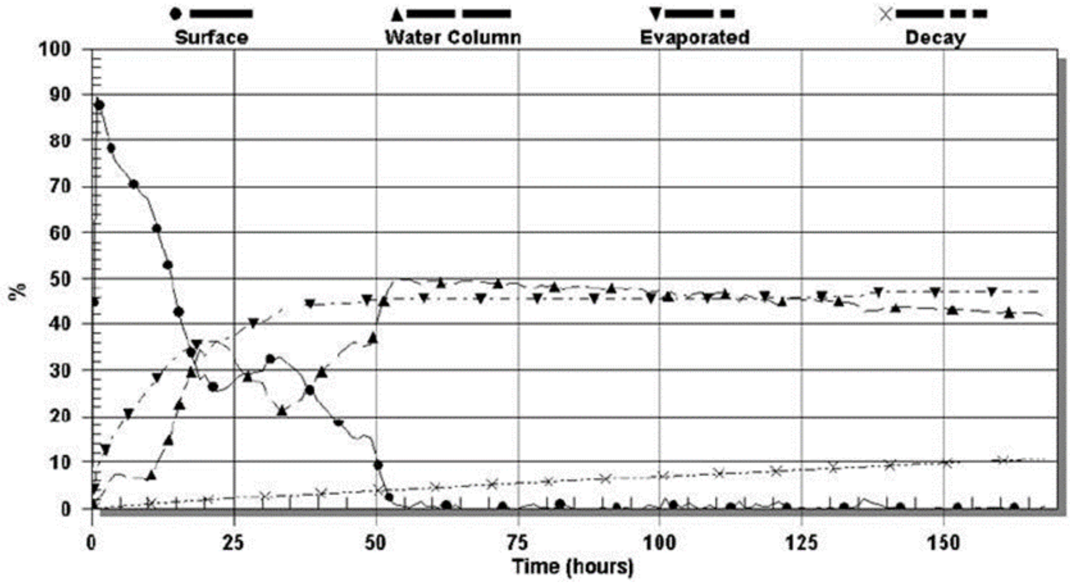
Modelling of surface diesel spills by APASA indicates that at least 40% by volume would evaporate within 40 hours of release under calm conditions (Figure 7-3). The remaining diesel would mostly remain on the surface, where it would be subjected to continuing weathering, including evaporation and photo-oxidation, although at a slowed rate (APASA, 2014a). Almost no diesel in this scenario is predicted to become entrained, and almost no aromatic hydrocarbons are predicted to become dissolved.

In variable weather simulation, wind-generated wave action and physical forces cause up to 45% of the diesel to become entrained into the water column after 40 hours (APASA, 2014a). At the end of 48 hours (two days) approximately 45% is predicted to have evaporated (Figure 7-4). Under conditions that generate wind waves (i.e., winds at or below approximately 12 knots), an increased portion of the residual component of diesel is predicted to become entrained beneath the surface (APASA, 2014a) with very little on the surface.



Source: APASA (2014a)

Figure 7-3: Proportional mass balance plot representing the weathering of marine diesel spilled onto the surface as a single release (50 m^3 over one hour) and subject to a constant 5 knot wind at 27°C water temperature and 25°C air temperature



Source: APASA (2014a)

Figure 7-4: Proportional mass balance plot representing the weathering of marine diesel spilled onto the surface as a single release (50 m^3 over one hour) and subject to variable wind at 27°C water temperature and 25°C air temperature

7.9.2.2 Spill modelling results

A surface release of 329 m^3 of diesel was modelled at the John Brookes WHP. Upon release, the diesel is forecast to spread rapidly out to a thin film on the sea surface; and evaporation is forecast to remove approximately 50% of the released volume within several days of release. The diesel will also become increasingly subject to entrainment into the water column as the density increases after losing the lighter components through evaporation.

The offshore location of the spill and distance from receptors means floating oil slicks would be subject to considerable evaporation and weathering before any contact to sensitive shorelines, reflected in the low probability (less than 0.5%) of floating oil greater than 10 g/m^2 or 1 g/m^2 thickness occurring. The receptors at highest risk were predicted to be the waters of the Montebello Marine Park at a 4% probability of contact by floating oil at concentrations greater than 10 g/m^2 within 9 hours and offshore Ningaloo at a 2.5% probability of contact by floating oil at concentrations greater than 10 g/m^2 within 5 hours. In the worst-case simulation, the maximum local accumulated concentrations on shorelines were predicted to be at Thevenard Island with 2 g/m^2, the Muiron Islands with 0.9 g/m^2 and the Southern Islands Coast with 1.8 g/m^2, all below the moderate exposure value of 100 g/m^2.

Entrained oil concentrations greater than 100 ppb were predicted with low probability (less than 2 %) for all simulations. The maximum concentrations were predicted at the Montebello Marine Park (2,218 ppb) and offshore Ningaloo reef (1,857 ppb). Dissolved aromatic hydrocarbons are highly volatile with a large proportion expected to evaporate at the sea surface unless the oil becomes entrained. Exposure to dissolved aromatic hydrocarbons above the 6 ppb impact threshold was low for all locations (at or less than 0.5%) with the exception of the Montebello Marine Park (57 ppb) and offshore Ningaloo (39 ppb).

7.9.3 Environmental Performance Outcomes and Control Measures

The EPOs relating to this event include:

- No loss of containment of hydrocarbon to the marine environment (EPO-VI-CW-08).

The control measures applied to prevent an oil spill are shown in Table 7-30, and corresponding EPSs 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 7-30: Control measure evaluation for the surface release of diesel (vessel collision/bunkering)

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
Standard Controls				
VI-CW-CM-24	Seafarer Certification.	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.
VI-CW-CM-25	Navigational lighting and aids.	Vessels meet minimum safety standards, thereby reducing potential for vessel collision events with associated diesel spill to the environment.	Costs associated with personnel time in checking vessel certifications are in place.	**Adopted** – Benefits considered to outweigh costs.
VI-CW-CM-51	Support vessel positioning.	Vessels maintain accurate positioning and reduce potential to impact the WHP.	Costs associated with requiring vessels to have appropriate positioning systems; however, these are standard on certain classes of vessel.	**Adopted** – The benefits to safety and the environment (thus reducing risk of environmental impacts due to vessel collisions) outweigh potential costs.
VI-CW-CM-23	Navigational charting of infrastructure.	Provides a means for marine users to be aware of the presence of the WHP and subsea infrastructure.	Costs associated with personnel time in issuing notifications.	**Adopted** – Benefits considered to outweigh costs.
VI-CW-CM-18	Dropped object prevention (LEMS).	Impacts to environment are reduced by preventing dropped objects.	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.

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
VI-CW-CM-21	WHP petroleum safety zone and cautionary area.	Exclusion zone applies around offshore platforms and is marked on Australian nautical charts to prevent vessel collision with an offshore platform.	No additional costs to Santos. Other marine users may be temporarily excluded from areas, disrupting their activities.	**Adopted** – Regulatory requirement must be adopted. Risk of excluding other marine users within a 500-m radius of an offshore platform is unlikely to significantly impact upon the marine user. The benefits to safety of the activity (thus reducing risk of environmental impacts due to vessel collisions) outweigh potential costs.
VI-CW-CM-43	Vessel spill response plan (SOPEP/SMPEP).	Implements response plans on board vessels to deal with unplanned hydrocarbon releases and spills quickly and efficiently to reduce impacts to the marine environment.	Administrative costs of preparing documents. Generally undertaken by vessel contractor so time for Santos personnel to confirm and check SOPEP/SMPEP in place.	**Adopted** – Benefits considered to outweigh costs.
VI-CW-CM-50	Oil pollution emergency plan (OPEP).	Implements response plans to deal with an unplanned hydrocarbon release quickly and efficiently to reduce impacts to the marine environment.	Administrative costs of preparing documents and large costs of preparing for and implementing response strategies.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented and that the vessels are compliant outweigh the costs.
VI-CW-CM-41	Refuelling and Chemical Transfer Procedure.	Minimises risk of pollution to ALARP during chemical transfers from an offshore support vessel to an offshore facility.	Personnel costs associated with ensuring procedures are in place and implemented during inspections.	**Adopted** – Benefits of ensuring procedures are followed and measures implemented outweigh the costs of personnel time.
Additional Controls				
N/A	No diesel bunkering.	Removes potential spill scenario.	Although not expected to occur frequently, the need for operational bunkering may arise during operational activities. Diesel bunkering offshore is considered to be a standard practice, with controls in place and risks well understood by the industry.	**Not Adopted** – In order to maintain the required level of flexibility, the ability to undertake bunkering of diesel is required. Potential risks are further reduced by not undertaking vessel-to-vessel or vessel-to-platform fuel transfers.
N/A	Require all support vessels involved in the activity to be double hulled.	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; also, requiring vessels	**Not Adopted** – Large costs associated with vessel selection and by having an activity schedule determined by vessel availability considered to be grossly disproportionate compared to low risk

Control Measure Reference No.	Control Measure	Environmental Benefit	Potential Cost/Issues	Evaluation
			to be refitted to ensure double hulls would be of high cost.	of a vessel collision and low risk of a large diesel spill.

7.9.4 Environmental Impact Assessment

As described in Section 7.5.6 the process to identify any HEVs within the EMBA (low exposure threshold) for the subsea release of condensate from wellheads was followed. No new hotspots were identified.

The impacts, likelihood and consequence ranking for a surface release of diesel (vessel collision/bunkering) are outlined in Table 7-31.

Table 7-31: Impacts, likelihood and consequence ranking – surface release of diesel (vessel collision/bunkering)

Description	
Receptors	• Physical environment (water and sediment quality) • Threatened or migratory fauna (marine mammals, marine reptiles, sharks, fish, rays and birds) • Protected and significant areas (marine parks and KEFs) • Socio-economic receptors (fisheries, tourism, and recreation)
Consequences	II-Minor
Given the properties of marine diesel and the distance from shorelines, dilution and dispersion from natural weathering processes, such as evaporation and ocean currents, indicate that the extent of exposure will be limited in extent and duration. The susceptibility of marine fauna to hydrocarbons depends on hydrocarbon type and exposure duration; however, given that exposures would be limited in extent and duration, exposure to marine fauna from this hazard is not expected to result in a fatality. Potential impacts to marine fauna from a hydrocarbon exposure are described in detail in Table 7-17 and Table 7-18 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 advices (Table 3-7). In the unlikely event of a vessel collision/bunkering spill of marine diesel, the potential impacts to the environment would be greatest within several 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 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 sensitive receptors such as submerged habitats. There is the potential for surface diesel to disrupt fishing activities if the diesel moves through fishing areas (Table 3-11). Tourism could be affected by surface diesel, either from reduced water quality preventing recreational activities or reducing aesthetic appeal or from impacts to marine fauna as described in Table 7-17and Table 7-18. Potential impacts to these receptors from a larger condensate release are described in detail in Section 7.6 On the basis of the above assessments, a surface diesel release at the John Brookes WHP has the potential to impact receptors in the water column. Given the limited extent, the worst-case consequence is considered to be Minor (II).	
Likelihood	a-Remote
A worst-case diesel release resulting from a vessel collision is unlikely to have widespread ecological effects given the nature of the hydrocarbons on board, the finite volumes that could be released, the water depth and the transient nature of marine fauna in this area. Long-term impacts resulting in complete habitat loss or degradation are not considered likely given the control measures proposed to prevent releases; therefore, the activity will be conducted in a manner that is considered acceptable. The likelihood of a diesel release occurring due to a dropped object/bunkering is limited given the set of mitigation and management controls in place. Consequently, the likelihood of a vessel collision releasing hydrocarbons to the environment, is considered to be remote (a).	
Residual Risk	The residual risk associated with this hazard is Very Low.

7.9.5 Demonstration of as Low as Reasonably Practicable

The use of support vessels is integral to the functioning of the facility; therefore, vessels and the associated risk of a diesel release cannot be completely eliminated. Vessel presence is required during operational activities to transfer supplies and equipment to the facility; offload equipment and waste; and perform inspection, maintenance, monitoring and repair activities. Helicopters are used to transfer crew to and from the facility but cannot accommodate the volumes of supplies and waste material that are transferred by vessel and thus vessel-to-platform loading cannot be substituted.

Offshore refuelling is standard industry practice; and oil pollution legislation, including the 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. The risk of diesel spill during refuelling has been further reduced through the WHP using solar power as the primary energy source, thus reducing the frequency of diesel transfers to the John Brookes WHP.

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.

In terms of spill response activities, Santos will implement oil spill response as specified within the vessel's SOPEP/SMPEP and/or 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 Low to Medium?	Yes –maximum credible spill volume from vessel collision (329 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 ecological 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 – management consistent with OPGGS (E) R 2023 including safety case and WOMP. Santos has considered the values and sensitivities of the receiving environment, including, but not limited to: conservation values of the identified protection priorities (Section 3.2) including the Montebello Marine Park, the Barrow Island Marine Management Area, Montebello Islands Marine Park, Muiron Island Marine Management Area, and Ningaloo Australian Marine Park relevant species recovery plans, conservation management plans and management actions, including but not limited to Recovery Plan for Marine Turtles in Australia 2017–2027 (DoEE, 2017), Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015b), National Recovery Plan for the Southern Right Whale (DCCEEW, 2024), Approved Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015a), and relevant recovery plans and conservation advices for birds.
Are risks and impacts consistent with Santos' Environmental Management 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).

The potential impacts and risks from diesel spills are well understood, and the activities will be managed in accordance with relevant legislation and standards. With the implementation of industry-standard 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.

8. Implementation Strategy

OPGGS(E)R 2023 Requirements
Regulation 22 (1)
The environment plan must contain an implementation strategy for the activity in accordance with this regulation.
Regulation 22 (16)
The implementation strategy must comply with the Act, the regulations and any other environmental legislation applying to the activity.

The specific measures and arrangements that will be implemented in the event of an oil pollution emergency are detailed within the OPEP.

Stakeholder engagement is assessed separately for the requirements of the activities. Ongoing stakeholder management strategies are discussed in Section 4.

8.1 Environmental Management System

OPGGS(E)R 2023 Requirements
Regulation 22 (2)
The implementation strategy must contain a description of the environmental management system for the activity, including specific measures to be used to ensure that, for the duration of the activity: a. the environmental impacts and risks of the activity continue to be identified and reduced to a level that is as low as reasonably practicable, and b. control measures detailed in the environment plan are effective in reducing the environmental impacts and risks of the activity to as low as reasonably practicable and an acceptable level, and c. environmental performance outcomes and standards set out in the environment plan are being met.

The Santos Health, Safety and Environmental Management System (HSEMS) exists to support its moral, professional and legal obligations to undertake work in a manner that does not cause harm to people or the environment. The HSEMS is a framework of policies, standards, processes, procedures, tools and control measures that, when used together by a properly resourced and competent organisation, ensure:

- 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 Addendum which require 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 outcomes and standards set out in this EP Addendum are met
- stakeholder consultation is maintained throughout the activity as appropriate.

8.2 Environmental Management Policy

Santos' Environment, Health and Safety Policy (Appendix A) clearly sets out Santos' strategic environmental objectives and the commitment of the management team to continuous environmental performance improvement. This EP Addendum 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 Addendum (refer to Sections 6 and 7). The control measures and EPS that will be implemented to manage the identified risks and impacts, and the environmental performance outcomes that will be achieved, are detailed below in Table 8-1.

To ensure that environmental risks and impacts remain acceptable and ALARP during the activity and for the duration of this EP Addendum, hazards will continue to be identified, assessed and controlled as described in Section 8.10 and Section 8.11

Any new, or proposed amendment to a control measure, EPS or EPO will be managed in accordance with the Environment Management of Change Procedure (EA-91-IQ-10001) (Section 8.10.2).

Oil spill response control measures and environmental performance standards and outcomes are listed in the OPEP.

8.3.1 Performance Standard Assurance Plans

Where relevant, performance standard assurance plans are referred to throughout this EP to provide evidence that critical systems are maintained in accordance with their design criteria. These plans, with titles beginning ‘PS-n’, detail the performance criteria and associated maintenance routines, including frequency and schedule of inspections, and ensure compliance with relevant regulations (e.g., SOLAS) where appropriate.

8.4 Environmental Performance Outcomes

To ensure environmental risks and impacts will be of an acceptable level, environmental performance outcomes have been defined and are listed in Table 8-1. Those EPOs relating to oil spill response are listed in the OPEP. These outcomes will be achieved by implementing the identified control measures to the defined environmental performance standards.

Table 8-1: Environmental Performance Outcomes

Reference	Environmental Performance Outcomes
EPO-VI-CW-01	No injury or mortality to EPBC Act and WA Biodiversity Conservation Act 2016 listed marine fauna during operational activities.
EPO-VI-CW-02	Reduce impacts to marine fauna from lighting on the WHP and support vessels through limiting lighting to that required by safety and navigational lighting requirements.
EPO-VI-CW-03	Reduce impacts to air and water quality from planned discharges and emissions from operational activities.
EPO-VI-CW-04	Seabed disturbance is limited to the operational area.
EPO-VI-CW-05	Reduce 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-VI-CW-06	No introduction of marine pest species.
EPO-VI-CW-07	No unplanned objects, emissions or discharges to sea or air.
EPO-VI-CW-08	No loss of containment of hydrocarbon to the marine environment.
EPO-VI-CW-09	Varanus Island Hub Operations Commonwealth Waters GHG emissions managed to achieve Santos' climate change targets of reduction of scope 1 and 2 emissions by 30% by 2030 and achieve net-zero scope 1 and scope 2 emissions by 2040.
EPO-VI-CW-10	Actively support the global transition to a lower carbon future by implementing the Santos Climate Policy to support the objective of the Paris Agreement.
EPO-VI-CW-11	No injury or death to EPBC Act and WA Biodiversity Conservation Act 2016 listed threatened, migratory or marine species as a result of the operation of the John Brookes WHP bird deterrent system.

8.4.1 Control Measures and Performance Standards

The control measures that will be used to manage identified environmental impacts and risks and the associated statements of performance required of the control measure (i.e., 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 VI Hub OPEP (EA-60-RI-00186.02).

Table 8-2: Control measures and environmental performance standards for the proposed activity (Environment Plan)

Control Measure	Control Measure Reference No.	Environmental Performance Standard	EPS Reference No.	Measurement Criteria	EPO Reference No.	Relevant Sections of the EP
Procedure for interacting with marine fauna.	VI-CW-CM-01	Vessels comply with Santos' Protected Marine Fauna Interaction and Sighting Procedure, which ensures compliance with Part 8 of the EPBC Regulations 2000, which includes controls for minimising the risk of collision with marine fauna.	VI-CW-CM-01-EPS 01	Completed vessel statement of conformance.	EPO-VI-CW-01	Section 6.1 Section 7.2
		Helicopter contractor's procedures comply with Santos' Protected Marine Fauna Interaction and Sighting Procedure, which ensures compliance with Part 8 of the EPBC Regulations 2000, which includes controls for minimising interaction with marine fauna.	VI-CW-CM-01-EPS 02	Helicopter contractor's procedures align with Santos' Protected Marine Fauna Interaction and Sighting Procedure.	EPO-VI-CW-01	Section 6.1 Section 7.2
		UAV contractor's procedures comply with Santos' Protected Marine Fauna Interaction and Sighting Procedure, which includes controls for minimising the risk of collision with marine fauna.	VI-CW-CM-01-EPS 03	Contractor's procedures align with Santos' Protected Marine Fauna Interaction and Sighting Procedure.	EPO-VI-CW-01	Section 6.1 Section 7.2
Bird deterrent system CCTV footage retrieved opportunistically from the John Brookes WHP.	VI-CW-CM-02	CCTV footage will be retrieved opportunistically (i.e., during personnel visits to the WHP) and reviewed for the: • effectiveness of the deterrent system • observations of bird species, numbers and response to deterrent activities.	VI-CW-CM-02-EPS 01	Completed bird count and activity logs.	EPO-VI-CW-11	Section 6.1 Section 6.2
				Compliance with the conditions of Permit E2020-0173 is reported annually to DAWE for the life of the permit and included in the annual performance report provided to NOPSEMA.		
Lighting will be used only as required for safe work conditions and navigational purposes.	VI-CW-CM-03	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.	VI-CW-CM-03-EPS 01	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.	EPO-VI-CW-02	Section 6.2 Section 7.2
Premobilisation review and planning of lighting on support vessels and the WHP is undertaken prior to IMMR activities commencing.	VI-CW-CM-04		VI-CW-CM-04-EPS 01		EPO-VI-CW-02	
Facilities Planned Maintenance System.	VI-CW-CM-05	Monthly reliability target of 90% met for the gas turbines on the John Brookes WHP.	VI-CW-CM-05-EPS 01	CMMS records.	EPO-VI-CW-03	Section 6.3
		Documented maintenance program is in place for equipment on facilities that provides a status on the maintenance of equipment.	VI-CW-CM-05-EPS03	CMMS records.	EPO-VI-CW-03 EPO-VI-CW-07	Section 6.4 Section 7.3
Vessels comply with Marine Order 97 (Marine Pollution – Air Pollution).	VI-CW-CM-06	Support vessels contracted whose practices comply with Marine Order 97 as applicable to vessel size, type, and class.	VI-CW-CM-06-EPS01	Vessel inspection records.	EPO-VI-CW-03	Section 6.3 Section 6.4
Fuel oil quality.	VI-CW-CM-07	MARPOL-compliant (Marine Order 97) fuel oil (diesel) will be used during the activity.	VI-CW-CM-07-EPS01	Fuel bunkering records.	EPO-VI-CW-03	Section 6.3 Section 6.4
National Greenhouse and Energy Reporting Scheme and National Pollutant Inventory (NPI) reporting – estimation of greenhouse gas, energy and criteria pollutants.	VI-CW-CM-08	VI Hub Operations Commonwealth Waters GHG emissions reported annually in accordance with NGERS and NPI. Note emissions for VI Hub Operations in Commonwealth waters will be reported with overall VI Hub Operations GHG emissions.	VI-CW-CM-08-EPS01	NGERS and NPI reporting records.	EPO-VI-CW-03 EPO-VI-CW-09	Section 6.3
Comply with the requirements of the Safeguard Mechanism, including purchase and/or surrender of Australian carbon credit units for any emissions above the baseline for the year, as determined by the Clean Energy Regulator.	VI-CW-CM-09	Manage net GHG emissions to within the accepted baseline for the VI Hub Operations, under the National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015.	VI-CW-CM-09-EPS01	Records demonstrate net GHG emissions managed within accepted baseline.	EPO-VI-CW-03 EPO-VI-CW-09	Section 6.3
Reduce GHG emissions for the VI Hub over the life of the EP through implementation of the Santos WA, NA, TL Decarbonisation Plan.	VI-CW-CM-10	Implement the in-progress GHG emissions reduction projects for the VI Hub Facility.	VI-CW-CM-10-EPS01	Records demonstrate the VI Hub Facility in-progress GHG emissions reducing projects are tracked via the Reliability, Integrity, Process and Process Safety monthly update.	EPO-VI-CW-03 EPO-VI-CW-09	Section 6.3

Control Measure	Control Measure Reference No.	Environmental Performance Standard	EPS Reference No.	Measurement Criteria	EPO Reference No.	Relevant Sections of the EP
VI Hub products generated from the activity will only be sold to customers from countries that are signatories to the Paris Agreement or have a net zero commitment, as at the date of the relevant contract of sale (administrative control)	VI-CW-CM-11	VI Hub sales contracts limited to customers from countries that are signatories to the Paris Agreement or have a net zero commitment.	VI-CW-CM-11-EPS01	Records demonstrate that customer countries are current signatories to the Paris Agreement or have a net-zero commitment.	EPO-VI-CW-10	Section 6.3
Vessels Planned Maintenance System.	VI-CW-CM-13	Documented maintenance program is in place for equipment on vessels that provides a status on the maintenance of equipment.	VI-CW-CM-13-EPS01	Planned Maintenance System records.	EPO-VI-CW-04 EPO-VI-CW-07	Section 6.5 Section 7.3
International Air Pollution Prevention Certificate.	VI-CW-CM-14	Pursuant to Marine Order 97, vessels will maintain a current International Air Pollution Prevention Certificate, which certifies that measures to prevent ozone-depleting substance emissions and reduce NOx, SOx and incineration emissions during the activity are in place.	VI-CW-CM-14-EPS01	Current International Air Pollution Prevention Certificate. Audit records. Vessel contract and premobilisation audit records.	EPO-VI-CW-03	Section 6.4
Ozone-depleting substance handling procedures.	VI-CW-CM-15	Ozone-depleting substances managed in accordance with Marine Order 97 to reduce the risk of an accidental release of ozone-depleting substances to air.	VI-CW-CM-15-EPS01	Completed ozone-depleting substances record book or recording system.	EPO-VI-CW-03;	Section 6.4
Waste incineration management.	VI-CW-CM-16	Waste incineration managed in accordance with Marine Order 97.	VI-CW-CM-16-EPS01	Completed waste record book or recording system.	EPO-VI-CW-03	Section 6.4
Planned subsea and offshore maintenance	VI-CW-CM-17	Detailed inspection work packs, 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 Offshore Subsea Inspection Procedure.	VI-CW-CM-17-EPS01	CMMS records.	EPO-VI-CW-04	Section 6.5
		Santos will maintain in good condition and repair all subsea structures that are, and all subsea equipment and other property that is used in connection with the VI Hub operations to ensure Santos can meet obligations under s.572 of the OPGGS Act. This will be achieved through the application of Santos Offshore Subsea Inspection Procedure. The procedure shall include a description of subsea inspection philosophies, procedures and reporting. Inspection finding reviews by technical authorities will be used to determine the requirements to inform next actions, specifically: detailed engineering assessments detailed risk assessments maintenance and remedial works future inspection schedules. The procedure shall require inspection reviews to be documented and resultant actions to be tracked and completed.	VI-CW-CM-17-EPS02	CMMS Records demonstrate ongoing inspection, and maintenance if required, on all subsea structures (including operational and suspended). Inspection reports.	EPO-VI-CW-07	Section 6.5 Section 7.3 Section 7.4 Section 7.6 Section 7.7 Section 7.8 Section 7.9
Dropped Object Prevention Procedure (LEMS).	VI-CW-CM-18	Implementation of the Santos Lifting Equipment Management System and LEMS Safe Lifting Operations, which includes the controls of: • lifting equipment certification and inspection • lifting crew competencies • heavy-lift procedures • preventive maintenance on cranes.	VI-CW-CM-18-EPS01	CMMS records. Lifting Equipment Register. Permit to work records. Training records.	EPO-VI-CW-04 EPO-VI-CW-05 EPO-VI-CW-08	Section 6.5 Section 7.3 Section 7.4 Section 7.6 Section 7.7 Section 7.8 Section 7.9
Dropped object recovery.	VI-CW-CM-19	Objects dropped overboard are recovered 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.	VI-CW-CM-19-EPS01	Fate of dropped objects detailed in incident documents.	EPO-VI-CW-04 EPO-VI-CW-05	Section 6.5 Section 7.3
Anchoring and equipment deploying management	VI-CW-CM-20	If anchoring or placement of equipment is required vessels will anchor or place equipment on seabed only at Santos pre-approved locations.	VI-CW-CM-20-EPS01	Incident database records show no anchoring or placement of equipment occurred at non-approved locations.	EPO-VI-CW-04 EPO-VI-CW-08	Section 6.5 Section 7.7
		Support vessels anchoring near subsea infrastructure must keep an anchor watch and an hourly log of anchor wire lengths and tensions to ensure that the vessel does not drag an anchor, in accordance with the Mooring Operations Procedure.	VI-CW-CM-20-EPS02	Records of anchor watch.	EPO-VI-CW-04 EPO-VI-CW-08	Section 6.5 Section 7.7
WHP Petroleum Safety Zone.	VI-CW-CM-21	A 500-m radius petroleum safety zone is defined around the offshore platforms and marked on Australian Hydrographic Service nautical charts.	VI-CW-CM-21-EPS01	Incident records show that no breaches have occurred of unauthorised access within the petroleum safety zone.	EPO-VI-CW-05 EPO-VI-CW-08	Section 6.6 Section 7.6

Control Measure	Control Measure Reference No.	Environmental Performance Standard	EPS Reference No.	Measurement Criteria	EPO Reference No.	Relevant Sections of the EP
						Section 7.9
Notify AHO and AMSA's JRCC prior to commencement of vessel-based IMMR.	VI-CW-CM-22	Santos notified AHO and AMSA's JRCC prior to commencement of IMMR activities (using vessels).	VI-CW-CM-22-EPS01	Records of transmittal.	EPO-VI-CW-05	Section 6.6
Navigational charting of infrastructure.	VI-CW-CM-23	The offshore facilities and subsea infrastructure are charted on Australian Hydrographic Service nautical charts.	VI-CW-CM-23-EPS01	Australian Hydrographic Service nautical charts show Santos' offshore facilities are charted.	EPO-VI-CW-05 EPO-VI-CW-08	Section 6.6 Section 7.6 Section 7.7 Section 7.8 Section 7.9
Navigational lighting and aids	VI-CW-CM-24	Navigational lighting and communication aids on offshore platforms are provided and inspected at frequencies outlined within PS-04 Navigational Aids (QE-10-RG-0004), which manages the methods to alert marine vessels and aircraft of the position of the facility to minimise the potential for collision.	VI-CW-CM-24-EPS01	CMMS records.	EPO-VI-CW-05 EPO-VI-CW-08 EPO-VI-CW-05 EPO-VI-CW-08	Section 6.6 Section 7.6 Section 7.9
		Support-vessel navigation equipment is compliant with SOLAS/AMSA Marine Order 30 (Prevention of collisions), and with Marine Order 21 (Safety and emergency arrangements).	VI-CW-CM-24-EPS02	Vessel inspection records.		Section 6.6 Section 7.6 Section 7.9
Seafarer Certification.	VI-CW-CM-25	Vessel crew are trained and competent, in accordance with Marine Order 70 with Flag State regulations, to navigate vessels and reduce interaction with other marine users.	VI-CW-CM-25-EPS01	Training records. Vessel contract and premobilisation audit records.	EPO-VI-CW-05 EPO-VI-CW-08	Section 6.6 Section 7.6 Section 7.9
Constant bridge watch on support vessels.	VI-CW-CM-26	Monitoring of surrounding marine environment undertaken from vessel bridge.	VI-CW-CM-26-EPS01	Records of bridge watch.	EPO-VI-CW-05 EPO-VI-CW-01	Section 6.6 Section 7.2
Stakeholder consultation.	VI-CW-CM-27	Santos provided a quarterly consultation update to a Santos wide stakeholder group on a quarterly basis. All stakeholder correspondence has been recorded in stakeholder database.	VI-CW-CM-27-EPS01	Records of transmittal. Stakeholder communications database.	EPO-VI-CW-05	Section 6.6
Sewage system	VI-CW-CM-28	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.	VI-CW-CM-28-EPS01	Current International Sewage Pollution Prevention Certificate.	EPO-VI-CW-03	Section 6.7
		Preventive maintenance on sewage treatment equipment is completed as scheduled.	VI-CW-CM-28-EPS02	Maintenance records.		
		Sewage from vessels or offshore platforms is discharged or retained, in accordance with Marine Order 96.	VI-CW-CM-28-EPS03	Records demonstrate that sewage was appropriately discharged or retained.		
Oily mixture system	VI-CW-CM-29	Oily mixtures (bilge water) only discharged to sea in accordance with Marine Order 91.	VI-CW-CM-29-EPS01	Oil record book.	EPO-VI-CW-03	Section 6.7
		Preventive maintenance on oil-filtering equipment completed as scheduled.	VI-CW-CM-29-EPS02	Maintenance records.		
		Pursuant to Marine Order 91, support vessels 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.	VI-CW-CM-29-EPS03	Current International Oil Pollution Prevention Certificate.		
Offshore platform deck drain system and bunding.	VI-CW-CM-30	Preventive maintenance on deck drainage sump and associated equipment completed as scheduled in accordance with John Brookes Performance Standard Assurance Plan PS-14-Bunding and Open Drains.	VI-CW-CM-30-EPS01	CMMS records.	EPO-VI-CW-03 EPO-VI-CW-04	Section 6.7 Section 7.4
Garbage management	VI-CW-CM-31	Garbage management plan implemented to reduce the risk of waste released to sea in accordance with Marine Order 95. The plan includes detail for: bin types lids and covers waste segregation bin storage food waste.	VI-CW-CM-31-EPS01	Garbage record book. Audit records. Inspection records.	EPO-VI-CW-03 EPO-VI-CW-05	Section 6.7 Section 7.3

Control Measure	Control Measure Reference No.	Environmental Performance Standard	EPS Reference No.	Measurement Criteria	EPO Reference No.	Relevant Sections of the EP
		Pursuant to Marine Order 95, placards displayed to notify personnel of waste disposal restrictions.	VI-CW-CM-31-EPS02	Audit records. Inspection records.		
		Garbage generated on offshore facilities will not be discharged to the marine environment.	VI-CW-CM-31-EPS03	Incident records.		
Deck cleaning product selection.	VI-CW-CM-32	Deck cleaning products planned to be released to sea meet the criteria for not being harmful to the marine environment according to MARPOL Annex V.	VI-CW-CM-32-EPS01	Safety datasheet and product supplier supplementary data as required.	EPO-VI-CW-03	Section 6.7
Chemical Selection Procedure.	VI-CW-CM-33	Production or process chemicals potentially discharged to sea are Gold, Silver, D or E rated through the OCNS, 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 so that only environmentally acceptable products are used.	VI-CW-CM-33-EPS01	Completed Santos risk assessments. OCNS List.	EPO-VI-CW-03	Section 6.7
Pipeline flushing prior to opening of subsea system.	VI-CW-CM-34	Subsea system flushed to reduce hydrocarbon content prior to opening of subsea system.	VI-CW-CM-34-EPS01	Completed operational records.	EPO-VI-CW-03	Section 6.7
Implementation of the management controls within the Santos Invasive Marine Species Management Plan.	VI-CW-CM-35	Vessels are managed to low risk in accordance with the Santos Invasive Marine Species Management Plan (EA-00-RI-10172) 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 • the management of immersible equipment to achieve low risk.	VI-CW-CM-35-EPS01	Completed risk assessment demonstrating vessel is low risk.	EPO-VI-CW-06	Section 7.1
Anti-foulant system.	VI-CW-CM-36	Anti-foulant systems are maintained in compliance with International Convention on the Control of Harmful Anti-fouling Systems in Ships (IMO, 2001).	VI-CW-CM-36-EPS01	Current International Anti-Fouling System Certificate.	EPO-VI-CW-06	Section 7.1
Ballast Water Management Plan.	VI-CW-CM-37	Pursuant to the Biosecurity Act 2015 and Australian Ballast Water Management Requirements 2017, support vessels carrying ballast water and engaged in international voyages shall manage ballast water so marine pest species are not introduced.	VI-CW-CM-37-EPS01	Ballast Water Management Plan. Completed ballast water record book or log.	EPO-VI-CW-06	Section 7.1
Inspection of platform structures and hydrocarbon-containing equipment.	VI-CW-CM-38	Structural integrity of offshore platforms meets inspection criteria and frequency as specified in PS-01 Structural Integrity (QE-00-RG-00213) to provide structural support for facilities.	VI-CW-CM-38-EPS01	CMMS records	EPO-VI-CW-04 EPO-VI-CW-08	Section 7.4 Section 7.6 Section 7.8
		Platform hydrocarbon-containing equipment meets inspection criteria and frequency as specified in PS-02 Hydrocarbon Containment: Hydrocarbon Containing Equipment, to prevent the uncontrolled release of hydrocarbons. All subsea inspections are carried out in accordance with the Santos Underwater Inspection Manual.	VI-CW-CM-38-EPS02			
		Inspection of topsides structural and miscellaneous equipment meets inspection criteria and frequency as specified in the Topside Inspection Procedure, which defines the philosophy, procedure and reporting requirements for topsides structural and miscellaneous equipment inspection of offshore fixed steel platforms and floating structures.	VI-CW-CM-38-EPS03			
		Inspection of rigid hydrocarbon riser sections and wellhead conductors above sea level will meet the inspection criteria and frequency specified in the Topside Riser & Wellhead Conductor Inspection Procedure, which defines the inspection philosophy, procedure and reporting requirements for rigid hydrocarbon risers and wellhead conductors above LAT.	VI-CW-CM-38-EPS04			
		Subsea assets , including as release valves, will meet the inspection criteria and frequency specified in the Subsea Inspection Procedure, which describes the inspection philosophy, procedure and reporting requirements for Santos subsea assets.	VI-CW-CM-38-EPS05			
Hazardous chemical management procedures.	VI-CW-CM-39	For hazardous chemicals, including hydrocarbons, the following standards apply to reduce the risk of an accidental release to sea: • Storage containers are closed when the product is not being used. • Storage containers are managed in a manner that provides for secondary containment in the event of a spill or leak. • Storage containers are labelled with the technical product name as per the safety datasheet.	VI-CW-CM-39-EPS01	Audit records. Inspection records.	EPO-VI-CW-04	Section 7.4

Control Measure	Control Measure Reference No.	Environmental Performance Standard	EPS Reference No.	Measurement Criteria	EPO Reference No.	Relevant Sections of the EP
		• Spills and leaks to deck, excluding storage bunds and drip trays, are immediately cleaned up. • Storage bunds and drip trays do not contain free-flowing volumes of liquid. • Spill response equipment is readily available.				
General chemical management procedures	VI-CW-CM-40	Safety datasheet is available for all chemicals to aid in the process of hazard identification and chemical management.	VI-CW-CM-40-EPS01	Safety datasheet.	EPO-VI-CW-04	Section 7.4
		Chemicals managed in accordance with safety data sheet in relation to safe handling and storage, spill-response and emergency procedures, and disposal considerations.	VI-CW-CM-40-EPS02	Audit records. Inspection records.		
		Dangerous goods managed in accordance with International Maritime Dangerous Goods Code to reduce the risk of an environmental incident, such as an accidental release to sea or unintended chemical reaction.	VI-CW-CM-40-EPS03	Site records.		
Refuelling and Chemical Transfer Procedure.	VI-CW-CM-41	Fuel transfers are undertaken in accordance with the Refuelling and Chemical Transfer Management Standard, which details requirements for the refuelling and chemical transfer from an offshore support vessel to an offshore or onshore facility, as well as refuelling of fixed or portable equipment and machinery.	VI-CW-CM-41-EPS01	Completed work permits. Job safety analysis form. Audit records. Inspection records.	EPO-VI-CW-08	Section 7.9
Spill response equipment on producing platforms.	VI-CW-CM-42	Spill response equipment is present on producing offshore platforms to contain and recover spills, thereby reducing potential for spills to reach the marine environment.	VI-CW-CM-42-EPS01	Audit records. Inspection records.	EPO-VI-CW-04	Section 7.4
Vessel spill response plan (SOPEP/SMPEP).	VI-CW-CM-43	Support vessels have a shipboard oil pollution emergency plan (SOPEP) or shipboard marine pollution emergency plan (SMPEP) that outlines steps taken to combat spills.	VI-CW-CM-43-EPS01	Audit records. Inspection records.	EPO-VI-CW-04 EPO-VI-CW-08	Section 7.4 Section 7.9
		Spill exercises on support vessels are conducted as per the vessels SOPEP or SMPEP.	VI-CW-CM-43-EPS02	Spill exercise close out reports.	EPO-VI-CW-04 EPO-VI-CW-08	
Remotely operated vehicle (ROV) inspection and maintenance procedures.	VI-CW-CM-44	Preventive maintenance on ROV completed as scheduled to reduce the risk of hydraulic fluid releases to sea.	VI-CW-CM-44-EPS01	Maintenance records	EPO-VI-CW-04 EPO-VI-CW-08	Section 7.4
		ROV pre-deployment inspection completed to reduce the risk of hydraulic fluid releases to sea.	VI-CW-CM-44-EPS02	Completed pre-deployment inspection.		
NOPSEMA-accepted WOMP	VI-CW-CM-45	A NOPSEMA-accepted WOMP for John Brookes, Halyard, and Spartan production wells is in place to specifically manage the risks associated with operation of these wells (including well intervention and maintenance activities). • WOMP includes control measures for well integrity that reduce the risk of an unplanned release of hydrocarbons, including: • minimum of two barrier envelopes • certified pressure-control equipment • certified pumping package (including hoses and pipework) • minimum requirements for pressure-testing operations.	VI-CW-CM-45-EPS01	NOPSEMA-accepted WOMP. CMMS records demonstrate that inspection and maintenance activities are compliant with the WOMP.	EPO-VI-CW-08	Section 7.6 Section 7.8
		A NOPSEMA-accepted WOMP is in place for Rosella Well to specifically manage the risks associated with this well.	VI-CW-CM-45-EPS02	NOPSEMA-accepted WOMP demonstrates that inspection activities are compliant with the WOMP. CMMS records.		
Well services procedures and criteria	VI-CW-CM-46	Santos' Asset Integrity Management Program complied with, which includes the framework of policies, procedures, and performance standards for production operation assets.	VI-CW-CM-46-EPS01	Certification and test records confirm compliance with project-specific procedures and Asset Integrity Management Programme (QE-91-IP-00302).	EPO-VI-CW-08	Section 7.6 Section 7.8
		Well Acceptance Criteria for critical well operations and integrity aspects are achieved. Well Acceptance Criteria will be selected based on the well objectives and Santos' Offshore Drilling and Completions technical standards.	VI-CW-CM-46-EPS02	Completed well acceptance criteria in well program. Incident records confirm no breach of containment.		
Testing and maintenance of emergency shutdown systems and shutdown/safety valves.	VI-CW-CM-47	Emergency shutdown systems and shutdown/ safety valves are routinely tested and maintained to ensure integrity and function is maintained. Their testing criteria and test frequency are specified within: • PS-06 ESD and Blowdown: Emergency Shutdown Valves (ESDVs including HIPPS), which prevents the escalation of events by isolating the process plant and/or utility equipment	VI-CW-CM-47-EPS01	CMMS records.	EPO-VI-CW-08	Section 7.6 Section 7.7 Section 7.8

Control Measure	Control Measure Reference No.	Environmental Performance Standard	EPS Reference No.	Measurement Criteria	EPO Reference No.	Relevant Sections of the EP
		• PS-07 ESD and Blowdown: Reservoir Isolation (including Surface-controlled Subsurface Safety Valves and XT valves), which applies to surface-controlled subsurface safety valves, XT valves and wellhead control panel to isolate the well inventories • PS-08 ESD and Blowdown: Safety Instrumented Systems, which applies to the logic solver modules holding the safety logic • PS-10 ESD and Blowdown: Pressure Safety Valves, 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.				
Incident response plan detailing the requirements for preparedness and response to emergencies and crises to protect people and the environment.	VI-CW-CM-48	In the event that the integrity of a pipeline/valve is compromised or there is an unplanned hydrocarbon release from: • the wellheads at John Brookes WHP • a subsea pipeline • a subsea wellhead, • the Varanus Island Incident Response Plan is initiated to activate the Isolation of the flowline/pipeline/wells.	VI-CW-CM-48-EPS01	Varanus Island Incident Response Plan (QE-00-ZF-00044) CMMS records.	EPO-VI-CW-08	Section 7.6 Section 7.7 Section 7.8
Emergency power system is provided on John Brookes WHP to secure secondary power source for safety integrity system.	VI-CW-CM-49	Uninterruptible power supply meet test and inspection criteria and test and inspection frequency as specified in PS-18 Emergency Power.	VI-CW-CM-49-EPS01	CMMS records.	EPO-VI-CW-08	Section 7.6 Section 7.7 Section 7.8
Accepted oil pollution emergency plan (OPEP).	VI-CW-CM-50	In the event of an oil spill to sea, the Santos OPEP requirements are implemented to mitigate environmental impacts.	VI-CW-CM-50-EPS01	Completed incident documentation.	EPO-VI-CW-08	Section 7.6 Section 7.7 Section 7.8 Section 7.9
Support vessel positioning.	VI-CW-CM-51	As per NOPSEMA-accepted safety case requirements, support vessels will maintain a ‘drift-off’ position relative to offshore platforms to reduce potential for impact.	VI-CW-CM-51-EPS01	Completed vessel positioning logs.	EPO-VI-CW-08	Section 7.6 Section 7.7 Section 7.8 Section 7.9
		If support vessels are using dynamic positioning, the dynamic positioning system is specified as per the relevant safety case’s requirements.	VI-CW-CM-51-EPS02	NOPSEMA-accepted safety case.		
NOPSEMA-accepted safety case.	VI-CW-CM-52	A NOPSEMA-accepted safety case for all licensed pipelines is in place to specifically manage the risks associated with operation and integrity, including maintenance activities.	VI-CW-CM-52-EPS01	NOPSEMA-accepted safety case. CMMS records.	EPO-VI-CW-08	Section 7.7
Inspection and corrosion monitoring of pipelines.	VI-CW-CM-53	Offshore pipelines and risers meet inspection and monitoring criteria and frequency as outlined in PS-03 Hydrocarbon Containment; Risers and Pipelines, which manages the inherent safety of risers and pipelines, including all mounted fittings, fixtures and supports.	VI-CW-CM-53-EPS01	CMMS records.	EPO-VI-CW-08	Section 7.6 Section 7.7 Section 7.8
Operational monitoring of low flow well leak.	VI-CW-CM-54	Low flow well leaks will be subject to operational monitoring as described in Section 9 of the OPEP until a risk assessment indicates negligible risk to the environment and well integrity risk assessment indicates no risk of escalation.	VI-CW-CM-54-EPS01	Incident Action Plan.	EPO-VI-CW-08	Section 7.6 Section 7.8
Santos decommissioning plan.	VI-CW-CM-55	Santos will submit a decommissioning plan to NOPSEMA by Q2 2025 for infrastructure reaching EOFL by 2030.	VI-CW-CM-55-EPS01	Completed Decommissioning Plan.	EPO-VI-CW-08	Section 7.6 Section 7.7 Section 7.8
		Santos will submit a Cessation of Production EP within one year of end of field life for each relevant infrastructure group.	VI-CW-CM-55-EPS02	Cessation of Production EP	EPO-VI-CW-08	
Santos staff listed in the Santos Bird Management Plan for Offshore Platforms will be provided with information summarising the key components of the document.	VI-CW-CM-56	Relevant Santos staff are provided with key information from the Santos Bird Management Plan for Offshore Platforms annually, including responsibilities, monitoring and reporting requirements.	VI-CW-CM-56-EPS01	Records that information has been provided to relevant personnel.	EPO-VI-CW-01 EPO-VI-CW-11	Section 6.6
Bird counts and activity logs will be recorded during campaigns at the WHP.	VI-CW-CM-57	During visits to the WHP the bird counts and activity logs are completed and logged. The data recorded must include bird name and numbers observed.	VI-CW-CM-57-EPS01	Bird counts and activity logs.	EPO-VI-CW-01 EPO-VI-CW-11	Section 6.6
All strikes will be reported by the helicopter operator to Santos. In	VI-CW-CM-58	All bird strikes are reported by helicopter operators to Santos as soon as practicable.	VI-CW-CM-58-EPS01	Incident records. Near miss records.	EPO-VI-CW-01 EPO-VI-CW-11	Section 6.6

Control Measure	Control Measure Reference No.	Environmental Performance Standard	EPS Reference No.	Measurement Criteria	EPO Reference No.	Relevant Sections of the EP
addition, the helicopter operator will advise Santos of near misses and other relevant hazards.		All bird strike near misses and other relevant bird hazards are reported by helicopter operators to Santos within 24 hours.				
Effectiveness of the deterrent system will be evaluated during campaigns at the WHP.	VI-CW-CM-59	During visits to the WHP effectiveness of the bird deterrent system will be evaluated and the findings reported to the Environment Team.	VI-CW-CM-59-EPS01	Records show findings are communicated to the Environment Team.	EPO-VI-CW-01 EPO-VI-CW-11	Section 6.6
Maintenance of the acoustic bird deterrent device.	VI-CW-CM-60	The acoustic bird deterrent system is maintained in accordance with the device specifications and Santos maintenance system.	VI-CW-CM-60-EPS01	Maintenance records.	EPO-VI-CW-01 EPO-VI-CW-11	Section 6.1
LDAR program at John Brookes WHP to detect fugitive emissions.	VI-CW-CM-61	Fugitive emissions from all equipment at the John Brookes WHP will be managed through: • a periodic leak detection and repair (LDAR) program. • continuous fixed gas detection system. • visual and personal gas detector inspections of the WHP equipment at the start of each quarterly WHP visit. • leak response and investigation.	VI-CW-CM-61-EPS01	LDAR records. John Brookes WHP Visit Procedure. CMMS records.	EPO-VI-CW-09	Section 6.3

8.5 Leadership, Accountability and Responsibility

OPGGS(E)R 2023 Requirements
Regulation 22 (3)
The implementation strategy must establish a clear chain of command, setting out the roles and responsibilities of personnel in relation to the implementation, management and review of the environment plan, including during emergencies or potential emergencies.

While Santos' Chief Executive Officer (CEO) has the overall accountability for the implementation of the Santos Management System (SMS) and Santos' Environment Team Lead is accountable for ensuring implementation, management and review of this EP.

Effective implementation of this EP will require collaboration and cooperation among Santos and its contractors. This is reflected in Table 8-3, which sets out the roles and responsibilities of personnel in relation to the implementation, management and review of the EP.

Table 8-3: Chain of command, key leadership roles and responsibilities

Roles	Responsibilities
Perth Office-based Roles	
GM – WA Production WA, NA & TL Operations	Has overall responsibility for: • complying with the EP and Santos policies and procedures • approving budgets to meet EP commitments • ensuring accurate reporting of environmental incidents • ensuring company has contractual provisions in place to enable rapid response to oil spill incidents.
Production Manager – WA, NA & TL	Has overall responsibility for: • implementing the EP and Santos policies and procedures • ensuring the appropriate level of budget and planning is in place to meet EP commitments • ensuring appropriate checks completed prior to mobilising support vessels • approving Environmental MoC documents • ensuring environmental incidents are appropriately investigated • applying appropriate enforcement mechanisms to prevent breaches of this EP.
Operations Superintendent – Varanus Island	Has responsibility for: • ensuring all relevant plans, commitments and procedures are available to personnel • implementing the CMMS • ensuring appropriate level of risk assessment has been completed • approving procedures and work instructions • developing resourcing plans • interfacing between onshore and offshore teams.
Onshore Installation Manager	Has responsibility for: • implementing EP commitments • ensuring personnel competency • ensuring compliance with procedures and work instructions • providing 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.
Offshore Designated Person (on WHP)	Has responsibility for: • reporting all incidents and potential hazards to the Person in Charge • controlling and implementing risk reduction measures during site-based activities • providing site response to incidents to minimise environmental impact (if safe to do so)

Roles	Responsibilities
	• ensuring all personnel working on facility are knowledgeable about the specific risks of the tasks being undertaken • ensuring a high standard of housekeeping is maintained at work locations.
Manager – Engineering WA, NA, TL	Has overall responsibility for: • implementing subsea maintenance and integrity programme • providing engineering support to the operational activities • providing technical assurance.
HSS Manager	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.
HSE Team Lead – Security and Emergency Response	Has overall responsibility for: • overarching incident and crisis management responsibility • managing the CMT and IMT personnel training program • reviewing and assessing competencies for CMT, IMT and field-based IRT members • managing the duty roster system for CMT and IMT personnel • managing the maintenance and readiness of incident response resources and equipment.
Environment Team Lead	Has overall responsibility for: • complying with Santos' Environmental Management Policy and this EP • providing operational HSE oversight and advice • ensuring adequate resources are provided for HSE support • facilitating the development and implementation of environmental management of change documents • ensuring EP-required reporting is accurate and timely • ensuring environmental incidents are appropriately investigated • ensuring appropriate enforcement mechanisms to prevent breaches of this EP are implemented • providing advice to ensure environmental incident reporting meets regulatory requirements (as outlined in the EP) and Santos' internal incident reporting and investigation procedure.
Senior Oil Spill Response Advisor	Has overall responsibility for: • providing upfront and ongoing guidance, framework and direction on preparation of the OPEP • developing and maintaining arrangements and contracts for incident response support from third parties • developing and defining objectives, strategies and tactical plans for response preparedness defined in the OPEP and the IRP • undertaking assurance activities on arrangements outlined within the OPEP.
Support Vessel Masters	Have 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 vessels 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.

8.6 Workforce Training and Competency

OPGGS(E)R 2023 Requirements
Regulation 22 (4)
The implementation strategy must include measures to ensure that each employee or contractor working on, or in connection with, the activity is aware of his or her responsibilities in relation to the environment plan, including during emergencies or potential emergencies, and has the appropriate competencies and training.

This section describes the mechanisms that will be in place so that each employee and contractor is aware of his or her responsibilities in relation to the EP Addendum and has appropriate training and competencies.

8.6.1 Inductions

All personnel that arrive on the facilities and crew on support vessels 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 (NOPSEMA regulations)
- operating environment (e.g., nearby protected marine areas, sensitive environmental periods)
- interaction with other marine users (i.e., topic to reinforce the importance of marine communications regarding any potential interactions with active commercial fishing)
- activities with highest risk (e.g., invasive marine species and hydrocarbon releases)
- EP commitments
- incident reporting and notifications
- regulatory compliance reporting
- 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 facilities or support vessels will complete relevant training and hold qualifications and certificates for their role. Santos and its contractors (e.g., support vessel, 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, desktop matrix, staff on-boarding processes, training departments, etc.

Personnel qualification and training records will be sampled before and/or during an activity. Such checks will be performed during the procurement process, facility acceptance testing, inductions, crew change, and operational inspections and audits.

8.6.3 Workforce Involvement and Stakeholder Communications

Daily operational meetings will be held offshore 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 preshift meetings.

Toolbox 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 on water, dropped objects).

8.7 Maintenance Management System

Santos uses a Computerised Maintenance Management System (CMMS) for offshore and onshore plant inspection. The planned maintenance management procedures are also supported by the Maintenance Management System. 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, Santos' Computer Maintenance Management System (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 Emergency Preparedness and Response

OPGGS(E)R 2023 Requirements
Regulation 22 (8)
The implementation strategy must contain an oil pollution emergency plan and provide for the updating of the plan.

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 emergency response plan, SMPEP or SOPEP) will be carried out on support vessels to refresh the crew in using equipment and implementing incident response procedures.

Santos will implement the Varanus Island Hub Oil Pollution Emergency Plan in the event of a hydrocarbon spill. The OPEP details how Santos will prepare and respond to a spill event and meets the requirement of Regulation (8).

8.9 Incident Reporting, Investigation and Follow Up

OPGGSR 2023 Requirements
Regulation 22 (7)
The implementation strategy must: a. state when the titleholder will report to the Regulator in relation to the titleholder's environmental performance for the activity, and b. provide that the interval between reports will not be more than 1 year. Note: Regulation 51 requires a titleholder to report on environmental performance in accordance with the timetable set out in the environment plan.
Regulation 22 (6)
The implementation strategy must provide for sufficient monitoring of, and maintaining a quantitative record of, emissions and discharges (whether occurring during normal operations or otherwise), such that the record can be used to assess whether the environmental performance outcomes and standards in the environment plan are being met.

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 will be documented in the incident management systems as appropriate. HSE incidents are investigated and reported in accordance with the Santos Incident Reporting, Investigation and Learning Procedure which uses root cause analysis.

Environmental recordable and reportable incidents will be reported to NOPSEMA as required, in accordance with Table 8-4. The incident reporting requirements will be provided to all crew on board the facilities and support vessels with special attention to the reporting time frames to provide for accurate and timely reporting.

For the purposes of this activity, in accordance with OPGGS(E) R 2023:

- A recordable incident, for an activity, means a breach of an environmental performance outcome or environmental performance standard, in the environment plan that applies to the activity, that is not a reportable incident.

- A reportable incident, for an activity, means an incident relating to the activity that has caused, or has the potential to cause, moderate to significant environmental damage.

For the purposes of this EP, a reportable incident is an incident that is assessed to have an environmental consequence of moderate or higher in accordance with the Santos environmental impact and risk assessment process outlined in Section 5. Of the planned and unplanned events assessed within this EP, the following were identified to have a potential consequence level of Moderate or higher if the event were to occur and would therefore be a reportable incident:

- introduction of IMS (major)
- marine fauna interaction (moderate)
- surface release of condensate from the John Brookes WHP (major)
- subsea release of condensate from a subsea pipeline (moderate)
- subsea release of condensate form wellheads.

8.10 Reporting and Notifications

OPGGSR 2023 Requirements
Regulation 22 (7)
The implementation strategy must: a. state when the titleholder will report to the Regulator in relation to the titleholder's environmental performance for the activity, and b. provide that the interval between reports will not be more than 1 year.
Regulation 22 (6)
The implementation strategy must provide for sufficient monitoring of, and maintaining a quantitative record of, emissions and discharges (whether occurring during normal operations or otherwise), such that the record can be used to assess whether the environmental performance outcomes and standards in the environment plan are being met.

8.10.1 Notifications and Compliance Reporting

Regulatory, other notification and compliance reporting requirements are summarised in Table 8-4

Santos

Table 8-4: Activity notification and reporting requirements

Requirement	Required Information	Timing	Type	Recipient
During the Activity				
OPGGS(E) Regulation 50 – Recordable Incidents NOPSEMA must be notified of a breach of an environmental performance outcome or standard, in the environment plan that applies to the activity that is not a reportable incident.	Complete NOPSEMA's Recordable Environmental Incident Monthly Report form.	The report must be submitted 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.	Written	NOPSEMA
OPGGS(E) Regulation 24(c), 47 and 48 – Reportable Incident NOPSEMA must be notified of any reportable incidents. For the purposes of Regulation 24(c), 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 2 hours after the first occurrence of a reportable incident, or if the incident was not detected at the time of the first occurrence, at the time of becoming aware of the reportable incident.	Oral	NOPSEMA
	A written record of the oral notification must be submitted. The written record is not required to include anything that was not included in the oral notification.	As soon as practicable after the oral notification.	Written	NOPSEMA NOPTA DMIRS
	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 • 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. • Consider reporting using NOPSEMA's Report of an Accident, Dangerous Occurrence or Environmental Incident form.	Must be submitted as soon as practicable, and in any case not later than 3 days after the first occurrence of the reportable incident unless NOPSEMA specifies otherwise. Same report to be submitted to NOPTA and DMIRS within seven days after giving the written report to NOPSEMA.	Written	NOPSEMA NOPTA DMIRS

Requirement	Required Information	Timing	Type	Recipient
OPGGS(E) Regulation 51 – Environmental Performance NOPSEMA must be notified of the environmental performance at the intervals provided for in the EP.	Report must contain sufficient information to determine whether or not environmental performance outcomes and standards in the EP have been met.	Annual performance report to be submitted to NOPSEMA annually from the date of acceptance of this EP.	Written	NOPSEMA
EPBC Act Part 13 Permit (Permit E2020-0173) Permit to install and operate bird deterrence equipment on unmanned wellhead platform 'John Brookes' 100 km offshore WA. DCCEEWE must be notified of compliance with the permit.	Compliance report must contain sufficient information to determine whether the conditions of the permit have been met and provide details and relative outcomes of the deterrent equipment installed over the preceding 12 months.	Within 3 months after every 12-month anniversary of the date of the permit.	Written	DCCEEW
Under the MoU between Santos and AMSA.	Titleholder agrees to notify AMSA of any marine pollution incident[5].	Within 2 hours of incident.	Oral	AMSA
	POLREP and SITREP available online (refer OPEP).	POLREP as requested by AMSA following verbal notification. SITREP as requested by AMSA within 24 hours of request.	Written	AMSA
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.	A fauna report will be submitted to DBCA within seven days to fauna@dbca.wa.gov.au.	Written	DBCA
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.	Not specified, however should include details of event and response actions being undertaken with the marine park.	So far as reasonably practicable prior to response action being written.	Not defined.	Director of National Parks
DPIRD 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

[5] *For clarity and consistency across Santos regulatory reporting requirements Santos will meet the requirement of reporting marine oil pollution by reporting oil spills assessed to have an environmental consequence of moderate or higher in accordance with Santos' environmental impact and risk assessment process outlined in Section 5.*

Requirement	Required Information	Timing	Type	Recipient
DCCEEW Any harm or mortality to EPBC Act-listed threatened marine fauna.	Notification of any harm or mortality to an EPBC listed species of marine fauna whether attributable to the activity or not.	Within 7 days to EPBC.permits@environment.gov.au.	Written	DCCEEW
DCCEEW Marine fauna sighting data.	Marine fauna sighting data recorded in the marine fauna sighting database.	Not later than 3 months of the end of the activity.	Written	DCCEEW
DCCEEW 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
DBCA Impacts to marine mammals or turtles in reserves.	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.	Within 48 hours.	Written	DBCA
DWER 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	DWER
DNP 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 operations (requested through consultation).	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 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.	So far as reasonably practicable prior to response action being written.	Oral and written	DNP
DoT All actual or impending MOP incidents that are in, or may impact,	Notification of actual or impending spillage, release or escape of oil or an oily mixture that is capable of	Within 2 hours.	Verbal	DoT

Requirement	Required Information	Timing	Type	Recipient
State waters resulting from an offshore petroleum activity.	causing loss of life, injury to a person or damage to the health of a person, property or the environment.			
DoT VI Hub OPEP	Provide DoT with an accepted copy of Revision 15 of the VI Hub OPEP once finalised.	As soon as practicable.	Written	DoT
WA Museum As requested during additional consultation.	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
City of Karratha As requested during consultation City of Karratha will be notified in the event of an emergency that may impact on the City's functions, interests or activities.	Santos will notify City of Karratha in the event of an emergency that may impact on the City's functions, interests or activities.	As soon as practicable.	Written .	City of Karratha
Wanparta Aboriginal Corporation (WAC): All actual or impending MOP incidents that are in, or may impact, WAC interests, 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	WAC
Recfishwest As requested during additional consultation	Activity notifications of commencement and cessation	Prior to commencement and upon completion of the activity	Written	Recfishwest

8.10.2 Monitoring and Recording of Emissions and Discharges

OPGGS(E)R 2023 Requirements
Regulation 34(e)
Includes an appropriate implementation strategy and monitoring, recording and reporting arrangements.
Regulation 22 (6)
The implementation strategy must provide for sufficient monitoring of, and maintaining a quantitative record of, emissions and discharges (whether occurring during normal operations or otherwise), such that the record can be used to assess whether the environmental performance outcomes and standards in the environment plan are being met.

Vessel-based discharges to the marine environment, associated with this activity will be recorded and controlled in accordance with requirements under relevant marine orders.

Santos and 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. Santos records discharges or emissions (where practicable), to the environment as described in Table 8-5. Monitoring of birds is described in Section 6.6.2.4.

Table 8-5: Emission and discharge monitoring

Discharge/Emission	Parameter	Record	Recording Frequency
Atmospheric emissions	GHG total volumes (carbon dioxide (CO2), methane (CH4) and nitrous oxide (N20))	Production Reporting System (PRS), estimated for NGERS reporting and put into and annual compliance report	Annually
Chemicals (discharged to marine environment as per Section 6.7)	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
Sewerage	Volume and location (support vessel)	Garbage Record Book	For every discharge
Unplanned discharge of solid waste	Volume	Incident report	For every discharge
Unplanned discharge of liquid hazardous materials	Volume	Incident report	For every discharge
Unplanned hydrocarbon release	Volume	Incident report	For every discharge

8.11 Document Management

8.11.1 Information Management and Document Control

This EP and OPEP, as well as approved management of change documents, are controlled documents; and current versions will be available on Santos' intranet. Santos' contractors are also required to maintain current versions of HSE documents including this EP and OPEP on their facilities.

Environmental performance outcomes 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.

8.11.2 Management of Change

Proposed changes to this EP and OPEP will be managed in accordance with Santos' Environment Management of Change Procedure, the 'MoC process'. 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 18, 19, 26(3) to (5), 38 and 39 of the OPGGS(E)R 2023 and determines if a proposed change can proceed and the manner in which it can proceed. The MoC procedure will determine whether a revision of the EP is required and whether that revision is to be submitted to NOPSEMA. For a change to proceed, the associated environmental impacts and risks must be demonstrated to be acceptable and ALARP. 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 for the assessment of new information that may become available after EP acceptance, such as new management plans for Australian marine parks, new recovery plans or conservation advice for species, and changes to the EPBC Protected Matters Search results. If a review identifies new information, this is treated as a “Change that has an impact on Environment Plan”, and the MoC process is followed accordingly.

The MoC procedure also includes an assurance check process which applies the MoC process to long term (usually five year multi-activity EPs) EPs that may have lengthy periods of time between use or acceptance and activity commencement. This helps Santos determine whether the activity will still comply with the EP and is still acceptable, or, if there are any changes to what is covered by the relevant EP. Where there is an identified change from the accepted EP content, a check is done to test the ‘significance’ of the change, to determine whether it can be accommodated which may then result in an MoC as described above.

Accepted MoCs become part of the in-force EP or OPEP and are tracked on a register and 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 persons identified in Table 8-3 (excluding the CEO and Directors), and the most relevant management position will be required to communicate the MoC to see it is implemented, which may include crew meetings, briefings and communications as appropriate for the change.

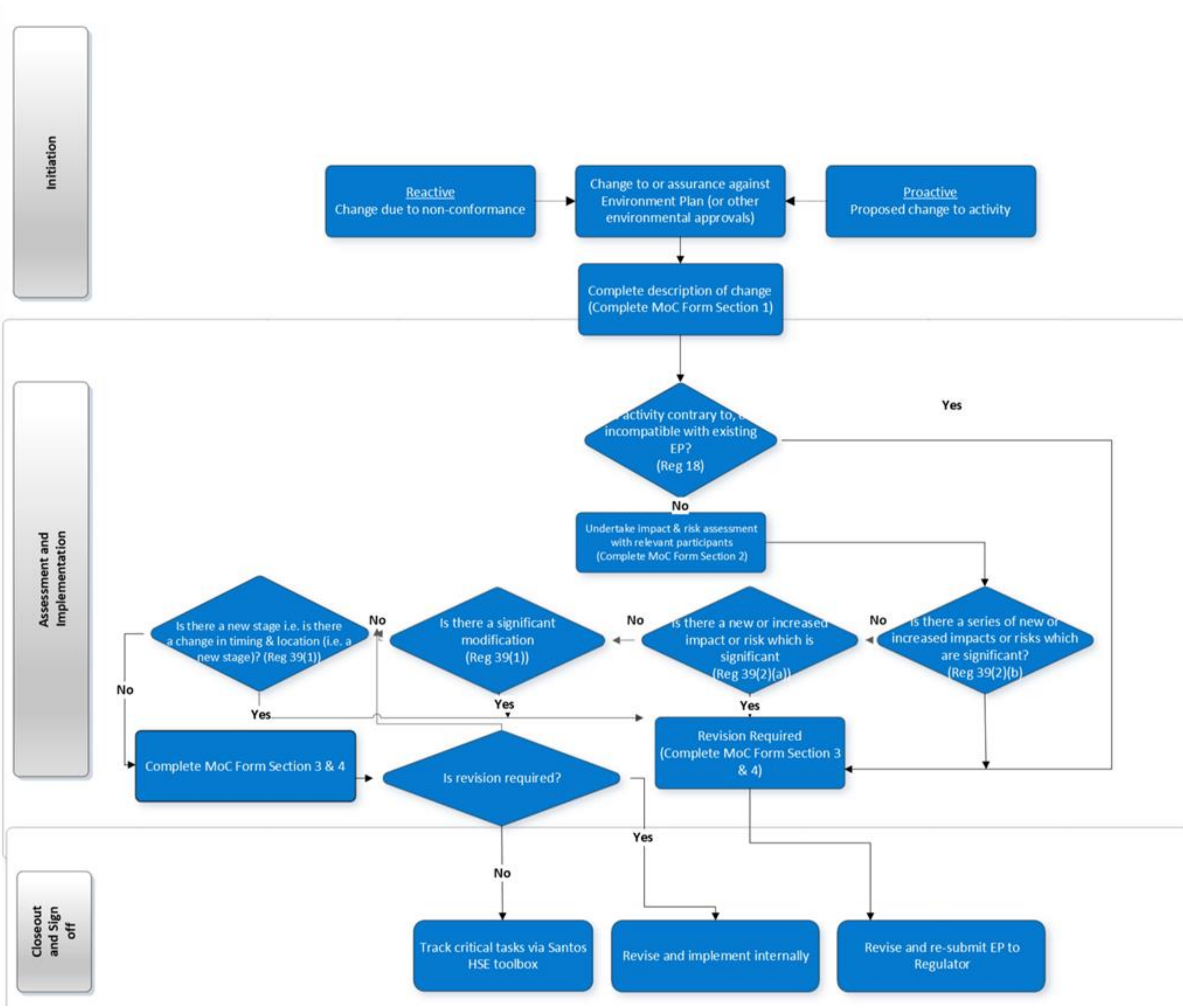


Figure 8-1: Environment management of change process

8.11.3 Reviews

This EP has assessed impacts and risk 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 aspects that may change over the validity of this EP are:

- legislation
- businesses conditions, activities, systems, processes and people
- industry practices
- science and technology
- societal and stakeholder expectations.
- To ensure Santos maintains up-to-date knowledge of the industry, legislation and conservation advice, the following tasks are undertaken:
- Maintain membership of AEP, which provides a mechanism for communicating potential changes in legislation, industry practice and other issues that may affect EP implementation to relevant personnel in Santos.
- Undertake annual spill response exercises to check spill response arrangements and capability are adequate.
- Identify stakeholders prior to any activity commencing under this EP via the mechanisms outlined in Section 4.2
- Review the values and sensitivities within the EMBA which includes completing a new EPBC Protected Matters Search, reviewing Appendix C against relevant legislation to capture and review any relevant updates and incorporate as required, and reviewing any recently known published relevant scientific papers.
- Subscribe to various regulator updates
- Hold regular liaison meetings with regulators.

Through maintenance of up-to-date knowledge (Section 8.11), 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 the Company's MoC procedure (Section 8.11.2).

8.12 Audits and Inspections

OPGGS(E)R 2023 Requirements
Regulation 22 (5)
The implementation strategy must provide for sufficient monitoring, recording, audit, management of nonconformance and review of the titleholder's environmental performance and the implementation strategy to ensure that the environmental performance outcomes and standards in the environment plan are being met.

8.12.1 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 in a manner consistent with Santos' Management Standard for Assurance SMS MS15.

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 8.12.3

8.12.2 Inspections

During an activity, frequent HSE inspections will be conducted to identify hazards, incidents and EP non-conformances. Santos representatives will be conducting EP compliance inspections throughout the activity to check compliance against all of the environmental performance outcomes 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 to Santos' relevant personnel (e.g., operations manager, Santos onboard representatives) and HSE Department representatives for review.

8.12.3 Non-conformance Management

EP non-conformances will be addressed and resolved by a systematic corrective action process as outlined in Santos' Management Standard for Assurance (MS15) and the Assurance Procedure (ST01). Non-conformances identified by audits and inspections will be entered into Santos' incident and action tracking management system (i.e., 'HSE Toolbox'). Once entered, corrective actions, time frames and responsible persons (including action owners and event validators) will be assigned. Corrective action 'close out' will be monitored using a management escalation process.

8.12.4 Continuous Improvement

For this EP, continuous improvement and may result in a review of the EP with changes applied in accordance with Section 8.11.2, and will be driven by:

- improvements identified from the review of business-level HSE key performance indicators
- actions arising from Santos' and departmental HSE improvement plans
- corrective actions and feedback from HSE audits and inspections, incident investigations and after-action reviews
- opportunities for improvement and changes identified through pre-activity reviews and management of change documents
- actions taken to address concerns and issues raised during the ongoing stakeholder consultation management process (Section 4)
- identified continuous improvement opportunities will be assessed in accordance with Santos' MoC process to ensure any potential changes to this EP, or OPEP, are managed in accordance with the OPGGS(E)R 2023 and in a controlled manner.

8.13 Post-acceptance Consultation Implementation Strategy

8.13.1 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.

8.13.1.1 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 has established or is currently in discussion on the establishment of consultation frameworks with four Pilbara PBCs that will provide for effective and regular engagement on proposed, planned, existing and completed activities. These PBCs, which have coastal interests from North West Cape to Dampier, are:

- Nganhurra Thanardi Garrbu Aboriginal Corporation (consultation framework discussions in progress)
- Buurabalayji Thalanyji Aboriginal Corporation (consultation framework finalised)
- Wirrawandi Aboriginal Corporation (consultation framework discussions in progress)
- Ngarluma Aboriginal Corporation (consultation framework discussions in progress).

8.13.1.2 Local Governments, 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 Exmouth, Shire of Ashburton and City of Karratha
- local industry – Exmouth Chamber of Commerce and Industry, Onslow Chamber of Commerce and Industry and Karratha and Districts Chamber of Commerce and Industry
- community groups – Exmouth Community Liaison Group, Shire of Ashburton Onslow Community Information Sessions.

This regional approach is complementary to Santos' existing and ongoing engagement of representative groups for other offshore marine user groups, including commercial fishing organisations.

8.13.2 Approach

Formal acceptance of the EP will be communicated via the NOPSEMA website. Santos will also provide access to the EP via the NOPSEMA website and will provide details on the Santos website on how to provide ongoing feedback.

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 provide quarterly updates on the activity to registered/subscribed interested parties.

Santos will apply the regional engagement model described in the previous section 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 apply continue to accept, assess and respond to post acceptance consultation feedback during the life of the activity. Records of any post acceptance consultation will be maintained in an appropriate Santos consultation database.

If, during the course of post acceptance consultation, Santos receives information demonstrating a new or increased environmental impact or risk that is not provided for in this EP, as in force at the time, Santos will apply its Management of Change process outlined in Section 8.11.2

Santos will maintain a database of relevant authorities, and other relevant interested persons and organisations for this activity. This includes updating its database in light of post acceptance consultation, including identification of new Relevant Persons.

9. References

AMOSC (2011). Oil Pollution Emergency Plan – Guidelines for the Australian Marine Petroleum Exploration and Production Industry. November 2011.

AMSA (2013a). Shipping fairways network. Data provided through consultation.

AMSA (2015). Technical Guideline for the Preparation of Marine Pollution Contingency Plans for Marine and Coastal Facilities. Accessed at [https://www.amsa.gov.au/sites/default/files/2015-04-np-gui012-contingency-planning.pdf].

APASA (2013a). Balnaves B20 Well: Quantitative Spill Risk Assessment. Prepared for Apache Energy Ltd. By Asia pacific Applied Science Associates. Perth. January 2013.

APASA (2013b). AEL Varanus Island Hub 2 Oil Spill Modelling Results – Scenario 9. Prepared for Apache Energy Ltd. By Asia pacific Applied Science Associates. Perth. August 2013.

APASA (2013c). AEL Varanus Island Hub 2 Oil Spill Modelling Results – Scenario 12B. Prepared for Apache Energy Ltd. By Asia pacific Applied Science Associates. Perth. August 2013.

APASA (2013d). AEL Varanus Island Hub 2 Oil Spill Modelling Results – Scenario 15. Prepared for Apache Energy Ltd. By Asia pacific Applied Science Associates. Perth. August 2013.

APASA (2013e). AEL Varanus Island Hub 2 Oil Spill Modelling Results – Scenario 23. Prepared for Apache Energy Ltd. By Asia pacific Applied Science Associates. Perth. August 2013.

APASA (2013f). East Spar Leak Scenario – Quantitative Oil Spill Risk Assessment. J0275. Prepared for Apache Energy Ltd. By Asia pacific Applied Science Associates. Perth. November 2013.

APASA (2014a). John Brookes Platform – Loss of Well Control, Oil Spill Risk Assessment. Prepared for Apache Energy Ltd. By Asia pacific Applied Science Associates. Perth. April 2014.

Aurand, D. and Coelho, G. (Editors). (2005). Cooperative Aquatic Toxicity Testing of Dispersed Oil and the 'Chemical Response to Oil Spills: Ecological Effects Research Forum.' Ecosystem Management & Associates, Inc., Lusby, MD. Technical Report 07-03, 105 pages + Appendices.

Baker, C., Potter, A., Tran, M. and Heap, A.D. (2008). Sedimentology and geomorphology of the northwest marine region: a spatial analysis (Geoscience Australia Record No. 2008/07). Geoscience Australia, Canberra.

Baker, B., Holdsworth, M., Finley, L. and Double, M. (2008) Seabird monitoring study at Coringa Herald National Nature Reserve. Report prepared for Department of the Environment, Water, Heritage & the Arts. Retrieved from Parks Australia: https://parksaustralia.gov.au/marine/pub/scientific-publications/archive/

coringa-herald-2007.pdf

Bartol, M.S. and Musick, J.A. (2003). Sensory biology of sea turtles. In: Lutz, P.L., Musick, J.A., Wyneken, J. (eds) Biology of sea turtles, Vol II. CRC Press, Boca Raton, FL, p. 79–102.

Bax, N., Williamson, A., Aguero, M., Gonzalez, E. and Geeves, W. (2003). Marine invasive alien species: a threat to global biodiversity. Marine Policy 27: 313–323.

BHPB (2005). Pyrenees Development: Draft EIS. BHP Billiton, Perth, Western Australia.

Braun, C.B. and Grande, T. (2008). Evolution of peripheral mechanisms for the enhancement of sound reception. In: Springer Handbook of Auditory Research. Fish Bioacoustics, Vol. 32 (ed. Popper, A. N., Fay, R. R. and Webb, J. F.), pp.99-144. New York: Springer-Verlag.

Cai, W. and Cowan, T. (2006). SAM and regional rainfall in IPCC AR4 models: Can anthropogenic forcing account for southwest Western Australian winter rainfall reduction? Geophysical Research Letters 33.

Carlile, N., Lloyd, C., Morris, R., Battam, H., Smith, L. (2017) Seabird Islands: Big Island, Five Islands Group, New South Wales. Corella 41: 57–62.

Chapman, C.C., Lea, M.A., Meyer, A., Sallée, J.B. and Hindell, M., 2020. Defining Southern Ocean fronts and their influence on biological and physical processes in a changing climate. Nature Climate Change, 10(3).

Church, J.A., Hunter, J.R., McInnes, K.L. and White, N.J. (2006). Sea-level rise around the Australian coastline and the changing frequency of extreme sea-level events. Australian Meteorological Magazine 55: 253–260.

Commonwealth of Australia (2021). National Inventory Report 2019. The Australian Government Submission to the United Nations Framework Convention on Climate Change.

Commonwealth of Australia (2020). Wildlife Conservation Plan for Seabirds. Department of Agriculture, Water and the Environment, Canberra.

Commonwealth of Australia (2017). Recovery plan for marine turtles in Australia 2017–2027. Department of the Environment and Energy, Canberra.

Commonwealth of Australia (2015). Conservation Management Plan for the blue whale: A recovery plan under the *Environment Protection and Biodiversity Conservation Act 1999* 2015–2025. Department of the Environment, Canberra.

Commonwealth Scientific and Industrial Research Organisation, n.d. Climate Change in Australia [WWW Document]. Climate Change in Australia. URL [https://www.climatechangeinaustralia.gov.au/en/] [Accessed 28-Mar-2022].

Commonwealth Scientific and Industrial Research Organisation (CSIRO), Bureau of Meteorology (2015). Climate change in Australia – information for Australia's natural resource management regions. CSIRO, Canberra.

Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Bureau of Meteorology, 2024. State of the Climate 2024. Australian Government.

DAFF (2011). Australian Ballast Water Management Requirements – Version 5. Viewed 26 March 2012, [http://www.daff.gov.au/aqis/avm/vessels/quarantine_concerns/ballast/australian-ballast-water-management-requirements.l].

DAFF (2017). Recovery Plan for Marine Turtles in Australia 2017–2027. Commonwealth of Australia. DoEE (2018). Threat Abatement Plan for the impact of marine debris on the vertebrate wildlife of Australia's coasts and oceans. Australian Government.

DAFF (2018). Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans. Australian Government.

Dai, A. (2013). Increasing drought under global warming in observations and models. Nature climate change 3: 52–58.

Dale, J., Gray, M., Popper, A., Rogers, P., and Block, B. (2015). Hearing thresholds of swimming Pacific bluefin tuna *Thunnus orientalis*. Journal of Comparative Physiology A, 1–14.

DBCA (2007). Management Plan for the Montebello/Barrow Islands Marine Conservation Reserves 2007–2017: Management Plan No. 55. Department of Environment and Conservation, Perth, Western Australia.

DBCA (2014a). Western Australian Oiled Wildlife Response Plan (WAOWRP). Prepared with the Australian Marine Oil Spill Centre (AMOSC).

DBCA (2014b). Pilbara Region, Oiled Wildlife Response Plan. Prepared with the Australian Marine Oil Spill Centre (AMOSC).

DBCA (2005). Management Plan for the Ningaloo Marine Park and Muiron Islands Marine Management Area 2005–2015. Management Plan No. 52. Department of Conservation and Land Management and Marine Parks and Reserves Authority, Perth, Western Australia.

DCCEEW (2024). National Recovery Plan for the Southern Right Whale *Eubalaena australis*.

DCCEEW (2023b). Australia's emissions projections 2023.

DCCEEW (2021). Guidance on key terms within the Blue Whale Conservation Management Plan.

DCCEEW (2012). National recovery plan of the red goshawk *Erythrotriorchis radiatus*. Department of Environment and Resource Management, Brisbane.

DCCEEW (2008a). The North-west Marine Bioregional Plan: Bioregional profile: A Description of the Ecosystems, Conservation Values and Uses of the North-West Marine Region. Department of the Environment Water, Heritage and the Arts, Canberra, ACT.

DCCEEW (2008b). Approved Conservation Advice for *Milyeringa veritas* (Blind Gudgeon). Canberra: Department of the Environment, Water, Heritage and the Arts. Available from: [http://www.environment.gov.au/biodiversity/threatened/species/pubs/66676-conservation-advice.pdf]. In effect under the EPBC Act from 26-Mar-2008.

DCCEEW(2008c). Approved Conservation Advice for *Ophisternon candidum* (Blind Cave Eel). Canberra: Department of the Environment, Water, Heritage and the Arts. Available from: [http://www.environment.gov.au/biodiversity/threatened/species/pubs/66678-conservation-advice.pdf]. In effect under the EPBC Act from 26-Mar-2008.

DCCEEW (2008d). Approved Conservation Advice for *Dermochelys coriacea* (Leatherback Turtle). Canberra: Department of the Environment, Water, Heritage and the Arts. Available from: [http://www.environment.gov.au/biodiversity/threatened/species/pubs/1768-conservation-advice.pdf]. In effect under the EPBC Act from 08-Jan-2009.

DCCEEW (2008e). Approved Conservation Advice for *Malurus leucopterus edouardi* (White-winged Fairy-wren (Barrow Island)). Canberra: Department of the Environment, Water, Heritage and the Arts. Available from: [http://www.environment.gov.au/biodiversity/threatened/species/pubs/26194-conservation-advice.pdf]. In effect under the EPBC Act from 03-Jul-2008.

DCCEEW (2008f). Approved Conservation Advice for *Malurus leucopterus* (White-winged Fairy-wren (Dirk Hartog Island)). Canberra: Department of the Environment, Water, Heritage and the Arts. Available from: [http://www.environment.gov.au/biodiversity/threatened/species/pubs/26004-conservation-advice.pdf]. In effect under the EPBC Act from 03-Jul-2008.

DCCEEW (2012). Conservation Management Plan for the Southern Right Whale - A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 2011 - 2021, Commonwealth of Australia, 2012.

DCCEEW(2013a). Recovery Plan for the White Shark (*Carcharodon carcharias*) 2013. Commonwealth of Australia.

DCCEEW (2013b). Recovery Plan for the Australian Sea Lion (*Neophoca cinerea*) 2013.

DCCEEW (2014a). Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) 2014. Commonwealth of Australia.

DCCEEW (2015a). Sawfish and River Sharks Multispecies Recovery Plan. Department of the Environment and Energy, Canberra.

DCCEEW (2015b). Conservation Management Plan for the Blue Whale—A Recovery Plan under the *Environment Protection and Biodiversity Conservation Act 1999*. Commonwealth of Australia.

DCCEEW (2015c). Conservation Advice *Calidris ferruginea* curlew sandpiper. Canberra: Department of the Environment. Available from: [http://www.environment.gov.au/biodiversity/threatened/species/pubs/856-conservation-advice.pdf]. In effect under the EPBC Act from 26-May-2015.

DCCEEW (2015d). Conservation Advice *Numenius madagascariensis* eastern curlew. Canberra: Department of the Environment. Available from: [http://www.environment.gov.au/biodiversity/threatened/species/ pubs/847-conservation-advice.pdf]. In effect under the EPBC Act from 26-May-2015.

DCCEEW (2015e). Wildlife Conservation Plan for Migratory Shorebirds. Canberra: Department of the Environment. Available from: [http://www.environment.gov.au/system/files/resources/9995c620-45c9-4574-af8e-a7cfb9571deb/files/widlife-conservation-plan-migratory-shorebirds.pdf].

DCCEEW (2011a). Approved Conservation Advice for *Aipysurus apraefrontalis* (Short-nosed Sea Snake). Canberra, ACT: Department of Sustainability, Environment, Water, Population and Communities. Available from: [http://www.environment.gov.au/biodiversity/threatened/species/pubs/1115-conservation-advice.pdf]. In effect under the EPBC Act from 15-Feb-2011.

DCCEEW (2011b). Approved Conservation Advice for *Aipysurus foliosquama* (Leaf-scaled Sea Snake). Canberra, ACT: Department of Sustainability, Environment, Water, Population and Communities. Available from: [http://www.environment.gov.au/biodiversity/threatened/species/pubs/1118-conservation-advice.pdf]. In effect under the EPBC Act from 15-Feb-2011.

DCCEEW (2022) National recovery plan for albatrosses and petrels Commonwealth of Australia, Hobart. Available from: https://www.dcceew.gov.au/sites/default/files/documents/national-recovery-plan-albatrosses-and-petrels-2022.pdf

DCCEEW (2011d). Approved Conservation Advice for *Sternula nereis* (Fairy Tern). Canberra, ACT: Department of Sustainability, Environment, Water, Population and Communities. Available from: [http://www.environment.gov.au/biodiversity/threatened/species/pubs/82950-conservation-advice.pdf]. In effect under the EPBC Act from 03-Mar-2011.

DCCEEW (2013). Approved Conservation Advice for *Rostratula australis* (Australian painted snipe). Canberra, ACT: Department of Sustainability, Environment, Water, Population and Communities. Available from: [http://www.environment.gov.au/biodiversity/threatened/species/pubs/77037-conservation-advice.pdf]. In effect under the EPBC Act from 03-May-2013.

del Hoyo, J., Elliot, A. and Sargatal, J. (1992) Handbook of the Birds of the World, Vol. 1: Ostrich to Ducks. Lynx Editions, Barcelona, Spain.

del Hoyo, J., Elliott, A., and Sargatal, J. (1996) Handbook of the Birds of the World, vol. 3: Hoatzin to Auks. Lynx Edicions, Barcelona, Spain.

DPIRD 2022. Fish Cube WA – Commercial Collector Component Public Cube. Department of Primary Industries and Regional Development.

Director of National Parks (2018). North-west Marine Parks Network Management Plan 2018, Director of National Parks, Canberra.

Double, M.C., Andrews-Goff, V., Jenner, K.C.S., Jenner, M.-N., Laverick, S.M., Branch, T.A. and Gales, N.J. (2014). Migratory movements of pygmy blue whales (*Balaenoptera musculus brevicauda*) between Australia and Indonesia as revealed by satellite telemetry. PloS one 9: e93578.

Duke, N.C., Kovacs, J.M., Griffiths, A.D., Preece, L., Hill, D.J., Van Oosterzee, P., Mackenzie, J., Morning, H.S. and Burrows, D. (2017). Large-scale dieback of mangroves in Australia's Gulf of Carpentaria: a severe ecosystem response, coincidental with an unusually extreme weather event. Marine and Freshwater Research 68: 1816–1829.

Dunlop, M., Hilbert, D.W., Ferrier, S., House, A., Liedhoff, A., Prober, S.M., Smyth, A., Martin, T.G., Harwood, T., Williams, K.J., Fletcher, C. and Murphy, H. (2012). The implications of climate change for biodiversity conservation and the National Reserve System: Final synthesis. CSIRO Climate Adaptation Flagship, Canberra.

Ecotox Services Australia (2009). Toxicity Assessment of Weathered and Un-Weathered Brecknock-2, Calliance-1 and Torosa-4 Condensate Samples. Test Report for Woodside Energy Ltd. June 2009.

EPA (2010). Environmental Assessment Guideline for Protecting Marine Turtles from Light Impacts. Environmental Assessment Guideline No. 5. Environmental Protection Authority Western Australia. November 2010.

Ferreira, L. C., Jenner, C., Jenner, M., Udyawer, V., Radford, B., Davenport, A., Moller, L., Andrews-Goff, V., Double, M., & Thums, M. (2024). Predicting suitable habitats for foraging and migration in Eastern Indian Ocean pygmy blue whales from satellite tracking data. *Movement Ecology, 12*(42). https://doi.org/10.1186/s40462-024-00481-x

Field, C.D. (1995). Impact of expected climate change on mangroves. Hydrobiologia 295: 75–81.

Finneran, J.J. (2015). Noise-induced hearing loss in marine mammals: A review of temporary threshold shift studies from 1996 to 2015. Journal of the Acoustical Society of America 138, 1702–1726. DOI: 10.1121/1.4927418.

Finneran, J.J. and Jenkins, A.K. (2012). Criteria and thresholds for U.S. Navy acoustic and explosive effects analysis. SSC Pacific, San Diego, CA, 60 pp.

French, D.P. (2000). Estimation of oil toxicity using an additive toxicity model. Proceedings of the 23rd Arctic and Marine Oil Spill Program Technical Seminar, June 2000, Vancouver, British Columbia, Canada (561–600).

French-McCay, D.P. (2002). Development and Application of an Oil Spill Toxicity and Exposure Model, OilToxEx. Environmental Toxicology and Chemistry 21(10): 2080-2094.

French-McCay, D. (2009). *State-of-the-art and research needs for oil spill impact assessment modeling*, in: Proceedings of the 32nd AMOP Technical Seminar on Environmental Contamination and Response. Presented at the 32nd AMOP Technical Seminar on Environmental Contamination and Response, Environment Canada, Ottawa, pp. 601–653.

Friedlingstein, P., Jones, M.W., O'Sullivan, M., Andrew, R.M., Hauck, J., Peters, G.P., Peters, W., Pongratz, J., Sitch, S., Le Quéré, C., Bakker, D.C., Canadell, J.G., Philippe, C., Jackson, R.B., Anthoni, P., Barbero, L., Bastos, A., Bastrikov, V., Becker, M., Bopp, L., Buitenhuis, E., Chandra, N., Chevallier, F., Chini, L.P., Currie, K.I., Feely, R.A., Gehlen, M., Gilfillan, D., Gkritzalis, T., Goll, D.S., Gruber, N., Gutekunst, S., Harris, I., Haverd, V., Houghton, R.A., Hurtt, G., Ilyina, T., Jain, A.K., Joetzjer, E., Kaplan, J.O., Kato, E., Klein Goldewijk, K., Korsbakken, J.I., Landschützer, P., Lauvset, S.K., Lefèvre, N., Lenton, A., Lienert, S., Lombardozzi, D., Marland, G., McGuire, P.C., Melton, J.R., Metzl, N., Munro, D.R., Nabel, J.E., Nakaoka, S.-I., Neill, C., Omar, A.M., Ono, T., Peregon, A., Pierrot, D., Poulter, B., Rehder, G., Resplandy, L., Robertson, E., Rödenbeck, C., Séférian, R., Schwinger, J., Smith, N., Tans, P.P., Tian, H., Tilbrook, B., Tubiello, F.N., Van der Werf, G.R., Wiltshire, A.J. and Zaehle, S. (2019). Global carbon budget 2019. Earth System Science Data 11: 1783–1838.

Geiling, N. (2014). *Arctic Shipping: Good for Invasive Species, Bad for the Rest of Nature*. Smithsonian. Available at: [http://www.smithsonianmag.com/science-nature/global-warmings-unexpectedconsequence-invasive-species-180951573/? no-ist] [Accessed 20/03/2017].

Geoscience Australia (2019). Gazetteer of Australia Place Name Search Database. Australian Government. Accessed 6 June 2019 from: [http://www.ga.gov.au/placename].

Gilmour, J., Speed, C.W. and Babcock, R. (2016). Coral reproduction in Western Australia. PeerJ 4: e2010. doi:10.7717/peerj.2010.

Haney, J.C., Lee, D.S. and Morris, R.D. (1999) Bridled Tern, Sterna anaethetus. (Charadriiformes: Laridae). In: Poole, A.; Gill (ed.), The Birds of North America, The Birds of North America, Inc., Philadelphia, PA.

Hazel, J. (2009). Turtles and Vessels: threat evaluation and behavioural studies of green turtles in near-shore foraging grounds. PhD thesis, James Cook University.

Heyward, A., Pinceratto, E. and Smith, L. (1997). Big bank shoals of the Timor Sea: an environmental resource atlas. Australian Institute of Marine Science, Melbourne. Higgins, P.J. and Davies, S.J.J.F. eds (1996) Handbook of Australian, New Zealand and Antarctic Birds. Volume Three – Snipe to Pigeons. Melbourne, Victoria: Oxford University Press.

Heyward, A., Jones, R., Meeuwig, J., Burns, K., Radford, B., Colquhoun, J., Cappo, M., Case, M., O'Leary, R., Fisher, R., Meekan, M. and Stowar, M. (2012). Montara: 2011 offshore banks assessment survey (Monitoring Study No. S5 Banks & Shoals). Australian Institute of Marine Science, Townsville, Queensland.

Heyward, A., Moore, C., Radford, B. and Colquhoun, J. (2010). Monitoring program for the Montara well release Timor Sea: final report on the nature of Barracouta and Vulcan shoals (Environmental Study No. S5). Australian Institute of Marine Science, Townsville, Queensland.

Heyward, A., Radford, B., Cappo, M., Case, M., Stowar, M., Colquhoun, J. and Cook, K. (2017a). Barossa Environmental Baseline Study, Regional Shoals and Shelf Assessment 2015 Final Report. Report prepared for ConocoPhillips Australia Pty Ltd., Perth, Western Australia.

Heyward, A., Wakeford, M., Cappo, M., Olsen, Y., Colquhoun, J., Radford, B., Case, M. and Stowar, M. (2017b). Applied Research Program – ARP7: Subtidal Benthos: towards benthic baselines in the Browse Basin, Final Report – Submerged Shoals 2017. Report prepared for Shell Australia Pty Ltd and INPEX, Perth, Western Australia.

Higgins, P.J. and S.J.J.F. Davies (eds) (1996) Handbook of Australian, New Zealand and Antarctic Birds. Volume 3: Snipe to Pigeons. Oxford University Press, Melbourne.

Hoegh-Guldberg, O., Jacob, D., Taylor, M., Bindi, M., Brown, S., Camilloni, I., Diedhiou, A., Djalante, R., Ebi, K.L., Engelbrecht, F., Guiot, J., Hijioka, Y., Mehrotra, S., Payne, A., Seneviratne, S., Thomas, A., Warren, R. and Guangsheng, Z. (2018). Impacts of 1.5 C global warming on natural and human systems, in: Global Warming of 1.5° C. An IPCC Special Report. Intergovernmental Panel on Climate Change, Geneva.

Hughes, L. (2003). Climate change and Australia: trends, projections and impacts. Austral Ecology 28: 423–443.

Hughes, L. (2011). Climate change and Australia: key vulnerable regions. Regional Environmental Change 11: 189–195.

Hughes, T.P., Kerry, J.T., Álvarez-Noriega, M., Álvarez-Romero, J.G., Anderson, K.D., Baird, A.H., Babcock, R.C., Beger, M., Bellwood, D.R. and Berkelmans, R. (2017). Global warming and recurrent mass bleaching of corals. Nature 543: 373–377.

International Energy Agency (IEA) (2021). Net Zero by 2050, A Roadmap for the Global Energy Sector. Accessed at: [https://www.iea.org/reports/net-zero-by-2050].

International Energy Agency (IEA) (2022). World Energy Outlook 2022. Accessed at: [https://iea.blob.core.windows.net/assets/830fe099-5530-48f2-a7c1-11f35d510983/WorldEnergyOutlook2022.pdf].

Intergovernmental Panel on Climate Change (IPCC), 2021. Climate Change 2021: The Physical Science Basis. International Panel on Climate Change. https://www.ipcc.ch/report/ar6/wg1.

Intergovernmental Panel on Climate Change (IPCC), 2023. AR6 Synthesis Report – Climate Change 2023.

Intertek Commodities (2014). John Brookes Condensate Crude Assay Number AU710-486/13. Report prepared on behalf of Apache Energy Ltd, Port Adelaide, South Australia.

ITOPF (2011). Oil tanker spill statistics 2011. [http://www.itopf.com/information-services/data-and-statistics/statistics/documents/STATSPACK2011.pdf] [Accessed 20 March 2012].

JASCO Applied Science (JASCO) (2016b). Potential Impacts of Underwater Noise from Operation of the Barossa FPSO Facility on Marine Fauna. Report prepared for Jacobs, Perth, Western Australia.

Jenner, K.C.S., Jenner, M-N.M. and McCabe, K.A. (2001). Geographical and temporal movements of humpback whales in Western Australian waters. APPEA Journal 41: 749-765.

Jensen, A.S. and Silber, G.K. (2003). Large whale ship strike database. U.S. Department of Commerce. National Oceanic and Atmospheric Administration. Technical Memorandum NMFS-OPR-25. pp.37.

Jensen, M.P., Allen, C.D., Eguchi, T., Bell, I.P., LaCasella, E.L., Hilton, W.A., Hof, C.A. and Dutton, P.H. (2018). Environmental warming and feminization of one of the largest sea turtle populations in the world. *Current Biology* 28: 154–159.

Koops, W., Jak, R.G. and van der Veen, D.P. (2004). Use of dispersants in oil spill response to minimise environmental damage to birds and aquatic organisms. Trondheim, Norway: Interspill 2004.

Ladich, F., and Popper, A. N. (2004). Parallel evolution in fish hearing organs. In: Evolution of the Vertebrate Auditory System, eds G. Manley, R. R. Fay, and A. N. Popper. New York, NY: Springer-Verlag. pp 95–127.

Laist, D.W., Knowlton, A.R., Mead, J.G., Collet, A.S. and Podesta, M. (2001). Collisions between ships and whales. Marine Mammal Science 17(1): 35–75. Last, P.R. and Stevens, J.D. (2009). Sharks and Rays of Australia (Second Edition). Collingwood, Victoria: CSIRO Publishing.

Leatherwood, S., Awbrey, F.T. and Thomas, A. (1982). Minke whale response to a transiting survey vessel. Report of the International Whaling Commission. 32: 795–802.

Lindquist, D.C., Shaw, R.F. and Hernandez Jr, F.J. (2005). Distribution patterns of larval and juvenile fishes at offshore petroleum platforms in the north central Gulf of Mexico. Estuarine, Coastal and Shelf Science 62: 655–665.

Longcore, T., and Rich, C. (2016). Artificial night lighting and protected lands: Ecological effects and management approaches. Natural Resource Report NPS/NRSS/NSNS/NRR—2016/1213. National Park Service, Fort Collins, Colorado.

Marquenie, J., Donners, M., Poot, H., Steckel, W. and de Wit, B. (2008). Adapting the spectral composition of artificial lighting to safeguard the environment. pp 1–6.

McCauley, R. (1998). Radiated underwater noise measured from the drilling rig Ocean General, rig tenders Pacific Ariki and Pacific Frontier, fishing vessel Reef Venture and natural sources in the Timor Sea, Northern Australia. (Report No. C98-20). Centre for Marine Science and Technology, Curtin University of Technology, Perth, Western Australia.

McCauley, R.D, Fewtrell, J., Duncan, A.J., Jenner, C., Jenner, M-N., Penrose, J.D., Prince, R.I.T., Adhitya, A., Murdoch, J., and McCabe, K. (2000). Marine Seismic Surveys – A Study of Environmental Implications, APPEA Journal, pp. 692–708.

McCauley, R.D., and Jenner, C.K. (2010). Migratory patterns and estimated population size of pygmy blue whales (*Balaenoptera musculus brevicauda*) traversing the Western Australian coast based on passive acoustics. Proc. 62nd IWC Annual Meeting, Agadir, Morocco, June 21–25, available at: ;http://iwcoffice.org/_documents/sci_com/SC62docs/SC-62-SH26.pdf] (Last viewed 6-Jan-11).

McCauley, R.D., and Jenner, C.K. (2010). 'Migratory patterns and estimated population size of pygmy blue whales (*Balaenoptera musculus brevicauda*) traversing the Western Australian coast based on passive acoustics'. *Proc. 62nd IWC Annual Meeting*. Agadir, Morocco, June 21-25.

McCauley, R.D. (2011). Woodside Kimberley sea noise logger program, Sept-2006 to June-2009: Whales, fish and man-made noise. Report produced for Woodside Energy Ltd, 86 pp.

McKinney, K. and Caplis, J. (2017). Evaluation of Oleophilic Skimmer Performance in Diminishing Oil Slick Thickness. Bureau of Safety and Environmental Enforcement. Sterling, VA, USA.

Meekan, M.G., Wilson, S.G., Halford, A. and Retzel, A. (2001). A comparison of catches of fishes and invertebrates by two light trap designs, in tropical NW Australia. Marine Biology 139: 373–381.

Milicich, M.J., Meekan, M.G. and Doherty, P.J. (1992). Larval supply: a good predictor of recruitment in three species of reef fish (Pomacentridae). Mar Ecol Prog Ser. 86: 153–166.

Mrosovsky, N., Ryan, G.D., and James, M.C. (2009). *Leatherback turtles: The menace of plastic*. Marine Pollution Bulletin 58: 287–289.

National Marine Fisheries Service (NMFS) (2001). Fisheries Statistics and Economics Division, Silver Spring, MD.

Neil, K.M., Hilliard, R.W., Clark, P., Russell, B., Clark, R. and Polglaze, J. (2005). Situation and Gaps Analysis of Introduced Marine Species, Vectors, Nodes and Management Arrangements for the Northern Planning Area, Report published by the National Oceans Office (Marine Division, Department of Environment and Heritage), Canberra.

NMFS (2018). Revisions to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Dept. of Commerce., NOAA. NOAA Technical Memorandum NMFS-OPR-59, 167 p.

National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) (2022). Section 572 Maintenance and removal of property. National Offshore Petroleum Safety and Environmental Management Authority. Commonwealth of Australia.

National Oceanic and Atmospheric Administration (NOAA) (2014). Oil Spills in Mangroves – Planning & Response Considerations. National Ocean Service, Office of Response and Restoration. September 2014.

NRDAMCME (1997). The CERCLA Type A Natural Resource Damage Assessment Model for Coastal and Marine Environments (NRDAMCME) Technical Documentation Vol 4, 14–42. [http://www/doi.gov/oepc/oepcbb.html].

NSW Marine Estate, 2024. NSW Government Website. [www.marine.nsw.gov.au]. [Accessed 18-Jul-2024].

Paulay, G., Kirkendale, L., Lambert, G. and Meyer, C. (2002). Anthropogenic biotic interchange in a coral reef ecosystem: A case study from Guam. Pacific Science 56(4): 403–422.

Pendoley Environmental. (2017). ConocoPhillips Barossa Project – Potential Impacts of Pipeline Installation Activities on Marine Turtles. Technical note prepared for CDM Smith, Perth, Western Australia.

Popper, A.N., Hawkins, A.D., Fay, R.R., Mann, D., Bartol, S., Carlson, Th., Coombs, S., Ellison, W.T., Gentry, R., Halvorsen, M.B., Lokkeborg, S., Rogers, P., Southall, B.L., Zeddies, D.G. and Tavolga, W.N. (2014). Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standard Committee S3/SC1 and registered with ANSI.

Ross, G.J.B., Weaver, K. and Greig, J.C. eds (1993). *The status of Australia's seabirds Proceedings of the National Seabird Workshop, Canberra, 1-2 November 1993*. Page(s) 73-137. Canberra: Biodiversity Group, Env. Aust.

Richardson, W.J. and Malme, C.I. (1993). Man-made noise and behavioural responses. In the bowhead whale. Edited by J.J. Burns, J.J Montague, and C.J Cowles. Spec. Publ. No. 2. Society for Marine Mammalogy, Lawrence, Kans. Pp. 631–700.

Richardson, W.J., Greene, C.R., Maime, C.I. and Thomson, D.H. (1995). Marine Mammals and Noise Academic Press, San Diego, California.

RPS (2010). Technical Appendix – Marine Mammals. Wheatstone Project EIS/ERMP. Unpublished report for Chevron Australia Pty Ltd, March 2010.

RPS (2019). Santos VI Hub QSRA. MAW0824J Santos VI Hub QSRA Rev 0. Unpublished report for Santos Energy Ltd, May 2019.

RPS (2021). Santos Spartan Oil Spill Modelling. Unpublished Report for Santos Ltd.

Salerno, J., Little, B., Lee, J., Ray, R., and Hamdan, L.J. (2016). Conserving archaeological sites as biological and historical resources in the Gulf of Mexico: the effects of crude oil and dispersant on the biodiversity and corrosion potential of shipwreck bacterial biofilms. American Geophysical Union's Ocean Sciences Meeting. New Orleans, February 22, 2016.

Salmon, M., Wyneken, J., Fritz, E. and Lucas, M. (1992). Sea finding by hatchling sea turtles: role of brightness, silhouette and beach slope orientation cues. Behaviour, 122.

Santos (2020). Santos Offshore – Impact Assessment of Bird Deterrent Systems at Offshore WHP on Seabirds. Santos Limited, Adelaide.

Santos (2024). Climate Report 2023. Santos Limited, Adelaide.

Scholten, M.C.Th., Kaag, N.H.B.M., Dokkum, H.P. van, Jak, R.G., Schobben, H.P.M. and Slob, W. (1996). Toxische effecten van olie in het aquatische milieu, TNO report TNO-MEP – R96/230. Den Helder, the Netherlands.

Shell Australia Pty Ltd (2019). Crux Offshore Project Proposal, Available online at: [https://www.nopsema.gov.au/assets/OPPs/A650135.pdf] [Accessed 5-6-2019].

Silber, K,G. and Bettridge, S. (2012). An assessment of the final rule to implement vessel speed restrictions to reduce the threat of vessel collisions with North Atlantic Right Whales. NOAA Technical Memorandum NMFS-OPR-48. February 2012.

Simmonds, M.P., Dolman, S.J. and Weilgart, L. (eds) (2004). Oceans of Noise [Online]. [http://www.wdcs.org/submissions_bin/OceansofNoise.pdf]. AWDCS Science Report Published by the Whale and Dolphin Conservation Society.

Snow, D.W. and Perrins, C.M. (1998) The Birds of the Western Palearctic, Volume 1: Non-Passerines. Oxford University Press, Oxford.

Solomon, S., Manning, M., Marquis, M. and Qin, D. (2007). Climate change 2007 – the physical science basis: Working group I contribution to the fourth assessment report of the IPCC. Cambridge University Press.

Southall, B.L., Bowles, A.E., Ellison, W.T., Finneran, J.J., Gentry, R.L., Greene Jr, C.R., Kastak, D., Ketten, D.R., Miller, J.H., Nachtigall, P.E., Richardson, W.J., Thomas, J.A. and Tyak, P.L. (2007). Marine mammal noise exposure criteria: initial scientific recommendations. Aquatic Mammals, vol. 33, no. 4, pp. 411–521.

Spalding, M.D., Brown, B.E., 2015. Warm-water coral reefs and climate change. Science 350: 769–771.

Steffen, W., Burbidge, A.A., Hughes, L., Kitching, R., Lindenmayer, D., Musgrave, W., Stafford, M. and Werner, P.A. (2009). Australia' biodiversity and climate change: A strategic assessment of the vulnerability of Australia's biodiversity to climate change. CSIRO, Canberra.

Surman, C.A. and Wooller R.D. (2003) Comparative foraging ecology of five sympatric terns at a sub-tropical island in the eastern Indian Ocean. Journal of Zoology 259: 219–230.

Threatened Species Scientific Committee (2014). Conservation Advice *Phaethon lepturus fulvus* white-tailed tropicbird (Christmas Island). Threatened Species Scientific Committee, Canberra.

Threatened Species Scientific Committee (2015a). Conservation Advice *Rhincodon typus* whale shark. Canberra: Department of the Environment. Available from: [http://www.environment.gov.au/biodiversity/ threatened/species/pubs/66680-conservation-advice-01102015.pdf. In effect under the EPBC Act from 01-Oct-2015.

Threatened Species Scientific Committee (2015b). Conservation Advice *Balaenoptera physalus* fin whale. Canberra: Department of the Environment. Available from: [http://www.environment.gov.au/biodiversity/threatened/species/pubs/37-conservation-advice-01102015.pdf]. In effect under the EPBC Act from 01-Oct-2015.

Threatened Species Scientific Committee (2015c). Conservation Advice *Balaenoptera borealis* sei whale. Canberra: Department of the Environment. Available from: [http://www.environment.gov.au/biodiversity/threatened/species/pubs/34-conservation-advice-01102015.pdf]. In effect under the EPBC Act from 01-Oct-2015.

Threatened Species Scientific Committee (2015d). Conservation Advice *Megaptera novaeangliae* humpback whale. Canberra: Department of the Environment. Available from: [http://www.environment.gov.au/biodiversity/threatened/species/pubs/38-conservation-advice-10102015.pdf]. In effect under the EPBC Act from 01-Oct-2015.

Threatened Species Scientific Committee (2015e). Conservation Advice *Anous tenuirostris melanops* Australian lesser noddy. Canberra: Department of the Environment. Available from: [http://www.environment.gov.au/biodiversity/threatened/species/pubs/26000-conservation-advice-01102015.pdf]. In effect under the EPBC Act from 01-Oct-2015.

Threatened Species Scientific Committee (2015e). Conservation Advice *Pterodroma mollis* soft-plumaged petrel. Canberra: Department of the Environment. Available from: [http://www.environment.gov.au/biodiversity/threatened/species/pubs/1036-conservation-advice-01102015.pdf]. In effect under the EPBC Act from 01-Oct-2015.

Threatened Species Scientific Committee (2015gf). Conservation Advice *Papasula abbotti* Abbott's booby. Canberra: Department of the Environment. Available from: [http://www.environment.gov.au/biodiversity/threatened/species/pubs/59297-conservation-advice-01102015.pdf]. In effect under the EPBC Act from 01-Oct-2015.

Threatened Species Scientific Committee (2016a). Conservation Advice *Calidris canutus* red knot. Canberra: Department of the Environment. Available from: [http://www.environment.gov.au/biodiversity/ threatened/species/pubs/855-conservation-advice-05052016.pdf]. In effect under the EPBC Act from 05-May-2016.

Threatened Species Scientific Committee (2016b). Conservation Advice *Calidris tenuirostris* great knot. Threatened Species Scientific Committee, Canberra.

Threatened Species Scientific Committee (2016c). Conservation Advice *Limosa lapponica baueri* Bar-tailed godwit (western Alaskan). Canberra: Department of the Environment. Available from: [http://www.environment.gov.au/biodiversity/threatened/species/pubs/86380-conservation-advice-05052016.pdf]. In effect under the EPBC Act from 05-May-2016.

Threatened Species Scientific Committee (2016d). Conservation Advice *Limosa lapponica menzbieri* Bar-tailed godwit (northern Siberian). Canberra: Department of the Environment. Available from: [http://www.environment.gov.au/biodiversity/threatened/species/pubs/86432-conservation-advice-05052016.pdf]. In effect under the EPBC Act from 05-May-2016.

Threatened Species Scientific Committee (2016e). Conservation Advice *Fregata andrewsi* Christmas Island frigatebird. Canberra: Department of the Environment. Available from: [http://www.environment.gov.au/biodiversity/threatened/species/pubs/1011-conservation-advice-07122016.pdf]. In effect under the EPBC Act from 07-Dec-2016.

Threatened Species Scientific Committee (2016f). Conservation Advice *Pezoporus occidentalis* night parrot. Canberra: Department of the Environment. Available from: [http://www.environment.gov.au/biodiversity/threatened/species/pubs/59350-conservation-advice-15072016.pdf]. In effect under the EPBC Act from 15-Jul-2016.

Thums, M., C. Ferreira, L., Jenner, C., Jenner, M., Harris, D., Davenport, A., Andrews-Goff, V., Double, M., Möller, L., Attard, C.R.M., Bilgmann, K., G. Thomson, P., McCauley, R., 2022. Pygmy blue whale movement, distribution and important areas in the Eastern Indian Ocean. Global Ecology and Conservation 35, e02054. https://doi.org/10.1016/j.gecco.2022.e02054

Tourism Western Australia (2014) Visitor Fact Sheets – Tourism Regional Level. Available at [http://www.tourism.wa.gov.au/Research_and_Reports/Regional_Fact_Sheets/Pages/Regional_Fact_Sheets.aspx] [Accessed April 2014].

Urban, E.K., Fry, C.H. and Keith, S. (1986) The Birds of Africa, Volume II. Academic Press, London.

URS (2010). Benthic Primary Producer (Seagrass and Macroalgae) Habitats of the Wheatstone Project Area. Report to Chevron Australia Pty Ltd by URS Australia Pty Ltd, Perth, Report R1442.

WAFIC (2016). Western Australia Fishing Industry Council Incorporated. Available at: [http://www.wafic.org.au/region/west-coast/] [Accessed August 2016].

Walker, D.I and McComb, A.J. (1990). Salinity response of the seagrass *Amphibolus antarctica*: an experimental validation of field results. Aquatic Botany 36: 359–366.

WDCS (2004). Oceans of Noise. Whale and Dolphin Conservation Society (Online). Available from: [http:www.wdcs.org/stop/pollution/index.php].

Wells, F.E., McDonald, J.I. and Huisman, J.M. (2009). Introduced marine species in Western Australia. Published by the Department of Fisheries, Perth, WA.

Whittock, P.A., Pendoley, K.L. and Hamann, M. (2016). Flexible foraging: Post-nesting flatback turtles on the Australian continental shelf. Journal of Experimental Marine Biology and Ecology 477: 112–119.

Wood, J., Southall, B.L. and Tollit, D.J. (2012). PG&E Offshore 3 D Seismic Survey Project EIR-Marine Mammal Technical Draft Report. SMRU Ltd.

Woodside (2011). Browse LNG Development Draft Upstream Environmental Impact Statement. EPBC Referral 2008/4111, November 2011.

Woodside (2012). NOPSEMA Rosebud 3D Marine Seismic Survey Environment Plan Summary, October 2012.

Xodus (2022). Spartan Development LCA. Report prepared for Santos Ltd.

Appendix A Santos' Environmental Management Policy

Environment, Health & Safety

Santos

Policy

Our Commitment

Santos is committed to being the safest gas company wherever we have a presence and preventing harm to people and the environment

Our Actions

We will:

1. Integrate environment, health and safety management requirements into the way we work
2. Comply with all relevant environmental, health and safety laws and continuously improve our management systems
3. Include environmental, health and safety considerations in business planning, decision making and asset management processes
4. Identify, control and monitor risks that have the potential for harm to people and the environment, so far as is reasonably practicable
5. Report, investigate and learn from our incidents
6. Consult and communicate with, and promote the participation of all workers to maintain a strong environment, health and safety culture
7. Empower our people, regardless of position, to "Stop the Job" when they feel it necessary to prevent harm to themselves, others or the environment
8. Work proactively and collaboratively with our stakeholders and the communities in which we operate
9. Set, measure, review and monitor objectives and targets to demonstrate proactive processes are in place to reduce the risk of harm to people and the environment
10. Report publicly on our environmental, health and safety performance

Governance

The Environment Health Safety and Sustainability Committee is responsible for reviewing the effectiveness of this policy.

This policy will be reviewed at appropriate intervals and revised when necessary to keep it current.

Kevin Gallagher

Managing Director & CEO

Status: APPROVED

Document Owner:	David Banks, Chief Operating Officer		
Approved by:	The Board	Version:	3

15 August 2022 Page 1 of 1

Appendix B Legislative Framework

Australian 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	There are no known sites of Aboriginal Heritage Significance within the operational area or EMBA. This Act would only apply to the activity if there was a discovery of Aboriginal remains, which is not considered likely to occur given the offshore location of the activity.	N/A
Australian Ballast Water Requirements, Version 7	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 invasive marine species
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 three national heritage places found on the National Heritage List, within the EMBA, as identified by the Act.	Section 3.2.3- Protected/significant areas
Australian Maritime Safety Authority Act 1990 (AMSA Act)	This Act specifies that the Australian Maritime Safety Authority's (AMSA) 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 Order in	Yes	AMSA	This Act applies to the use of any vessel associated with operations, and is relevant to the activity in regards to the unplanned pollution from ships.	Section 7.9– Hydrocarbon release (vessel collision) Section 7.7 – Hydrocarbon spill from a ruptured flowline as a result of dropped object

Commonwealth Legislation	Summary	Relevant to activity?	Administering Authority	Relevant Aspects of the activity	EP Section
	Commonwealth waters. This Act 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 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.				
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 invasive marine species (IMS). This Act was considered during development of the Santos IMS Management Zone (IMSMZ) and IMS Management Plan (EA-00-RI-10172).	Section 7.1 – Introduction of invasive marine species
Marine Orders	Marine Orders (MO) 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 6 and 7 – planned and unplanned events

Commonwealth Legislation	Summary	Relevant to activity?	Administering Authority	Relevant Aspects of the activity	EP Section
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.	No	The Department of Immigration and Border Protection	This Act applies to the shipwrecks (over 75 years old) within the EMBA. There is no planned interaction or interference with shipwrecks, and any unplanned impacts is only expected to affect the surface waters.	N/A
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 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.	Yes	Commonwealth – Department of Agriculture and Water Resources	This Act applies to all internationally sources vessels operating in Australian Waters which could have the potential for the introduction of IMS and potential ballast water exchange.	Section 7.1– Introduction of IMS
Corporations Act 2001	This Act is the principal legislation regulating matters of Australian companies, such as the formation and	Yes	Commonwealth – Australian Securities and Investments Commission	The titleholder has provided ACN details within the meaning of the Act.	Section1

Commonwealth Legislation	Summary	Relevant to activity?	Administering Authority	Relevant Aspects of the activity	EP Section
	operation of companies, duties of officers, takeovers and fundraising.				
Environment Protection and Biodiversity Conservation Act 1999 Environment Protection and Biodiversity Conservation Amendment Regulations 2006	The National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) is the sole assessor for offshore petroleum activities in Commonwealth water (as of 28 February 2014). Under the new arrangements, environmental protection will be met through NOPSEMA's decision-making processes. This Act is the Australian Government's key piece of environmental legislation. The Act focuses on the protection of matters of national environmental significance (MNES). Australian Marine Park Management Plans were also developed under this Act.	Yes	Commonwealth – Department of Environment and Energy	This Act applies to all aspects of the activity that have the potential to impact MNES. Appropriate environmental approvals will be sought from NOPSEMA for all operations (this EP) which outlines compliance with the relevant regulations and plans under the Act. Where activities have existing approvals under the Act, these will continue to apply.	Section 6.2– Light emissions Section 6.1– Noise emissions Section 6.7– Planned operational discharges Section 7.7 and 7.9: Hydrocarbon release (vessel collision and pipeline rupture) Section 7.2– Marine fauna collisions
Historic Shipwrecks Act 1976 Historic Shipwrecks Regulations 1978	This Act protects shipwrecks that have lain in territorial waters for 75 years or more. It is an offence to interfere with any shipwreck covered by the Act. This Act is no longer in effect as it has been replaced by the Underwater Cultural Heritage Act 2018 (refer to the row below for details).	No	Commonwealth – Department of Environment and Energy	This Act applies to the shipwrecks (over 75 years old) within the EMBA. There is no planned interaction or interference with shipwrecks, and any unplanned impacts is only expected to affect the surface waters.	Section 7.7 – Hydrocarbon release (pipeline rupture)
Underwater Cultural Heritage Act 2018	This Act extends protection provided under the Historic Shipwrecks Act 1976 to other wrecks such as submerged aircraft and human remains. It also increases penalties	Yes	Commonwealth – Department of Environment and Energy	No planned interaction or interference to shipwrecks. Potential impact could be due to a hydrocarbon spill but the credible spill is to surface, and	Sections 7.6 through 7.9 – Unplanned hydrocarbon spills

Commonwealth Legislation	Summary	Relevant to activity?	Administering Authority	Relevant Aspects of the activity	EP Section
	applicable to damaged sites. The Act came into effect on 1 July 2019.			therefore shipwrecks are highly unlikely to be impacted. Twelve shipwrecks identified within EMBA.	
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 Environment and Energy Climate Change Authority	This Act applies to the atmospheric emissions through combustion engine use to operate the vessels associated with the activity. Implementation of the Act will reduce the impact of GHG emissions associated with vessel use for the installation and commissioning activity, through compliance with MARPOL Annex VI (Marine Order Part 97: Marine Pollution Prevention – Air Pollution), and require the use of low sulphur fuel.	Section 6.4– Atmospheric emissions Section 6.3 – Greenhouse gas 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 and Regional Development	Implementation of this Act reduces the impact of GHG emissions associated with vessel use for the installation and commissioning activity, through compliance with MARPOL Annex VI (Marine Order Part 97 - Marine Pollution Prevention – Air Pollution), and require the use of low sulphur fuel.	Section 6.4 – Atmospheric emissions Section 6.3 – Greenhouse gas emissions
Marine Safety (Domestic Commercial Vessel) National Law Act 2012	This Act is a single regulatory framework for the certification, construction, equipment, design and operation of domestic commercial vessels inside Australia's exclusive economic zone.	Yes	Commonwealth – Australian Maritime Safety Authority (AMSA)	All vessel movements associated with the activity will be governed by AMSA marine safety regulations under the Act.	Section **Error! Reference source not found.**- Interaction with other marine users Section 7.9 – Surface release of diesel (vessel collision/bunkering)
Navigation Act 2012	An act regulating navigation and shipping including Safety of Life at Sea (SOLAS). A number of Marine Orders enacted under this	Yes	AMSA (operational) Department of Infrastructure and Regional Development	All vessel movements associated with the activity will be governed by marine safety regulations	Section **Error! Reference source not found.** – Interaction with other marine users

Commonwealth Legislation	Summary	Relevant to activity?	Administering Authority	Relevant Aspects of the activity	EP Section
	Act apply directly to offshore petroleum exploration and production activities: Marine Order - Part 21: Safety of navigation and emergency procedures Marine Order - Part 30: Prevention of collisions Marine Order - Part 70: Seafarers Certification.		Minister for Infrastructure and Regional Development	and marine orders under the Act.	Section 7.7 – Hydrocarbon spill from a ruptured flowline as a result of dropped objects
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". Specific environmental provisions relating to work practices essentially require operators to control and prevent the escape of wastes and petroleum. The Act also requires that activities are carried out in a manner that does not unduly interfere with other rights or interests, including the conservation of the resources of the sea and seabed, such as fishing or shipping. In some cases, where there are particular environmental sensitivities or multiple use issues it may be necessary to apply special conditions to an exploration permit area. The holder of a petroleum title must maintain adequate	Yes	NOPSEMA	The activity involves undertaking installation and commissioning subsea equipment, which is a petroleum activity regulated by NOPSEMA under this Act.	Section 6– Risk assessments for planned events Section 7– Risk assessments for unplanned events

Commonwealth Legislation	Summary	Relevant to activity?	Administering Authority	Relevant Aspects of the activity	EP Section
	insurance against expenses or liabilities arising from activities in the title, including expenses relating to clean-up or other remedying of the effects of the escape of petroleum. The OPGGS Environment Regulations provide an objective based regime for the management of environmental performance for Australian offshore petroleum exploration and production activities in areas of Commonwealth jurisdiction. Key objectives of the Environment Regulations include to: ensure operations are carried out in a way that is consistent with the principles of ecologically sustainable development adopt best practice to achieve agreed environment protection standards in industry operations encourage industry to continuously improve its environmental performance.				
Ozone Protection and Synthetic Greenhouse Gas Management Act 1989	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 Environment and Energy	The activity does not include import, export or manufacture activities of ODS. This Act applies where ODS is found on vessel refrigeration systems; however, this is a rare occurrence.	Section 6.4– Atmospheric emissions Section 6.3 – Greenhouse gas emissions
Protection of the Sea (Powers of Intervention) Act 1981 Protection of the Sea (Powers of	The Act authorises the Commonwealth to take measures for the purpose of protecting the sea from pollution by oil and other noxious substances	Yes	Commonwealth – Department of Infrastructure and Regional Development	This Act applies to vessel discharges and movements associated with the activity. The Act is relevant to the extent that Santos will comply	Section **Error! Reference source not found.** – Interaction with other marine users Section 7.7– Hydrocarbon spill from a ruptured

Commonwealth Legislation	Summary	Relevant to activity?	Administering Authority	Relevant Aspects of the activity	EP Section
Intervention) Regulations 1983	discharged from ships and provides legal immunity for persons acting under an AMSA direction.			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 - Part 91: Marine Pollution Prevention – Oil Marine Order - Part 93: Marine Pollution Prevention – Noxious Liquid Substances Marine Order - Part 95: Marine Pollution Prevention – Garbage Marine Order - Part 96: Marine Pollution Prevention – Sewage Marine Order - Part 98: Marine Pollution – Anti-fouling Systems.	flowline as a result of dropped object
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 - Part 91: Marine Pollution Prevention – Oil Marine Order - Part 93: Marine Pollution Prevention – Noxious Liquid Substances	Yes	Commonwealth – Department of Infrastructure and Regional Development	This Act applies to vessel discharges and movements associated with the activity. The Act is 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 - Part 91: Marine Pollution Prevention – Oil Marine Order - Part 93: Marine Pollution Prevention – Noxious Liquid Substances Marine Order - Part 95: Marine Pollution	Section 7.7– Hydrocarbon spill from a ruptured flowline as a result of dropped object

Commonwealth Legislation	Summary	Relevant to activity?	Administering Authority	Relevant Aspects of the activity	EP Section
	Marine Order - Part 94: Marine Pollution Prevention – Harmful Substances in Packaged Forms Marine Order - Part 95: Marine Pollution Prevention – Garbage Marine Order - Part 96: Marine Pollution Prevention – Sewage Marine Order - Part 97: Marine Pollution Prevention – Air Pollution Marine Order - Part 98: Marine Pollution – Anti-fouling Systems.			Prevention – Garbage Marine Order - Part 96: Marine Pollution Prevention – Sewage Marine Order - Part 98: Marine Pollution – Anti-fouling Systems.	
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	AMSA	This Act applies to diesel refuelling which will be undertaken at sea as part of the activity. Compliance with the Act reduces the risk of bunker oil pollution.	Section 7.9 (vessel collision)
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 ant-fouling paints used on ships.	Yes	Commonwealth, Department of Infrastructure and Regional Development and AMSA	This Act applies to vessel movements in Australian Waters associated with the activity. Vessels are required to have biofouling systems in place to prevent introduction of IMS/harmful impact on Australian biodiversity.	Section 7.1– Introduction of IMS
State Legislation					
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 and associated regulations.	Yes	Department of Primary Industries and Regional Development (DPIRD)	Introduction of invasive marine species.	Section 7.1– Introduction of IMS

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, grey water, and putrescible wastes generated from support vessels and MODU. Deck drainage/deck wash-down, cooling, brine, ballast and bilge water from support vessels. Hydraulic fluid released by valve operation on subsea infrastructure. Various discharges from planned maintenance activities.	Section 6.7– operational discharges
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 or JAMBA)	This agreement recognises the special international concern for the protection of migratory birds and birds in danger of extinction that migrate between Australia and Japan. Implemented in EPBC Act 1999.	Yes	Only relevant in so far as the credible spill scenario may result in impact to migratory seabirds foraging in area.	Section 7.6, to 7.9– 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 or CAMBA)	This agreement recognises the special international concern for the protection of migratory birds and birds in danger of extinction that migrate between Australia and China. Implemented in EPBC Act 1999.	Yes	Only relevant in so far as the credible spill scenario may result in impact to migratory seabirds foraging in area.	Section 7.6 to 7.9– 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.	**Section 6.1–** Acoustic disturbance to marine fauna Section 6.2-Light emissions Section 6.5– Seabed and benthic habitat disturbance Section 7.2 – Interaction with marine fauna Section 7.3 to 7.9– Unplanned hydrocarbon and non-hydrocarbon/ chemical spills

International Agreements and Conventions	Summary	Relevant to Activity?	Relevant Aspects	EP Section
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 worse-case credible spill scenarios may enact a national arrangement for response.	Sections 7.6 to 7.9– 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.	Section 7.6 to 7.9 – 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 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 six Annexes, dealing respectively with oil, noxious liquid substances, harmful packaged substances, sewage, garbage and air pollution. Detailed rules are laid out as to the extent to which (if at all) such substances can be released in different sea areas. The legislation giving effect to MARPOL in Australia is the Protection of the Sea (Prevention of Pollution from Ships) Act 1983, the Navigation Act 2012 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.	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 **Error! Reference source not found.**– Interaction with other marine users

International Agreements and Conventions	Summary	Relevant to Activity?	Relevant Aspects	EP Section
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 IMO has been addressing the problem of invasive marine species in ship's 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 8th September 2017 (IMO 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 IMO Guidelines.	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 invasive marine species
United Nations Convention on the Law of the Sea (UNCLOS) (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 to 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	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 Orders - Part 91: Marine Pollution Prevention – Oil Marine Orders - Part 93: Marine Pollution Prevention – Noxious Liquid Substances Marine Orders - Part 95: Marine Pollution Prevention – Garbage	United Nations Convention on the Law of the Sea (UNCLOS) (1982)

International Agreements and Conventions	Summary	Relevant to Activity?	Relevant Aspects	EP Section
	of the Convention in 1982, and UNCLOS in 1994.		Marine Orders - Part 96: Marine Pollution Prevention – Sewage Marine Orders - Part 97: Marine Pollution Prevention – Air Pollution Marine Orders - Part 98: Marine Pollution - Anti-fouling Systems	
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 to the extent that to reduce impact of GHG emissions associated with vessel use, Santos will comply with MARPOL Annex VI (Marine Orders Part 97: Marine Pollution Prevention – Air Pollution) and require the use of low sulphur fuel. The MODU and support vessels will use diesel, which is a low sulphur fuel.	United Nations Framework Convention on Climate Change (1992)

Appendix C Santos' Values and Sensitivities of the Western Australian Marine Environment

VARANUS ISLAND HUB OPERATIONS (COMMONWEALTH WATERS) VALUES AND SENSITIVITIES OF THE MARINE AND COASTAL ENVIRONMENT

October 2024

Table of contents

Tables

Figures

1. Introduction

1.1. Overview

The operation of the VI Hub in Commonwealth waters has been managed under the Varanus Island Hub Operations Environment Plan for Commonwealth Waters (Cwth) (VI Hub Operations EP) (John Brookes, Greater East Spar and Associated Facilities) (EA-66-RI-10003) accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) on 11 September 2014. The EP was revised (five yearly revision) in August 2019 in accordance with Regulation 19 of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS(E)R 2009) and accepted by NOPSEMA in July 2020. The EP was then revised in accordance with Regulation 17(5) of the OPGGS(E)R 2009 to incorporate the operations associated with the single well Spartan gas field, that was tied-back to the John Brookes wellhead platform (WHP) via a single flexible flowline and umbilical. The latest update (June 2024) incorporates the operations associated with the Halyard-2 well (replaces Halyard -1), that will be tied into the existing Greater East Spar (GES) infrastructure.

This document supports the VI Hub Operations EP and describes the existing environment that may be affected (EMBA) by the activity and includes details of the relevant values and sensitivities of the environment, as required by the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS (E) Regulations).

Section 3.1 of the VI Hub Operations 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 VI Hub Operations EP (Document No. EA-60-RI-10003), stated values in the Marine Bioregional Plans (DSEWPaC, 2012a,b) and information obtained through consultation. Marine and coastal species identified in the protected matters report (Appendix D of the VI Hub Operations 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 activities will occur in Petroleum Production Licences WA-63-L, WA-29-L, WA-45-L and WA-13-L approximately 127 km northwest of Karratha. The water depth in the operational area ranges between approximately 45 m and 115 m.

The EMBA is located entirely within Western Australian coastal waters and is located within the North-West Marine Region (NWMR) and Southwest Marine Region (SWMR). Other IMCRA 4.0 bioregions of interest include: Christmas Island Province.

Based on the Integrated Marine and Coastal Regionalisation of Australia (IMCRA) Version 4.0 spatial framework, there are eleven provincial-scale bioregions that occur within the EMBA. These 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 Bioregions. The bioregions within the EMBA are **(Figure 1)**:

- Northwest Shelf Province
- Northwest Province
- Northwest Transition
- Timor Province

- Central Western Transition
- Central Western Shelf Transition
- Central Western Shelf Province
- Northwest Shelf Transition
- Christmas Island Province
- Southwest Shelf Transition; and
- Central Western Province.

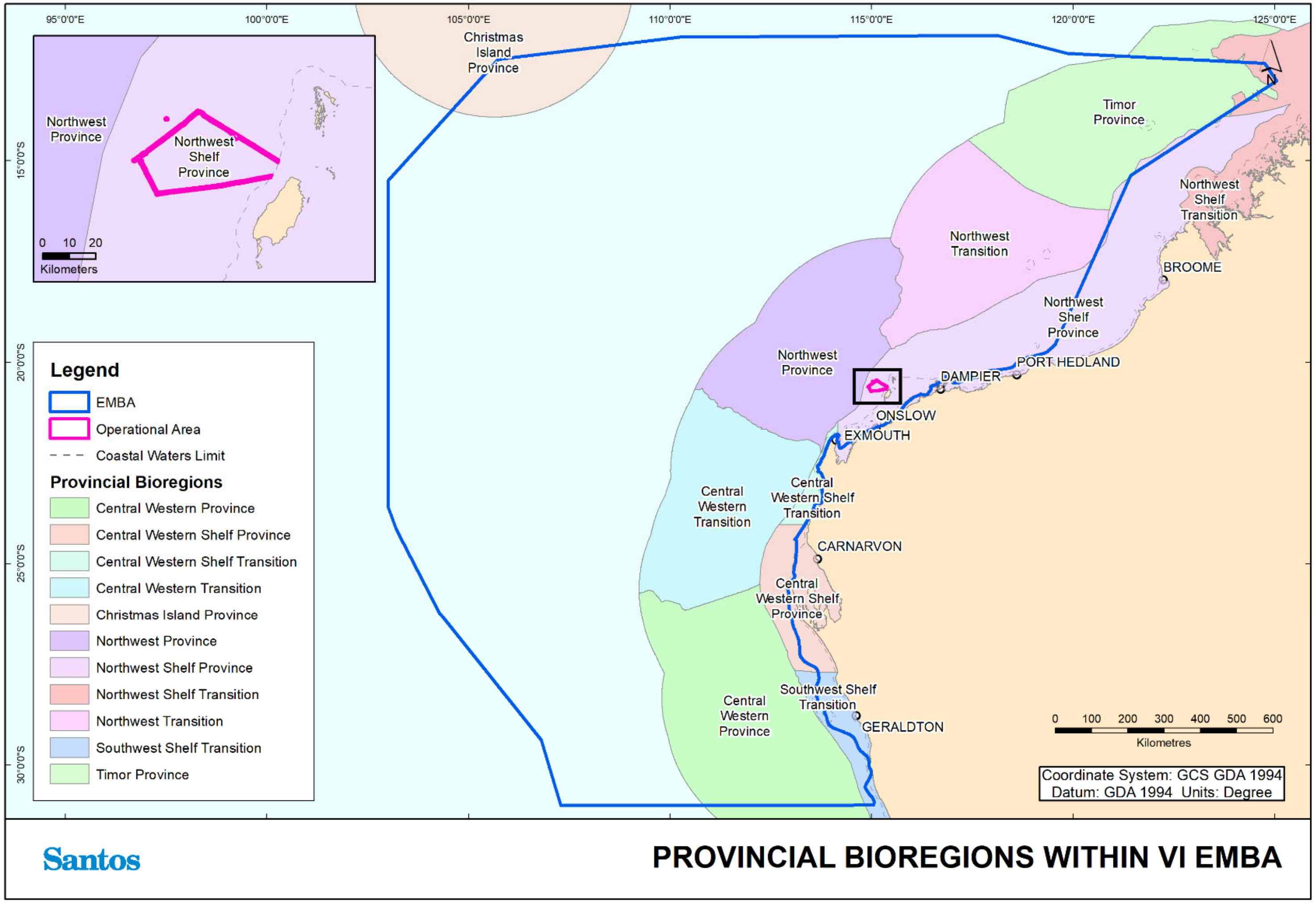


Figure 1: IMCRA 4.0 Provincial Bioregions within the EMBA

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 consists of five major landform features: continental shelf, continental slope, continental rise, Exmouth plateau and abyssal plain. Most of the area consists of either continental shelf or continental slope (DEWHA 2008a).

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).

An important characteristic of the EMBA is the significant narrowing of the continental shelf around North West Cape from the broad continental shelf in the north. At North West Cape the shelf is only 7 km wide – the narrowest of anywhere on the Australian continental margin (DEWHA 2008a). Shelf width affects oceanography with flow on effects to productivity and ecosystem functioning.

Several geomorphic formations within the EMBA have been associated with Key Ecological Features (DEWHA 2008a) and these are discussed in **Section 10**.

2.1.3. Southwest Shelf Transition

This bioregion consists of a narrow continental shelf, ranging from approximately 40-80 km wide that is noted for its physical complexity. It includes a series of nearshore ridges and depressions that form inshore lagoons, a smooth inner shelf plain, a series of offshore ridges and a steep, narrow outer shelf. The near-shore ridges are formed by eroded limestone reefs and pinnacles that stand 10-20 m above the sea floor. The edge of the inner shelf plain is marked by a series of broken offshore ridges that extend north to the northern limits of the bioregion, where they emerge to support the tropical carbonate reef growth of the Houtman Abrolhos Islands (DEWHA, 2008b).

2.1.4. Central Western Province

This bioregion is characterised by a narrow continental slope that is heavily incised by many submarine canyons as far north as Kalbarri. The Perth Canyon, formed by erosive processes associated with the ancient Swan River, cuts into the continental shelf at approximately the 150 m depth contour, north-east of Rottnest Island. Other relatively large canyons, such as the Murchison Canyon, occur in the bioregion but little is known about them as they have not yet been studied (DEWHA, 2008b).

The bioregion contains the most extensive area (52,185 km^2) of continental rise on the Australian margin. The continental rise is located on the edge of the Perth Abyssal Plain (103,911 km^2). There is a large terrace known as the Carnarvon Terrace on the continental slope, extending north from the Houtman Abrolhos Islands at an average of 780 m water depth (DEWHA 2008b).

2.1.5. Central Western Shelf Province

This bioregion is located on the Dirk Hartog Shelf and is generally very flat. It varies in width from less than 20 km in the north to around 125 km in the vicinity of Shark Bay. A small area of reef and tidal sand waves or sandbanks occur at the entrance to Shark Bay and within its vicinity. Other topographic features of the bioregion include a deep hole and associated area of banks and shoals offshore of Kalbarri. The banks and shoals in this bioregion are of note because they occur at latitudes significantly south of banks and shoals elsewhere in the North-west Marine Region (DEWHA, 2008a).

2.1.6. Central Western Transition

The Central Western Transition is characterised by large areas of continental slope, with sediments dominated by muds and sands that decrease in grain size with increasing depth. The slope is incised by numerous topographic features such as terraces (i.e. the Carnarvon Terrace), canyons (i.e. Cloates Canyon and Carnarvon Canyon) and rises. A large part of the bioregion consists of the Cuvier Abyssal Plain. The Wallaby Saddle is another important feature of this bioregion, and it is the most extensive area of this type of topographic feature in the North-west Marine Region (DEWHA, 2008a).

2.1.7. Central Western Shelf Transition

The Central Western Shelf Transition is located entirely on the continental shelf and is comprised mainly of sandy sediments. The close proximity of the coast to the shelf break is a significant feature of this bioregion and is an important factor in determining its biodiversity (DEWHA, 2008a).

Ningaloo Reef is the most significant geomorphic feature in the bioregion. It extends south of North West Cape along the Cape Range Peninsula, and stretches for over 260 km. It is the only example in the world of an extensive fringing coral reef on the west coast of a continent (DEWHA, 2008a).

2.1.8. Northwest Province

The bioregion occurs entirely on the continental slope and is comprised of muddy sediments. It is distinguished by a number of topographic features, such as the Exmouth Plateau, terraces, and canyons (including the Swan and Cape Range canyons), as well as deep holes and valleys on the inner slope. The Montebello Trough occurs on the eastern side of the Exmouth Plateau and represents more than 90 per cent of the area of troughs in the North-west Marine Region. Significantly, this bioregion contains the steepest shelf break of the North-west Marine Region, along the Cape Range Peninsula near Ningaloo Reef (DEWHA, 2008a).

2.1.9. Northwest Transition

The majority (52 %) of the Northwest Transition bioregion occurs on the continental slope, with smaller areas in the north-west of the bioregion located on the Argo Abyssal Plain and continental rise. The sediments of the slope are dominated by sands, whereas the sediments of the abyssal plain/deep ocean floor are dominated by muds. More than 60 % of the Argo Abyssal Plain occurs within this bioregion and much of the Northwest transition occurs in water over 4,000 m deep (DEWHA, 2008a).

Other topographic features within the bioregion include areas of rise, ridges, canyons and apron/fans. The bioregion also has reefs such as Mermaid, Clerke and Imperieuse reefs, which are collectively known as the Rowley Shoals (DEWHA, 2008a).

2.1.10. 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).

2.1.11. Northwest Shelf Transition

The Northwest Shelf Transition is predominantly located on the continental shelf with a small portion extending onto the continental slope causing waters in the area to be relatively shallow, only up to 330 m. It also consists of geomorphic features that are unique to the Northwest Shelf Transition and not found elsewhere in the North-west Marine Region (DEWHA, 2008a). An example of this is that 90 % of the Region's carbonate banks are located within the Northwest Shelf Transition (DEWHA, 2008a).

The Bonaparte Depression lies within the Northwest Shelf Transition, which is a 45 000 km^2 geomorphic basin that is the only occurrence of its type in the North-west Marine Region (DEWHA, 2008a). The Bonaparte Depression is a relatively flat feature with a higher content of mud and gravel than what is found elsewhere in the Northwest Shelf Transition, and it has a number of pinnacles of which form the key ecological feature 'pinnacles of the Bonaparte Basin.

2.1.12. Timor Province

The Timor Province is located on the continental slope. The notable topographical features include the Scott Plateau, the Ashmore Terrace and part of the Rowley Terrace and Argo Abyssal Plain (DEWHA, 2008a). Of these, the Scott Plateau is particularly significant with water depths of up to 3,000 m and being fringed by spurs and valleys (DEWHA, 2008a). The Scott Plateau is also separated from Rowley Terrace by canyons that are up to 50 million years old (DEWHA, 2008a).

The Timor Province encompasses almost half of the reefs in the North-west Marine Region, including Scott Reef and Seringapatam Reef within the EMBA (DEWHA 2008a).

2.1.13. Christmas Island Province

This bioregion contains the 4th largest abyssal plain/deep ocean floor area and smallest area of slope of all the National Benthic Marine Bioregionalisation (NBMB) bioregions (DEH, 2005a). Christmas Island is an uplifted limestone island. It is relatively stable despite active uplift (Brewer et al., 2009). Due to the similar geomorphology and location adjacent to Indonesia in the tropical Indian Ocean, the fauna contained in this bioregion is probably similar or related to the fauna associated with the Cocos (Keeling) Island bioregion.

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 17°C in winter to a maximum of 34°C in summer (BoM, 2024a). Due to the arid climate, daytime visibility in the area is generally greater than 5 nautical miles (SSE 1991).

The Northwest Marine Region typically experiences low annual rainfall, with Barrow Island (the nearest weather station to Varanus Island) recording a mean annual rainfall of 268 mm (BoM, 2024a). Heavy rainfall events are becoming more intense across northern Australia, particularly short-duration, extreme rainfall events, which have increased by 10% or more in some regions since the 1970s (Commonwealth of Australia, 2022).

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

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).

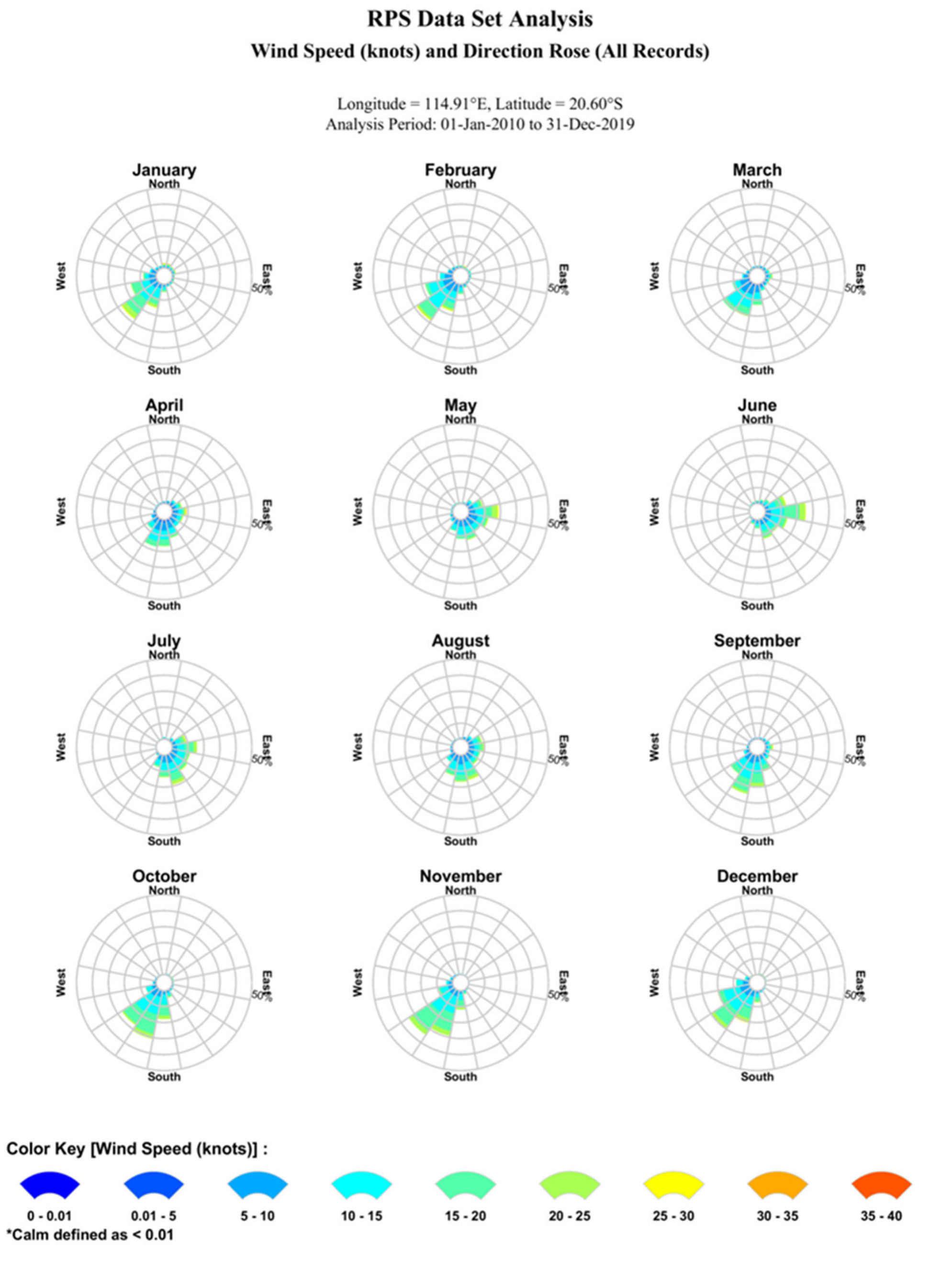


Figure 2:Monthly wind rose distributions derived from 2010-2019 (RPS, 2023)

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. . The NWS and Pilbara coast (within the NWMR) experiences more cyclonic activity than any other region of the Australian mainland coast (BoM, 2024b). Tropical cyclone activity typically occurs between November and April and is most frequent in the region during December to March (i.e. considered the peak period), with an average of about one cyclone per month (BoM, 2024b). There has been a decrease in the number of tropical cyclones observed in the Australian region since at least 1982. Climate change is projected to further reduce the frequency of tropical cyclones, though the proportion of high-intensity cyclones is expected to increase (Commonwealth of Australia, 2022).

Waters in the southwest and southern Western Australia experience a Mediterranean style climate that is characterised by cool, wet winters and hot, dry summers. In winter, wind patterns are characterised by a prevailing westerly wind stream. This enables winter cold fronts and strong westerly winds to regularly penetrate the south-west, with cold fronts crossing the coast every week or so. Apart from the passage of storms, typically lasting one day or less, the weather is otherwise mild in winter with winds variable and relatively weak. In summer, cold fronts rarely penetrate into the south of the state with any strength and hot easterly winds prevail.

The Bonaparte Basin and Timor Sea region in the north has a tropical climate. These areas experience a distinct 'wet' season with summer monsoonal conditions from October to March and a distinct 'dry' season with cooler and drier conditions from April to September. The wet season usually comprises south-westerly winds capable of generating thunderstorm activity, high rainfall and cyclones. The dry season usually comprises dry and warm conditions with little rainfall (Fugro, 2015).

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 formation of meanders and eddies are also a feature of the Leeuwin Current and a number of eddies occur south of Shark Bay (DEWHA 2008a). The strength of the Leeuwin Current is influenced by seasonal variability in the pressure gradient (DEWHA 2008a). These eddies and variations in the current contribute to localised upwellings, which can enhance nutrient availability and biological productivity in the region (Add relevant ref to NWM Bioregional Plan). These processes are particularly significant in areas such as Ningaloo Reef and the adjacent Commonwealth waters, where interactions between the Leeuwin and Ningaloo currents create zones of enhanced productivity, further supporting marine biodiversity (Department of Sustainability Environment and Water, 2012 b) 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 brings warm, low-salinity water from the Pacific into the Indian Ocean. Seasonal winds and cyclones enhance productivity by mixing deeper, nutrient-rich waters with surface waters, supporting ecological processes in the region (Department of Sustainability Environment and Water, 2012 a). (**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). Recent studies indicate that the Indonesian throughflow plays a critical role in the global ocean circulation, affecting not only local marine ecosystems but also broader climate patterns. As the climate continues to warm, these currents are expected to undergo further changes, impacting the transport of heat and nutrients in marine environments (Commonwealth of Australia, 2022). Ocean temperatures across Australia have warmed by more than 1°C since 1900, with marine heatwaves becoming more frequent and lasting longer, particularly off southern and western Australia (Commonwealth of Australia, 2022).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). In the North Marine Region, tidal flows play a dominant role in water movement, with oceanographic currents like the Indonesian Throughflow having a minor seasonal influence (Department of Sustainability Environment and Water, 2012 b).   Large-scale currents of the Timor and Arafura seas in the north are dominated by the Indonesian Throughflow. Christmas and Cocos (Keeling) Islands territories are located in the eastern Indian Ocean, in the path of the South Equatorial Current that carries the Indonesian Throughflow waters into the Indian Ocean. During summer, monsoon winds are highly influential in driving water movement and water column mixing (O'Hara 2023).

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).

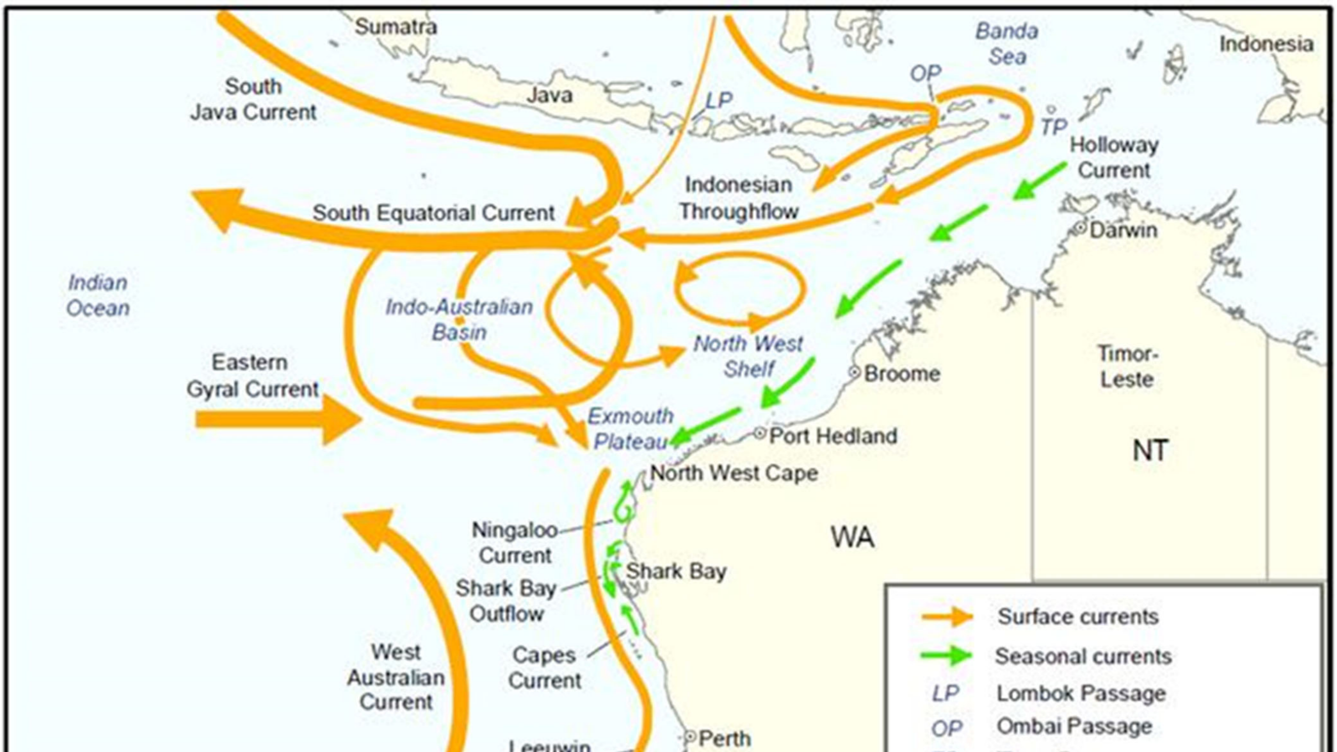
Tides in the area are generally semi-diurnal (i.e. two high tides and two low tides per day) with a spring/neap cycle. Mid-shelf tidal currents are predicted to have average speeds of approximately 0.25 knots during neap tides and up to 0.5 knots during spring tides (NSR 1995, WNI 1995).

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). Cyclones and tropical storms can greatly increase wave heights by up to 8 m in the outer Timor Sea during the cyclone season (Przeslawski et al. 2011).

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 the NT and WA

3. Benthic and Pelagic Habitats

Benthic habitats are defined as those subtidal habitats lying below the lowest astronomical tide (LAT). The benthic habitats within waters in the EMBA lie at depths ranging from LAT down to more than 6,000 m at Argo and Cuvier abyssal plains (DEWHA 2008a, 2008b).

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 coastal waters of the southwest 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 18 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).

The waters in the EMBA contain extensive coral communities. 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.

Three bioregions (Northwest Province, Central Western Province and Central Western Transition) lie in deep waters below the photic zone. Photosynthetic corals are not present in these locations and hence these bioregions are not discussed further.

3.1.1. Southwest Shelf Transition

The coral reefs of the Houtman Abrolhos Islands are the most southern extensive coral community along the west coast. Smaller localised pockets do occur as far south as Rottnest Island and even extend to Cape Naturaliste in the Southwest Shelf Province. The reefs around the Abrolhos Islands comprise 211 known species of corals and all but two of the coral species are tropical (Department of Fisheries (DoF) 2012). The greatest diversity and density of corals is found on the reef slopes, shallow reef perimeters and lagoon patch reefs in the more sheltered northern and eastern sides of each of the three limestone platforms that support the island groups (DoF 2012).

3.1.2. Central Western Shelf Province

The Central Western Shelf Province occurs on the continental shelf between Coral Bay and Busselton and is generally flat with depths ranging from 0–100 m. The province includes Shark Bay and Bernier, Dorre and Dirk Hartog Islands.

Studies at Shark Bay recorded 80 species of coral (Marsh 1990). The study determined that salinity and seasonal temperature gradients restrict the distribution of corals to areas that have normal salinity in the western half of the Bay, a few species occur in the metahaline waters but none in the hyper saline areas (Marsh 1990). The eastern shores of Bernier, Dorre and Dirk Hartog Islands provide the most favourable habitats for coral growth due to shelter, and water with relatively small salinity and temperature fluctuations. Some sections of these islands support prolific coral growth (up to 100% cover) both in the sheltered leeward and exposed areas. This bioregion is a transitional zone between the predominantly tropical flora and fauna of the north and temperate flora and fauna further south (CALM & NPNCA 1996).

3.1.3. Central Western Shelf Transition

A significant proportion of this bioregion is covered by the Ningaloo Reef. The Ningaloo Reef is unique in that it is the largest fringing reef in Australia and is the only large reef found on the western side of a continent in the southern hemisphere.

A 300 km section of the coast, from Red Bluff to North West Cape and extending to Bundegi in Exmouth Gulf, is included in the Ningaloo Marine Park. Ningaloo Reef supports variable lagoonal, intertidal and subtidal coral communities along its length. Ningaloo Reef is characterised by a high diversity of hard corals with at least 217 species representing 54 genera of hermatypic (reef building) corals recorded to date (Veron & Marsh 1988). The most diverse coral communities are found in the shallow relatively clear water, high energy environment of the fringing barrier reef and low energy lagoonal areas to the west of North West Cape (CALM & MPRA 2005a).

Coral diversity reduces with increasing depth, and corals are uncommon at depths greater than 40 m (Waples & Hollander 2008). At depths between 20 and 30 m hard corals have been found to be more dominant in the northern areas of the Ningaloo Marine Park, whereas in southern areas other sessile invertebrates such as sponges, are more prevalent (Waples & Hollander 2008).

3.1.4. Northwest Transition

This bioregion lies mostly over the continental slope and the abyssal plain in deep waters that preclude photosynthetic coral growth (DEWHA 2008a). However, in contrast with the surrounding area, the Rowley Shoals are three distinct reef systems (Mermaid, Clerke and Imperieuse Reefs) approximately 30–40 km apart that rise vertically to the surface from depths of between 500 and 700 m. The marine reef fauna of the Rowley Shoals is considered to be exceptionally rich and diverse, including species typical of the oceanic coral reef communities of the Indo-West Pacific. As many of these species are not found in the inshore tropical waters of northern Australia, such populations are of regional significance (DEWHA 2008a).

A 1993 survey at Mermaid Reef recorded 214 species of scleractinian corals (Done et al. 1994) which is comparable to a more recent survey recording 211 species, including 22 new distribution records (McKinney 2009). The Rowley Shoals system has maintained high coral cover and has not been impacted by mass bleaching, despite neighbouring bleaching events reported at Scott reef during 1998 and 2016 (Gilmour et al*., 2021*). Since 1997, mean coral cover has increased through periods of impact and recovery from cyclones, reaching the highest (71%) on record in 2017 (Gilmour et al. 2019). The survey found that coral assemblages of the Rowley Shoals are broadly comparable to those found on the reefs of the outer Great Barrier Reef and in the Coral Sea. While the coral fauna is similar to Scott Reef, it differs considerably from that of north-western Australia (Veron 1986). Veron (1986) notes that the clear water of the Rowley Shoals allows coral communities to exist over a great range of depths, while the strong wave action on the outer coral slopes and the wide tidal range result in distinct patterns of zonation.

Recent genetic studies have also shown distinct genetic differences between offshore reef systems, the inshore macrotidal Kimberley region and Ningaloo Coast World Heritage Area reefs (Adam et al. 2022, Gilmour et al. 2016, Underwood 2009, Underwood et al. 2020). This is likely a result of their isolation, with negligible supply of larva from other reefs (Adam et al. 2022, Thomas et al. 2017). These studies highlight the importance of local recruitment in offshore reef systems in order to maintain healthy coral populations, which may reduce their capacity to adapt to rapid environmental change.

3.1.5. 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. 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.

3.1.6. Timor Province

Although water depths in this province are generally deep (200 m to almost 6,000 m) there are several reefs and islands that are regarded as biodiversity hotspots (DEWHA 2008a).

Ashmore Reef, Cartier Island, Hibernia, Scott and Seringapatam Reefs are areas of enhanced local biological productivity, within an area of relatively unproductive waters. Ashmore Reef National Nature Reserve supports one of the greatest number of coral species of any reef off the West Australian coast, with 255 species of reef-building corals in 56 genera (Veron 1993). Taxonomic revisions and additional surveys have resulted in a net increase in species numbers to 275 (Griffith 1997, Ceccarelli et al. 2011). Species are typical of the Indo-pacific region and none are unique or considered endemic. However, 41 species (15% of the total hard coral species at the site) are listed as vulnerable on the International Union for Conservation of Nature (IUCN) Red List (IUCN 2019). In 1998, hard coral covered an area of around 717 ha at Ashmore Reef. The majority of hard corals occur in the deep lagoon (265 ha) and shallow reef top (315 ha) with small areas in the shallow lagoons, and reef edge/slope habitats (Skewes et al. 1999a). The soft, non-reef building corals are less well studied at Ashmore Reef than the hard corals (Hale & Butcher 2013). In 1986, 39 soft coral taxa were recorded within the Ashmore Reef, including the vulnerable blue coral (*Heliopora coerulea*) which was moderately common on the reef flats (Marsh 1993). In 1998, the total cover of soft coral at Ashmore Reef was 323 ha and *Sarcophyton* spp. was the dominant taxa covering around 19 ha in total (Skewes et al. 1999b, Hale & Butcher 2013).

The species composition of all the hard coral reefs in the bioregion is very similar and reflects strong links with Indo-West Pacific fauna, largely as a result of the dispersal of coral spawn via regional currents. The reefs and islands in this bioregion are thought to be important biological stepping-stones between centres of biodiversity in the Indo–Pacific and reef ecosystems further south (DEWHA 2008a).

Seringapatam Reef is a regionally important scleractinian coral reef as it has a high biodiversity, which is comparable to Ningaloo Reef. Results from the Western Australian Museum (WAM) survey in 2006 noted 159 species of scleractinian corals with a hard coral cover of approximately 16% (WAM 2009). The dominant benthic habitats of the reef were observed to include hard and soft corals (Heyward et al. 2013 cited in ConocoPhillips 2018).

Scott Reef consists of two reefs, North Scott Reef and South Scott Reef, which are separated by a deep (400–700 m) channel. North Scott Reef is an annular reef which encloses a lagoon that is connected to the ocean. South Scott Reef is a crescent-shaped reef which forms an arc and partially encloses another lagoon. Light penetration at Scott reef is high due to low turbidity. Light penetration depths to the deeper part of South Reef Lagoon are in excess of 50m with corals able to survive at depths of up to 70 m (Woodside Energy Limited et al. 2010). Studies at Scott reef have identified over 300 scleractinian coral species in the shallow water habitats alone, from almost 60 genera and 14 different families (Gilmour et al. 2013). The Scott reef system has experienced two mass bleaching events in 1998 and 2016, with the latter showing > 90% decreases in cover of branching corals (Porites, Acropora, Millepora, Isopora and Pocillopoiridae) (Gilmour et al*.,* 2021). Regular monitoring following the 1998 mass bleaching event showed increasing cover of branching corals 5 years post bleaching event, with most coral groups recovering approximately 12 years later (Gilmour et al*.,* 2021).

Hibernia Reef consists of an approximately oval-shaped reef, with large areas of the reef becoming exposed at low tide. Hibernia Reef is also characterised by a deep central lagoon and drying sand flats.

There are a number of shoals and banks in the NMR and NWMR. Relatively few studies have been undertaken of these features with the majority of the understanding derived from the Big Bank Shoals study (Heyward et al. 1997), PTT Exploration and Production Public Co Ltd (PTTEP) surveys initiated in response to the Montara incident (Heyward et al. 2010; Heyward et al. 2011) and ConocoPhillips baseline surveys undertaken to support the Barossa Area Development (Heyward et al. 2017). The PTTEP surveys completed at Ashmore, Cartier and Seringapatam Reefs were undertaken during a coral bleaching disturbance likely to be attributed to regional thermal stress indicated by both *in situ* and satellite-based data for the region. The condition of the reefs communities was consistent with previous surveys within the area and did not indicate any disturbance from the Montara incident (Heyward et al. 2010; Heyward et al. 2012).

In general, the submerged features are characterised by abrupt bathymetry, rising steeply from the surrounding outer continental shelf at depths of 100 m–200 m. The shoals and banks tend to flatten at depths of 40-50 m, with horizontal plateau areas of several square kilometres generally present at 20-30 m depths (Heyward et al. 2010). The shoals and banks support a diverse and varied range of benthic communities, including algae, reef-building soft corals, hard corals and filter-feeders (Heyward et al. 1997, Heyward et al. 2012). The plateau areas were dominated by benthic primary producer habitat, with interspersed areas of sand and rubble patches (Heyward et al. 2012).

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 extending from Busselton to the NT border support predominantly tropical species although temperate species are also found, particularly between Busselton and Exmouth (Walker 1987). One species, *Cymodocea angustata*, is endemic to WA (Department of Parks and Wildlife (DPAW) 2013).

3.2.1. Southwest Shelf Transition

Species diversity of seagrasses in this bioregion is the highest in the world, with 14 species occurring (DEWHA 2008a). In total, 10 seagrass species have been recorded at the Abrolhos Islands ranging from small, delicate species (e.g. *Halophila* spp.) to larger, more robust types (*Posidonia* spp.) that grow in large meadows (DoF 2012). Small paddle-weeds (*Halophila* spp.) grow in protected lagoon areas or deep waters between the islands, such as Goss Passage and the larger species may be found growing on reef as well as in sandy areas (DoF 2012). *Thalassodendron pachyrhizum*, which is encountered growing on the exposed reef crest area, has been recorded at several of the island groups. There are also two species of wire-weed (*Amphibolis* spp.), endemic to southern Australia, found at the Abrolhos (DoF 2012). The most abundant seagrass is *Amphibolis antarctica*, while *Amphibolis griffithii* appears to be restricted to bays such as Turtle Bay in the Wallabi Group.

The larger ribbon-weeds (*Posidonia* species) grow in sheltered bays and lagoons where the sand cover is deeper and more stable (e.g. Turtle Bay, the Gap, East Wallabi Island, the lagoon on the west side of West Wallabi Islands and around North Island) (DoF 2012).

Nine species of seagrass are found in the Perth region, including at Rottnest Island where *Amphibolis* thrives in clear waters overlying limestone rock (Amalfi 2006). Seagrasses are a major component of the ecosystem on the Rottnest Shelf, thriving in waters ranging in depth from intertidal to 45m (Amalfi 2006). All of the seagrass species identified with the exception of *Syringodium isoetifolium* and *H. ovalis* are endemic to temperate areas of southern Australia (Amalfi 2006). At Rocky Bay, on the north side of the island where it is protected from big swells and strong south to south-westerly winds, a mix of dense seagrass meadow consisting of *Amphibolis* and *Posidonia* thrive. The meadows around Rottnest Island serve as nurseries for juveniles of many fish species and are home to species such as the cobbler (*Cnidoglanis macrocephalus)* and long-headed flathead (*Leviprora inops*) (Amalfi 2006).

3.2.2. Central Western Shelf Province

Shark Bay contains the largest reported seagrass meadows in the world (approximately 4,000 km^2), as well as some of the most species-rich seagrass assemblages (Walker et al. 1989). Twelve species of seagrass are found in the Bay with the dominant species being *Amphibolis antarctica*. Seagrass is a fundamental component of biological processes in Shark Bay; it has modified the physical, chemical and biological characteristics of the Bay and provides food, habitat and nursery grounds for many species (CALM & National Parks and Nature Conservation Authority (NPNCA) 1996).

3.2.3. Central Western Shelf Transition

Nine species of seagrasses have been found throughout Ningaloo Reef (van Keulen & Langdon 2011). Some delineation of temperate and tropical species exists; however, several species were found throughout the Ningaloo Reef. Halophila ovalis was the most commonly found seagrass at Ningaloo and was generally found growing in sandy patches between coral bomboras. *Amphibolis antarctica* is a large meadow forming species that has been found growing in large clumps in Bateman Bay, north of Coral Bay (van Keulen & Langdon 2011).

3.2.4. Northwest Transition

The Rowley Shoals provide the only suitable shallow substrate for seagrasses in this predominantly deep bioregion. Sparse seagrass is found within subtidal coral reef communities of the Rowley Shoals but is not a major habitat type. Two species of seagrass, *Thalassia hemprichii* and *Halophila ovalis*, have been recorded at Mermaid Reef (Huisman et al. 2009). Earlier studies at Mermaid and Imperieuse Reef recorded the above two species and a third species: *Thalassodendron ciliatum* (Walker & Prince 1987).

3.2.5. 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 & Marsh 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).

Surveys near Onslow found that *Halophila* spp. were the most widespread of the seagrasses in that region. Seagrasses were found to be generally sparsely distributed (<10 % cover), occurring in small patches within larger areas of suitable substrate. Small areas of higher (>50 %) seagrass cover occurred in shallow clear water areas but were not common (URS 2009, URS 2010b, Chevron 2010).

Similarly, 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).

A significant meadow of large seagrasses at Mary Anne Reef east of Onslow was identified almost 30 years ago and its presence today is unconfirmed. The meadow was several hundred hectares (ha) of *Cymodocea angustata* at 30–50 % cover, occurring primarily at a depth of 2–3 m (Walker & Prince 1987).

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. Southwest Shelf Transition

The Houtman Abrolhos Islands have known species of benthic algae with macroalgae communities considered important in supporting a diversity of marine life.

More than 340 species of macroalgae (including 54 species of green algae, 71 species of brown algae, and 222 species of red algae) have been recorded from rock platforms around Rottnest Island (Amalfi 2006).

3.3.2. Central Western Shelf Province

Although seagrasses are the most visually dominant organisms found in Shark Bay (Walker et al. 1989) macroalgae are also a significant component within the system, with 161 taxa of benthic macroalgae reported from the location (Kendrick et al. 1990). The seagrass meadows host a large number of epiphytic algal species (Kendrick et al. 1990), which numerically dominate the algal flora of the area. Eighty algal species were epiphytic on the seagrass *Amphibolis antarctica*, and of these, over half have been reported both as epiphytes and benthic algae. Benthic macroalgae can be found growing on occasional subtidal rock (limestone–sandstone) platforms and extensive sand flats that occur throughout Shark Bay, and as drift within seagrass meadows (Kendrick et al. 1990).

The benthic algae of Shark Bay are not predominantly temperate as is the case with the seagrasses (Walker et al. 1989) and seagrass epiphytes (Kendrick et al. 1990). The majority of taxa are either of tropical or cosmopolitan distribution. Their local distribution within Shark Bay is correlated with salinity, with benthic algal species richness lower in areas of high salinity (Kendrick et al. 1990).

Limestone platforms occur along the bioregion’s coastline and high energy environments are likely to be dominated by large brown algae including *Ecklonia radiata* and *Sargassum* spp. with articulated coralline algae making up the understorey. More diverse algae assemblages may be observed in sheltered locations such as potholes and ledges (DoF 2007).

3.3.3. Central Western Shelf Transition

Macroalgal beds along the Ningaloo coastline are generally found on the shallow limestone lagoonal platforms and occupy about 2,200 ha of the Ningaloo Marine Park and Muiron Islands Marine Management Area (CALM & MPRA 2005a). Macroalgal communities within the area have been broadly described (Bancroft & Davidson 2000). The dominant genera are the brown algae *Sargassum*, *Padina*, *Dictyota* and *Hydroclathrus* spp. (McCook et al. 1995).

3.3.4. Northwest Transition

Although macroalgae is present at the Rowley Shoals, it is not recognised as a key habitat component in the Mermaid Reef Marine National Nature Reserve Plan of Management (EA 2000) or the Rowley Shoals Marine Park Management Plan (DEC & MPRA 2007b).

There is nothing to suggest that the algal flora of the Rowley Shoals is unique within the Indo-Pacific (Huisman et al. 2009). A study of macroalgae at 16 locations at Mermaid Reef recorded over 100 species (Huisman et al. 2009). The algal flora recorded at the Rowley Shoals represents a small portion of the highly diverse Indo-Pacific flora. The majority of species that were recorded at Mermaid Reef had been previously recorded from mainland north-western Australia or from Indonesia (Huisman et al. 2009).

3.3.5. 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 2005a).

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 2005b). 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).

3.3.6. Timor Province

Macroalgae at Ashmore Reef are estimated to cover over 2,000 ha, mostly on the reef slope and crest areas (Hale & Butcher 2013). The algal community is dominated by turf and coralline algae, with fleshy macroalgae comprising typically less than 10% of total algal cover (Skewes et al. 1999b).

Surveys at Scott and Seringapatam Reefs recorded over 100 species of marine algae (Huisman et al. 2009). The marine algal community was similar between reefs and also similar to the Rowley Shoals. Algae found at these offshore atolls forms a small subset of the Indo-Pacific algal flora, with virtually all of the species identified thus far having been previously collected from north-western Australia or from localities further north. Although further research is necessary, at present there is nothing to suggest that the macroalgae communities of these offshore atolls are unique within the Indo-Pacific (Huisman et al. 2009).

3.4. Non-Coral Benthic Invertebrates

The offshore marine environment from Busselton to the Northern Territory 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. Southwest Shelf Transition

The inner shelf of the bioregion, extending between 0-50 m deep, includes distinct ridges of limestone reef with extensive beds of macro-algae (principally *Ecklonia* spp.). These inshore lagoons are inhabited by a diverse range of coralline algae, sponges, molluscs, and crustaceans. On the outer shelf and shelf break filter feeding sponges and bryozoans dominate the hard bottom. The reefs around the Houtman Abrolhos Islands support 492 known species of molluscs, 110 known species of sponges, 172 known species of echinoderms and 234 known species of benthic algae (DEWHA 2008b). Western rock lobster, the dominant large benthic invertebrate in this bioregion, is an important part of the food web of the inner shelf.

3.4.2. Central Western Province

The understanding of marine life in this bioregion is mostly confined to the demersal fish on the continental slope. The exception to this is the Perth Canyon which, although poorly understood, is known to have unique sea floor features with ecological properties of regional significance.

3.4.3. Central Western Shelf Province

The Central Western Shelf Province occurs on the continental shelf in water depths from 0 to 100 m. Biological communities of the shelf are likely to include a sparse invertebrate assemblage of sea cucumbers, urchins, crabs and polychaetes on sand substrates. Hard substrates are likely to contain sessile invertebrates such as sponges and gorgonians. The biological communities of this bioregion share many similarities with the adjoining temperate region (DEWHA 2008a).

Stromatolites occur in Shark Bay. Although they are a microbial colony (prokaryote), and not an invertebrate (eukaryote), they are described here as a unique benthic biological community. Stromatolites are rock-like structures built by cyanobacteria. Shark Bay's stromatolites are 2,000 to 3,000 years old and are similar to life forms found on Earth up to 3.5 billion years ago. Until about 500 million years ago, stromatolites were the only macroscopic evidence of life on the planet; hence they provide a unique insight into early life forms and evolution. The stromatolites are located in the hypersaline environment of Hamelin Pool and are one of the reasons for the area's World Heritage Listing (DPAW 2009).

3.4.4. Central Western Transition

The Central Western Transition extends from the shelf break to the continental slope with some parts of the bioregion occurring on the abyssal plain. Water depths range from 80 m to almost 6,000 m. Sediments are dominated by muds and sands that decrease in grain size with increasing depth. The present level of understanding of the marine environment in this bioregion is generally poor. The harder substrate of the slope in waters of 200–2,000 m deep is likely to support populations of epibenthic fauna including bryozoans and sponges. These support larger infauna and benthic animals such as crabs, cephalopods, echinoderms, and other filter feeding epibenthic organisms. In the deeper waters of the abyss, the benthic communities are likely to be sparse (DEWHA 2008a).

3.4.5. Central Western Shelf Transition

The Central Western Shelf Transition is located entirely on the continental shelf and is comprised mainly of sandy sediments in depths between 0 and 80 m (DEWHA 2008a).

Some sponge species and filter-feeding communities found in deeper waters offshore from the Ningaloo Reef appear to be significantly different to those of the Dampier Archipelago and Abrolhos Islands, indicating that the Commonwealth waters have some areas of potentially high and unique sponge biodiversity (Rees et al. 2004).

3.4.6. Northwest Province

The Northwest Province is located entirely on the continental slope in water depths of predominantly between 1,000–3,000 m and is comprised of muddy sediments. Despite the present poor knowledge of the benthic communities on the Exmouth Plateau, information on sediments in the bioregion indicates that benthic communities are likely to include filter feeders and epifauna. Soft-bottom environments are likely to support patchy distributions of mobile epibenthos, such as sea cucumbers, ophiuroids, echinoderms, polychaetes and sea pens.

3.4.7. Northwest Transition

The Northwest Transition is located from the shelf break (200 m water depth) over the continental slope to depths of more than 1,000 m at the Argo Abyssal Plain. Benthic habitat mapping surveys and epibenthic sampling conducted by CSIRO at the continental slope (approximately 400 m water depth) showed that all survey sites predominantly comprised soft, muddy sediment, which was often riffled. Gravel, boulders and small outcrops were occasionally recorded. Epifaunal abundance was similar all sites, with epifauna limited to sparsely distributed isolated individuals. Epifauna included isolated scattered sessile crinoids, anemones, glass sponges and seapens. Occasional non-sessile fauna included urchins, prawns and other decapods, holothurians and sea stars. Modelling indicated a 1 km long beam trawl across the continental shelf (approximately 400 m water depth) would be expected to yield sparse (<20 individuals) and low diversity (<10 species) of epibenthic fauna (≥1 cm body size) (Williams et al. 2010). Deeper on the continental slope at approximately 700 m and approximately 1,000 m, habitats were similar to those observed at 400 m (Williams et al. 2010).

Although soft sediment habitat may appear monotonous and featureless, there is likely to be some marked differences in terms of ecological functioning and faunal composition between shelf and deep-sea areas, with the 200 m isobath widely believed to represent a key boundary (Wilson 2013, Brewer et al. 2007, Gage & Tyler 1992). Beyond the 200 m isobath, deep-sea benthic communities rely exclusively on the settling of organic detritus from the overlying water column as a food source. The spatial and temporal distribution of benthic fauna depends on factors such as sediment characteristics, depth and season (Wilson 2013).

Due to contrasting depths, the Rowley Shoals supports a diverse marine invertebrate community including a number of endemic species. Invertebrate species (excluding corals) at the Rowley Shoals include sponges, cnidarians (jellyfish, anemones), worms, bryozoans (sea mosses), crustaceans (crabs, lobsters, etc.), molluscs (cuttlefish, baler shells, giant clams, etc.), echinoderms (starfish, sea urchins) and sea squirts (DEC & MPRA 2007b).

3.4.8. 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).

Epibenthic dredge surveys in nearshore areas around Broome covered 1,350 m^2 of seabed in depths between 11 and 23 m. The survey recorded 357 taxa comprising 52 sponges, 30 ascidians, 10 hydroids, 52 cnidarians (not including scleractinian corals), 69 crustaceans, 73 molluscs and 71 echinoderms. The most important species on soft bottom habitats in terms of biomass was the heart urchin *(Breynia desorii)*, whilst sponges were the dominant fauna by biomass on hard bottom habitats. The biomass of other filter feeders, especially ascidians, soft corals, gorgonians was also high, indicating the importance of these groups in characterising hard bottom habitats.

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[2]009, Rio Tinto 2009, BHPBIO 2011).

3.4.9. Northwest Shelf Transition

The Northwest Shelf Transition is located on the continental shelf with a small area extending onto the continental slope, with water depths ranging from 0–330 m. Nearshore areas may support significant filter feeding communities, but these have not yet been described (Masini et al. 2009).

Pipeline route surveys north of the Kimberley in water depths from 10–250 m recorded a seabed largely devoid of hard substrate, with only sparse epibenthic fauna noted on the predominantly sandy substrate. Occasional epibenthic fauna (featherstars, gorgonians, bryozoans, sea urchins, hydroids and sponges) were recorded in areas where rocky substrate or outcrops were present (URS 2010a).

In contrast, benthic surveys at Echuca Shoals identified broad areas of hard substrate with substantial epibenthic fauna. The shallow shoal areas were dominated by a flat ‘reef’ platform with crinoids, sea whips, soft corals and low densities of hard corals. With increasing depth (25–80 m) soft corals and sponges became increasingly dominant. At greater depths (80–100 m) the density of epibenthic fauna decreased substantially with sea whips and sea fans became dominant (URS 2010a).

3.4.10. Timor Province

The Timor Province is located on the continental slope and abyssal plain and water depths range from 200 m to almost 6,000 m. Benthic studies in this bioregion are scarce, however data from the North West Slope Trawl Fishery suggests that muddy sediments in the Timor Province support significant populations of crustaceans (Brewer et al. 2007). Additionally, research into the demersal fish communities of the continental slope has identified the Timor Province as an important bioregion. This is due to the presence of a number of endemic fish species, and two distinct demersal community types associated with the upper slope (water depths of 225–500 m) and mid-slope (water depths of 750–1,000 m) (Last et al. 2005). The current understanding of the relationship between demersal fish communities and benthic environments on the continental slope is rudimentary (DEWHA 2008a).

Over 130 species of sponges have been recorded at the Ashmore Reef National Nature Reserve (Russell & Hanley 1993).

Studies of Seringapatam Reef have observed the dominant benthic habitats to include filter feeders, such as sponges, gorgonians, hydroids and seapens (Heyward et al. 2013 cited in ConocoPhillips 2018).

3.4.11. Christmas Island Province

Three major molluscs grow on Christmas Island’s reefs: bivalves, gastropods and cephalopods. Echinoderms include sea stars, brittle stars, feather stars, sea urchins and sea cucumbers (DoNP, 2012). The deeper waters connecting Christmas Island to the Cocos (Keeling) Island Province are described below.

4. Shoreline Habitats

Shoreline habitats are defined as those habitats that are adjacent to the water along the mainland and of islands that occur above the Lowest Astronomical Tide (LAT) and most often in the intertidal zone.

The 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 **Sections 4.1- 4.4**, in terms of the 18 IMCRA v. 4.0 bioregions where relevant and where information is available.

4.1. Mangroves

Mangroves commonly occur in sheltered coastal areas in tropical and sub-tropical latitudes (Kathiresan and Bingham 2001). Up to eight species of mangroves are found further north in the Central Western Shelf Transition region, but 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 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.

4.1.1. Central Western Shelf Province

Shark Bay (in the Central Western Shelf Province) supports the southern-most area of substantial mangrove habitat in Western Australia (Rule et al. 2012). The mangroves of Shark Bay comprise only one species, the white mangrove *Avicennia marina*, and these trees occur around the coastline in widely dispersed and often isolated stands of varying size.

4.1.2. Central Western Shelf Transition

The regional mangroves from Exmouth to Broome (within the Central Western Shelf Transition and southern part of the Northwest Shelf Province) represent Australia's only 'tropical-arid' mangroves. The most significant stand of mangroves in the Central Western Shelf Transition is Mangrove Bay on the western side of the Cape Range Peninsula in the Ningaloo Marine Park. This small area of mangrove (37 ha) represents the largest area of mangrove habitat within the Ningaloo Marine Park and is considered extremely important from a biodiversity conservation perspective (CALM 2005).

4.1.3. 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).

4.2. 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.

4.2.1. Southwest Shelf Province and Southwest Shelf Transition

Intertidal platforms within the Northwest and Southwest bioregions support a mosaic of fauna and flora that typically exhibits strong variability in percent cover, community composition, abundance, and diversity both between and within reefs at varying spatial and temporal scales (SKM 2009, 2011). Reef platforms typically exhibit zonation of fauna and flora from upper to lower levels on the intertidal zone, with increasing diversity, abundance, and biomass lower in the intertidal (Morton and Britton in Jones 2004, SKM 2009, 2010, 2011, Hanley and Morrison 2012).

On the south coast of the Southwest Shelf Province, the coastal geomorphology changes from the predominant limestone reefs to eroded Precambrian rocks. Intertidal platforms are also common along the Southwest Shelf Transition. Shark Bay in the Central Western Shelf Province has a high diversity of intertidal marine habitats because of the diversity of benthic substrate, salinity and the broad geographical features which influence depth, water movement and turbidity (CALM 1996, DSEWPaC 2013b). This includes extensive limestone platforms as well as sand flats, mud flats, salt marsh and mangroves and beaches (CALM 1996).

4.2.2. Central Western Shelf Province and Transition

Limestone pavements extend out from the beach into subtidal zones, e.g. along the Ningaloo Coast and North West Cape; and higher relief platforms (>0.5 m off high water mark) are also present at several headlands along the North West Cape.

4.2.3. Northwest Shelf Province and Northwest Shelf Transition

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) reports that as a result of the monsoonal influxes of freshwater and land-derived nutrients distinctive tropical marine ecosystems have occurred.

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; 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 6.1**).

4.3.1. Southwest Shelf Transition

Sandy beaches throughout the Abrolhos Islands host breeding populations of the Australian sea lion. The Abrolhos Islands represent the northernmost breeding population of Australian sea lions. The current population at the Abrolhos Islands is estimated to be approximately 90 individuals (DoF 2012).

In addition to this, beaches in the South West province provide a variety of socio-economic values including tourism, commercial and recreational fishing, and support of other recreational activities.

4.3.2. Central Western Shelf Province

Sandy beaches are found along the coastline at Shark Bay within the marine park which is further described in **Section 12.3.2**.

4.3.3. Northwest Shelf Province

Eighty Mile Beach Marine Park is one of the Australia's largest uninterrupted sandy beaches (stretching 220 km) and is an important feeding grounds for small wading birds that migrate to the area each summer, travelling from countries thousands of kilometres away (DEC 2012a).

4.4. 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. This habitat is also widespread heading south towards Perth.

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 8.2.2**).

5. 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 A**), are shown in **Table 1,** along with their WA and NT conservation listings (as applicable) and discussed in **Section 5.2** 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 14.5 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		
Cape range cave gudgeon, Blind gudgeon (*Milyeringa veritas)*	Vulnerable	Vulnerable	-	Species or species habitat known to occur within area.	None - No BIA defined
Blind cave eel (*Ophisternon candidum*)	Vulnerable	Vulnerable	-	Species or species habitat known to occur within area.	None - No BIA defined
Grey nurse shark (*Carcharias taurus*)	Vulnerable	Vulnerable	-	Species or species habitat known to occur within area	None - BIA not found in EMBA
White shark, Great white shark (*Carcharodon carcharias*)	Vulnerable & Migratory	Vulnerable	-	Foraging, feeding or related behaviour known to occur within area. Overlaps with foraging BIA (Abrolhos Islands)	Yes – Refer to **Table 3**
Whale shark (*Rhincodon typus*)	Vulnerable & Migratory	Migratory	-	Foraging, feeding, or related behaviour known to occur within area. Overlap with foraging BIAs	Yes – Refer to **Table 3**
Northern river shark, New Guinea river shark (*Glyphis garricki*)	Endangered	-	Priority 1	Species or species habitat may occur within area	None - No BIA defined
Dwarf sawfish, Queensland sawfish *(Pristis clavata*)	Vulnerable & Migratory	Migratory	Priority 1	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	Species or species habitat known to occur within area.	None - BIA not found in EMBA
Narrow sawfish, Knifetooth sawfish (*Anoxypristis cuspidata*)	Migratory	Migratory	-	Species or species habitat known to occur within area	None - No BIA defined
Green sawfish, Dindagubba, Narrowsnout sawfish (*Pristis zijsron*)	Vulnerable & Migratory	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 - No BIA defined
Shortfin mako, Mako shark (*Isurus oxyrinchus*)	Migratory	Migratory	-	Species or species habitat likely to occur within area	None - No BIA defined
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 known to occur within area.	None - No BIA defined
Porbeagle, Mackerel shark *(Lamna nasus*)	Migratory	Migratory	-	Species or species habitat may occur within area	None - No BIA defined
Scalloped hammerhead shark (*Sphyrna lewini)*	Conservation Dependent	-	-	Species or species habitat likely to occur within area	None - No BIA defined
Southern bluefin tuna *(Thunnus maccoyii)*	Conservation Dependent	-	-	Breeding known to occur within area	None - No BIA defined
Southern dogfish, Endeavour dogfish, Little gulper shark (*Centrophorus uyato/ Centrophorus zeehaani/ Squalus uyato*)	Conservation Dependent	-	-	Species or species habitat likely 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.

5.1. Regional Surveys

Within the EMBA a number of important geographical areas for fish exist, including Ningaloo Marine Park, Montebello/Barrow Island Marine Park, Abrolhos Marine Park, and the Rowley Shoals.

5.1.1. Central Western Shelf Province

The Central Western Shelf Province is located near Shark Bay and is the northern limit of a transition region between temperate and tropical marine fauna. Of the 323 fish species recorded from Shark Bay, 83 % are tropical species with 11 % warm temperate and 6 % cool temperate species (CALM 1996).

5.1.2. Central Western Shelf Transition

Ningaloo is the largest fringing coral reef in Australia, forming a discontinuous barrier that encloses a lagoon that provides habitat for many fish species. Gaps that regularly intercept the main reef line provide channels for water exchange with deeper, cooler waters (CALM 2005). Ningaloo Reef is a well-known biodiversity hotspot, supported by the direct link between the reef and the ancient reef systems found closer to the equator by the Leeuwin Current (Kemps 2010). Approximately 500 species of fish have been reported to inhabit the reef (Kemps 2010). The Piercam project from inception in 2005 to 2013, identified 165 fish species from 50 families at the Point Murat Navy Pier alone, located within the Ningaloo Marine Park (Whisson & Hoschke 2013).

Seasonal aggregations of whale sharks occur at Ningaloo each year (CALM 2005). There is limited data available on species diversity and distribution of sharks in the Ningaloo area as chondrichthyan biodiversity for the area has not been specifically recorded. Despite this, it is possible that the Ningaloo Reef Marine Park contains the largest and most diverse collection of sharks on the Australian coastline (Stevens et al. 2009). It was estimated in 2009 by Last and Stevens (cited in Stevens et al. 2009), that there are likely to be 118 species of chondrichthyan fishes occurring in the park. Of these species, 59 are shark species predicted to be found at depths of less than 200 m (Stevens et al. 2009).

The lagoon at Ningaloo Reef appears to provide a juvenile habitat and nursery area for shark species such as the grey nurse shark (*C. taurus*), black-tipped reef shark (*Carcharhinus melanopterus*) and other reef sharks (Carcharhinidiae) (Stevens et al. 2009). A study conducted on the distribution and abundance of elasmobranches in the Ningaloo Marine Park, in 2009, tracked the movements of six key shark species. Species such as *Galeocerdo cuvier* (tiger shark) and *Sphyrna mokarran* (great hammerhead) were found to remain for brief time periods in the park, in contrast to other species found to re-visit the Ningaloo area (Stevens et al. 2009). Several species of sharks within Ningaloo have been identified as key indicator species for the health of the system (Stevens et al. 2009).

Barrow Island includes Biggada Reef, an ecologically significant fringing reef, and the Montebello Islands comprise over 100 islands, the majority of which are rocky outcrops; providing fish habitat (DEC 2007a). Within the Barrow/Montebello region, at least 380 fish species have been recorded (de Lestang & Jankowski 2017). Most species exhibit wide distributions, with local species composition closely resembling that of the Dampier Archipelgao. Coral habitats support the most diverse fish community in this region, comprising, among others, many species of damselfish (Pomacentridae), parrotfish (Scaridae), snappers (Lutijanidae) and groupers (Serranidae) (de Lestang & Jankowski 2017). The region's macroalgal habitats are considered important nursery areas for a diverse range of fish species, such as emperor (Lethrinidae), threadfin bream (Nemipteridae), tuskfish (Labridae) and trevally (Carangidae) (de Lestang & Jankowski 2017).

Ramsar wetlands within the area (e.g. Eighty Mile Beach and Ashmore Reef National Nature Reserve) can also provide important habitat for fish.

5.1.3. Central Western Transition

The biological communities of the Central Western Transition are thought to be distinctive owing to the proximity of deep oceans areas to the continental slope and shelf, resulting in close interaction between pelagic species of the Cuvier Abyssal Plain and those of the slope and shelf (DEWHA 2008a).

The present level of understanding of the marine environment in this bioregion is generally poor. The diversity of fish and cephalopod species changes with depth, generally decreasing species numbers with increasing depth. The demersal slope fish bioregionalisation identified some endemism in communities in this bioregion (Last et al. 2005), however, it is lower than other areas of the North-west Marine Region (DEWHA 2008a).

Bentho-pelagic fish, such as deep-water snappers (e.g. *Paracaesio* spp, and *Eletis* spp.), hatchetfish (*Argyropelecus* spp.), dragonfish (*Melacosteus* spp.), viperfish (*Chauliodus* spp.) and a number of eels species migrate between the benthic and pelagic systems, forming an important link between these systems (DEWHA 2008a).

Transient fish species through the Central Western Transition bioregion include southern bluefin tuna (migrating to and from spawning grounds), broadbill swordfish (*Xiphius gladius*), bigeye tuna (*Thunnus obesus*), yellowfin tuna (*Thunnus albacares*) and striped marlin (*Tetrapturus audax*). Pelagic sharks also range across the bioregion following schools of pelagic fish (DEWHA 2008a).

5.1.4. Central Western Province

The Perth Canyon appears to be an important ecological feature attracting krill and fish aggregations that in turn attract larger species such as predatory fish and pygmy blue whales (DSEWPaC 2012). Demersal slope fish assemblages in this bioregion are characterised by high species diversity. Scientists have described 480 species of demersal fish that inhabit the slope of this bioregion and 31 of these are considered endemic to the bioregion. Demersal fish on the slope in this bioregion in particular have high species diversity compared with other more intensively sampled oceanic regions of the world. Below 400 m water depth demersal fish communities are characterised by a diverse assemblage where relatively small, benthic species (grenadiers, dogfish and cucumber fish) dominate.

5.1.5. Northwest Transition

The Northwest Transition bioregion may support sparse populations of bentho-pelagic fish and cephalopods in low densities. Pelagic fish species likely to be present include grenadiers and hatchetfish (*Argyropelecus* spp.) as well as transient populations of highly mobile pelagic fish. Adult and juvenile southern bluefin tuna are through to migrate through this bioregion on their way to and from spawning grounds in the north-eastern Indian Ocean (DEWHA 2008a).

The slope habitat of this bioregion is associated with important populations of demersal fish species and supports the second richest demersal fish assemblage nationally (Last et al. 2005). Over 508 fish species have been identified on the slope in this area and 64 of these species are endemic. The high diversity and endemism of the demersal fish fauna indicates important interactions between physical processes and trophic structures in this bioregion. For more information on the slope habitat for fish and sharks, refer to **Section 10.1.15**.

The Rowley Shoals within the Northwest Transition comprise three oceanic reef systems approximately 30–40 km apart, namely Mermaid Reef, Clerke Reef and Imperieuse Reef. The Shoals are thought to provide a source of invertebrate and fish recruits for reefs further south and as such are regionally significant (DEC 2007b).

5.1.6. Northwest Shelf Province and Northwest 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 and 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 and 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).

5.1.7. Northwest Shelf Transition

Creek systems, mangroves and rivers, and ocean beaches within this region provide habitat for a variety of species including barramundi, tropical emperors, mangrove jack, trevallies, sooty grunter, threadfin and cods (Fletcher and Santoro 2013). The offshore atolls and the continental shelf waters in the Northwest Shelf Transition are also geographically important for fish species. They support species of recreational and commercial interest, including saddle-tail snapper and red emperor, cods, coral and coronation trout, sharks, trevally, tuskfish, tunas, mackerels and billfish (Gaughan et al. 2019).

The Rowley Shoals within the Northwest Shelf Transition comprise three oceanic reef systems approximately 30–40 km apart, namely Mermaid Reef, Clerke Reef and Imperieuse Reef. The Shoals are thought to provide a source of invertebrate and fish recruits for reefs further south and as such are regionally significant (DEC 2007b). See **Section 11** on State Marine Parks and Nature Reserves for further details on important geographical areas for fish.

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*												

Species		Month											
Species Common Name	**Species Latin Name**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
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											

5.1.8. Timor Province

The diversity of demersal fish assemblages on the continental slope in the Timor Province (as well as the Northwest Transition and the Northwest Province) is high compared to elsewhere along the Australian continental slope (DSEWPaC 2012). Elements of the Timor Province are not well known, due to limited survey data in the northern limits of the region. The province is geographically extensive and includes 418 fish species, 64 of which are endemic to the region (Last et al. 2009). Key indicator species include *Bembrops nelsoni*, *Bythaelurus* sp., *Halicmetus* sp., *Malthopsis* spp, *Neobythites australiensis*, *Nobythites bimaculatus*, *Neobythites macrops*, *Neobythites soelae*, *Parapterygotrigla* sp., *Physiculus roseus* (Last et al. 2005).

Scott and Seringapatam Reefs are regionally important for the diversity of their fauna, including 558 fish species (Department of the Environment (DoE) 2014). Scott Reef has enormous habitat diversity and is considered a hot spot for fish, with five endemic species (DoE 2014). Scott Reef has biogeographic significance due to the presence of species which are at or close to the limits of their geographic ranges, including fish known previously only from Indonesian waters such as cardinalfish, azure damselfish (*Chrysoptera hemicyanea*), comb-tooth blenny (*Escnius schroederi*) and several Gobiids (DoE 2014).

5.1.9. Christmas Island Province

The Christmas Island Province is in deep, offshore waters (2,200 m – 6,000 m depth range). The island's predominantly intact fringing reefs and adjacent waters support a number of marine and coastal ecosystems and species, including over 600 fish species, with most being typical of the Indian Ocean region. These waters provide habitat for pelagic finfish species including tuna (*Thunnus* sp.) and wahoo (*Acanthocybium solandri*), and some demersal species such as ruby snapper (*Etelis carbunculus)*. The island has more than 50 reef fish species that are not found anywhere else in Australia (although some species may also occur at the neighbouring Cocos Islands) (DNP, 2014).

5.2. Fish Species

Three species of fish listed as Threatened under the EPBC Act (**Table 1**) were identified in the Protected Matters search (Appendix D of the VI Hub Operations EP):

- Blind gudgeon (*Milyeringa veritas*)
- Blind cave eel (*Ophisternon candidum*)
- Southern bluefin tuna *(Thunnus maccoyii)*

In addition, the Barrow cave gudgeon *(Milyeringa justitia*) has been identified as relevant threatened species under the BC Act. This species is not listed under the EPBC Act. Octopuses were also identified as a totemic species for the Ngarla people, during consultation with the Wanparta Aboriginal Corporation (WAC).

5.2.1. Blind Gudgeon and Blind Cave Eel

Both the blind gudgeon (*Milyeringa veritas*) and blind cave eel (*Ophisternon candidum*) are known to occur on the Cape Range Peninsula (in the Central Western Shelf Transition) (Humphreys and Feinberg 1995). 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).

5.2.2. 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.

5.3. 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 VI Hub Operations EP) identified six species of shark and three species of sawfishes listed as threatened within the EMBA (**Table 1**), including:

- Grey nurse shark (*Carcharias taurus*)
- Great white shark (*Carcharodon carcharias*)
- Northern river shark (*Glyphis garricki*)
- Whale shark (*Rhincodon typus*)
- Dwarf sawfish (*Pristis clavata*)
- Freshwater sawfish (*Pristis pristis*)
- Green sawfish (*Pristis zijsron*).
- Scalloped hammerhead shark (*Sphyrna lewini)*
- Southern dogfish (*Centrophorus uyato)*

Nine sharks and rays are specially protected as migratory under the BC Act 2016 in WA.

The Biologically Important Areas (BIAs) for relevant species detailed above are illustrated in **Figure 4.**

5.3.1. 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 (McCauley 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.

5.3.2. 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). The relevant great white shark BIAs in the EMBA are detailed in **Table 3** and is shown on **Figure 4.**

5.3.3. Northern River Shark

The northern river shark (*Glyphis garricki*) is listed as endangered under the EPBC Act and is one of the rarest species of shark in the world. Adults only recorded in marine habitats, whereas neonates, juveniles and subadults recorded in freshwater, estuarine and marine environments. It is also listed as a Priority 1 conservation species in WA.

The associated recovery plan (Sawfish and River Sharks Multispecies Recovery Plan, Commonwealth of Australia 2015) identifies adults and juveniles are being known in WA marine waters north of Derby. Pupping and juvenile sharks are identified as known to occur in Cambridge Gulf and pupping is also identified as likely to occur in King Sound. 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.

5.3.4. 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*and 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 relevant whale shark BIAs in the EMBA are detailed in **Table 3** and is shown on **Figure 4.**

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).

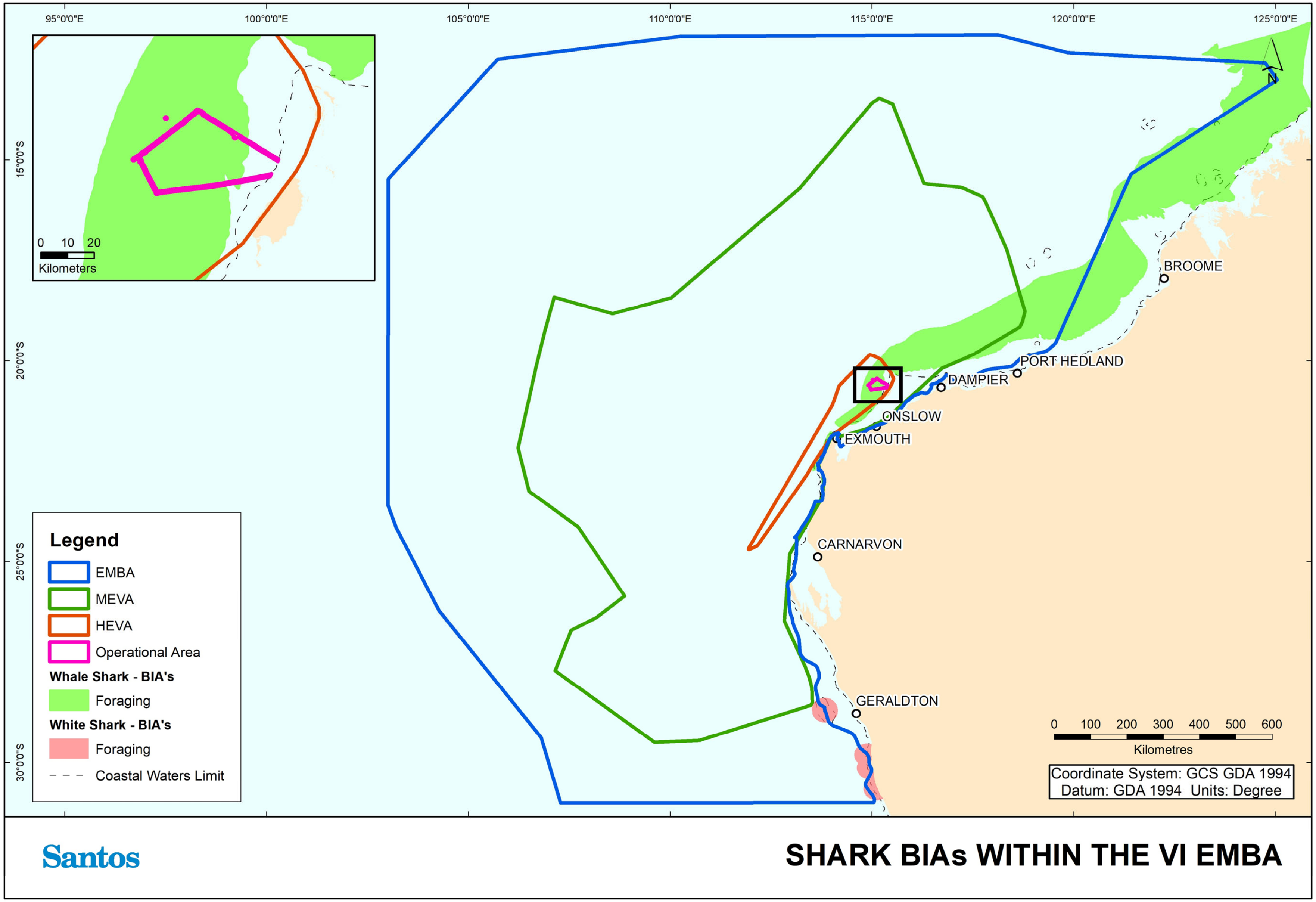


Figure 4: Biologically Important Areas for EPBC Protected Sharks in the Vicinity of the EMBA and Operational Area

5.3.5. 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.

The relevant sawfish BIAs in the EMBA are detailed in **Table 3**.

5.3.6. 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 and the green sawfish is listed as Vulnerable under the BC 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).

The relevant sawfish BIAs in the EMBA are detailed in **Table 3**.

5.3.7. 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.

5.3.8. Narrow Sawfish

The narrow sawfish (*Anoxypristis cuspidata*) is listed as migratory under the EPBC Act. It is a marine or marginal (brackish water) species found from inshore waters to a depth of 40 m (Compagno et al. 2006). Though details of its ecology are not precisely known, it probably spends most of its time on or near the bottom in shallow coastal waters and estuaries. A study showed the narrow sawfish to be the most abundant amongst the sawfish sampled in the Gulf of Carpentaria (Peverell, 2005) which holds some consistency with the offshore distribution of the species as shown by a study of Northern Prawn Fishery by-catch. Peverell (2005) also used catch data of offshore surface net fisheries to conclude that narrow sawfish also inhabit the mid-water column and can thus be described as a benthopelagic animal. The narrow sawfish is known to form aggregations of mature females during the months of October to November. Its Australian distribution is unclear though it is most common in the Gulf of Carpentaria with southward ranges extending to Broad Sound in Queensland and the Pilbara Coast (circa 116°E), Western Australia (Last & Stevens 2009).

5.3.9. Giant Manta Ray / Reef Manta Ray

The giant manta ray appears to be a seasonal visitor to coastal or offshore sites. Giant manta rays are often seen aggregating in large numbers to feed, mate, or clean. Sightings of these giant rays are often seasonal or sporadic but in a few locations their presence is a more common occurrence. This species is not regularly encountered in large numbers and, unlike some other rays do not often appear in large schools (>30 individuals) when feeding. Overall, they are encountered with far less frequency than the smaller manta species, despite having a larger distribution across the globe (IUCN 2019).

The giant manta ray (*Mobula birostris*) occurs in tropical, sub-tropical and temperate waters of the Atlantic, Pacific and Indian Oceans. They are commonly sighted along productive coastlines with regular upwelling, oceanic island groups and particularly offshore pinnacles and seamounts. The giant manta ray is commonly encountered on shallow reefs while being cleaned or is sighted feeding at the surface inshore and offshore. It is also occasionally observed in sandy bottom areas and seagrass beds (IUCN 2019).

The reef manta ray (*Mobula birostris*) has a circumtropical and sub-tropical distribution, existing in the Pacific, Atlantic and Indian Oceans. Within this broad range, however, actual populations appear to be sparsely distributed and highly fragmented. This is likely due to the specific resource and habitat needs of this species.

Overall population size is unknown, but subpopulations appear, in most cases, to be small (about 100–2,000 individuals). A proportion of the individuals in some populations undertake significant coastal migrations (IUCN 2019). Since the species is migratory it is possible that individuals may be encountered in the operational area, however, given that they generally do not aggregate in large groups, high numbers are not expected to be encountered during the activities.

5.3.10. Oceanic Whitetip Shark

The oceanic whitetip shark (*Carcharhinus longimanus*) is listed as migratory under the EPBC Act. The oceanic whitetip shark is widespread throughout tropical and subtropical waters of the world (30° N to 35° S) (IUCN 2020). They are an oceanic and pelagic species that regularly occurs in waters of 18 to 28°C, usually >20°C (IUCN 2020). Within Australian waters, they are found from Cape Leeuwin (Western Australia) through parts of the Northern Territory, down the east coast of Queensland and New South Wales to Sydney (Last and Stevens 2009). They are usually found in surface waters, though can reach depths of >180 m (Castro et al. 1999). They have occasionally been recorded inshore but are more typically found offshore or around oceanic islands and areas with narrow continental shelves (Last and Stevens 1994).

5.3.11. Shortfin Mako and Longfin Mako Sharks

The shortfin mako and longfin mako sharks are listed as migratory under the EPBC Act. The longfin mako is widely distributed but rarely encountered oceanic shark that ranges from Geraldton around the north coast to at least Port Stephens in New South Wales (DSEWPaC 2012). The shortfin mako is an oceanic and pelagic species, although they are occasionally seen inshore. They are found throughout temperate seas but are rarely found in waters colder than 16°C.

5.3.12. Porbeagle (Mackerel Shark)

The porbeagle (mackerel shark) (*Lamna nasus*) is listed as migratory under the EPBC Act. The porbeagle is wide-ranging, typically occurring in oceanic waters off the continental shelf, although they occasionally enter coastal waters (Francis et al. 2002 cited in DoE 2014e). The porbeagle is known to undertake seasonal migrations, although the timing and details of these migratory movements are not well understood (Saunders et al. 2011 cited in DoE 2014e).

5.3.13. Southern Dogfish

The southern dogfish (*Centrophorus uyato*) is listed as conservation dependent under the EPBC Act and may be found within the combined EMBA. The southern dogfish is a small, deepwater shark that is endemic to the continental shelf waters of southern Australia, occurring on the upper-slope in depths between 180 and 900 m. Genetic studies have suggested that there are likely to be three distinct stocks of southern dogfish, with the western stock distributed from the western GAB to southern Western Australia, overlapping with the combined EMBA. Similar to other shark species, southern dogfish are vulnerable to overfishing due to their life history characteristics of being slow to mature and having low fecundity, with southern dogfish thought likely to have some of the lowest fecundity rates of all sharks. Although there are no accurate species-specific data on the historic take of southern dogfish, they are caught incidentally by commercial fisheries. However, the current areas targeted by these sectors are unlikely to have substantial overlap with southern dogfish.

No southern dogfish BIAs were identified in the EMBA.

5.4. 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 13.2**. 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. Specifically, the Sawfish and River Sharks Multispecies Recovery Plan (DoEE 2015) cites that *"all areas where aggregations of individuals have been recorded displaying biologically important behaviour such as breeding, foraging, resting or migrating, are considered critical to the survival of the species unless population survey data suggests otherwise"*.

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 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
Great white shark	*Carcharodon carcharias*	Foraging – associated with pinniped colonies in the mid-west and south west and waters off Bremer Bay	Waters off pinniped colonies throughout the South-west Marine Region Waters off Bremer Bay

6. Marine Reptiles

Twenty nine 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 VI Hub Operations EP).

Of the reptile species identified in the Protected Matters search (Appendix D of the VI Hub Operations EP), eight are listed as threatened and six are listed as migratory. These species are show in **Table 4** along with their WA and NT 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		
Green turtle (*Chelonia mydas*)	Vulnerable Migratory	Vulnerable	-	Breeding known to occur within area. Overlaps with BIAs and critical habitats	Yes – refer to **Table 6**
Flatback turtle (*Natator depressus*)	Vulnerable Migratory	Vulnerable	-	Breeding known to occur within area Overlaps with BIAs and critical habitats (including mating,	Yes – refer to **Table 6**
Hawksbill turtle (*Eretmochelys imbricata*)	Vulnerable Migratory	Vulnerable	-	Breeding known to occur within area Overlaps with BIAs and critical habitats	Yes – refer to **Table 6**
Loggerhead turtle (*Caretta caretta*)	Endangered Migratory	Endangered	-	Breeding known to occur within area Overlaps with BIAs and critical habitats	Yes – refer to **Table 6**
Olive ridley turtle (*Lepidochelys olivacea*)	Endangered Migratory	Endangered	-	Species or species habitat known to occur within area	None - BIA not found in EMBA
Leatherback turtle (*Dermochelys coriacea*)	Endangered Migratory	Vulnerable	-	Species or species habitat 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 may occur within area	None - No BIA defined

[3] An overview of WA fauna conservation codes is provided in **Section 5** (fish and sharks).

6.1. Marine Turtles

Six 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*), olive ridley turtle (*Lepidochelys olivacea)* and leatherback turtle (*Dermochelys coriacea*) (**Table 4**).

These six species are listed on the EPBC Act List of Threatened Species as either 'endangered' or 'vulnerable' and all six species are also listed as 'migratory'. They are also listed as threatened species under the BC Act.

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 six marine turtle species in the EMBA (DSEWPaC, 2012b)

Life Stage		Green turtle	Flatback turtle	Hawksbill turtle	Loggerhead turtle	Olive ridley 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 (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.	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.	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.	Not recorded within North West Shelf region. 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.	Many feed within continental shelf waters, however it is not known if others are pelagic, as with the east Pacific population.	Mostly pelagic but will forage close to shore and over continental shelf in temperate waters.

6.1.1. 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 2008). 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). Aerial surveys conducted in 2000 and 2001 in the Exmouth region recorded only 12 sightings in Commonwealth waters and these turtles were most likely loggerheads (BHP 2005). In a survey commissioned by Santos around the islands in the Exmouth Region, loggerhead turtles were recorded nesting on Flat Island north of the Exmouth Gulf which was the first time they had been recorded in that location (Astron 2014). Loggerhead nesting and breeding occurs from November to March, with a peak in late December/early January (Limpus 2008b).

Figure 5 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).

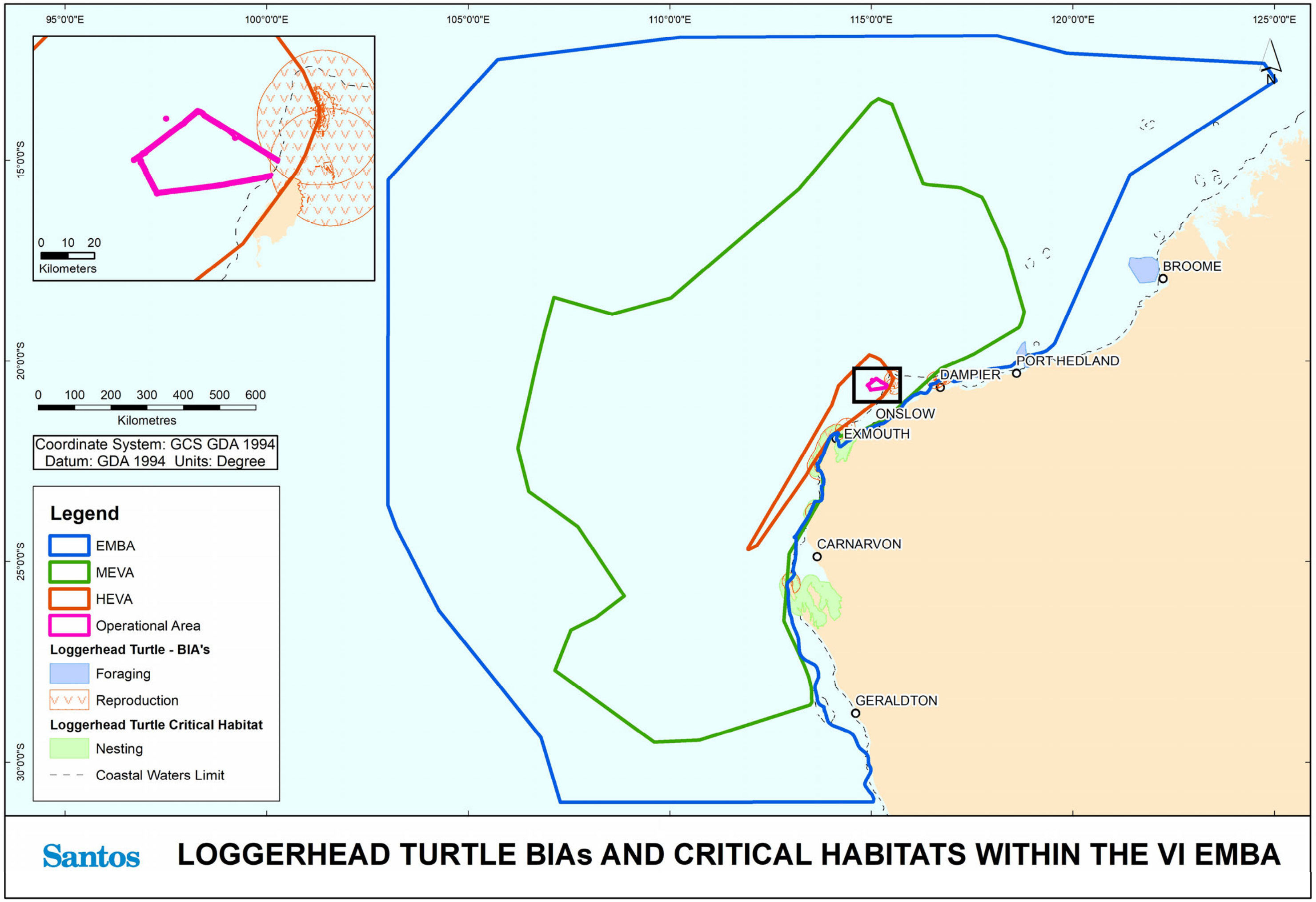


Figure 5: Biologically Important Areas and Habitat Critical for the Loggerhead Turtle in the Vicinity of the EMBA and Operational Area

6.1.2. 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 turtles have also been recorded nesting in the Bonaparte or Van Diemen Gulf bioregions and some nesting has been recorded on the west coast of Bathurst Island in the Tiwi Islands and Melville Island. BIAs for Green turtles occur on the north coast of the Tiwi Islands and an reproduction buffer has been defined 20 km from the Tiwi Islands with internesting expected between October and April (DoEE, 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 reproduction green turtles found the existing BIA for reproductionencompassed the spatial extent, however the BIA is likely largely underestimated for foraging areas.

Figure 6 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).

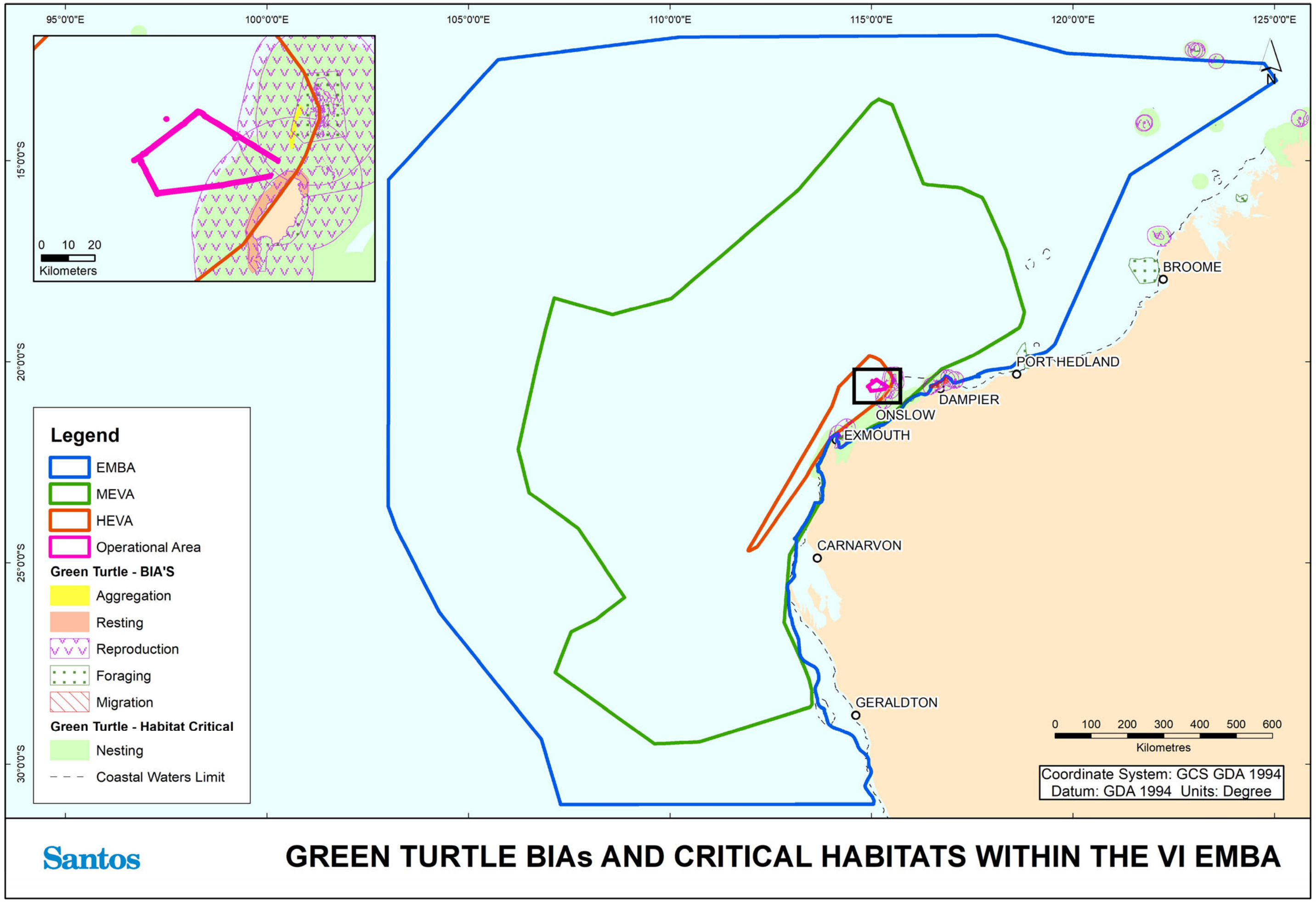


Figure 6: Biologically Important Areas and Habitat Critical for the Green Turtle in the Vicinity of the EMBA and Operational Area

6.1.3. 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 7 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).

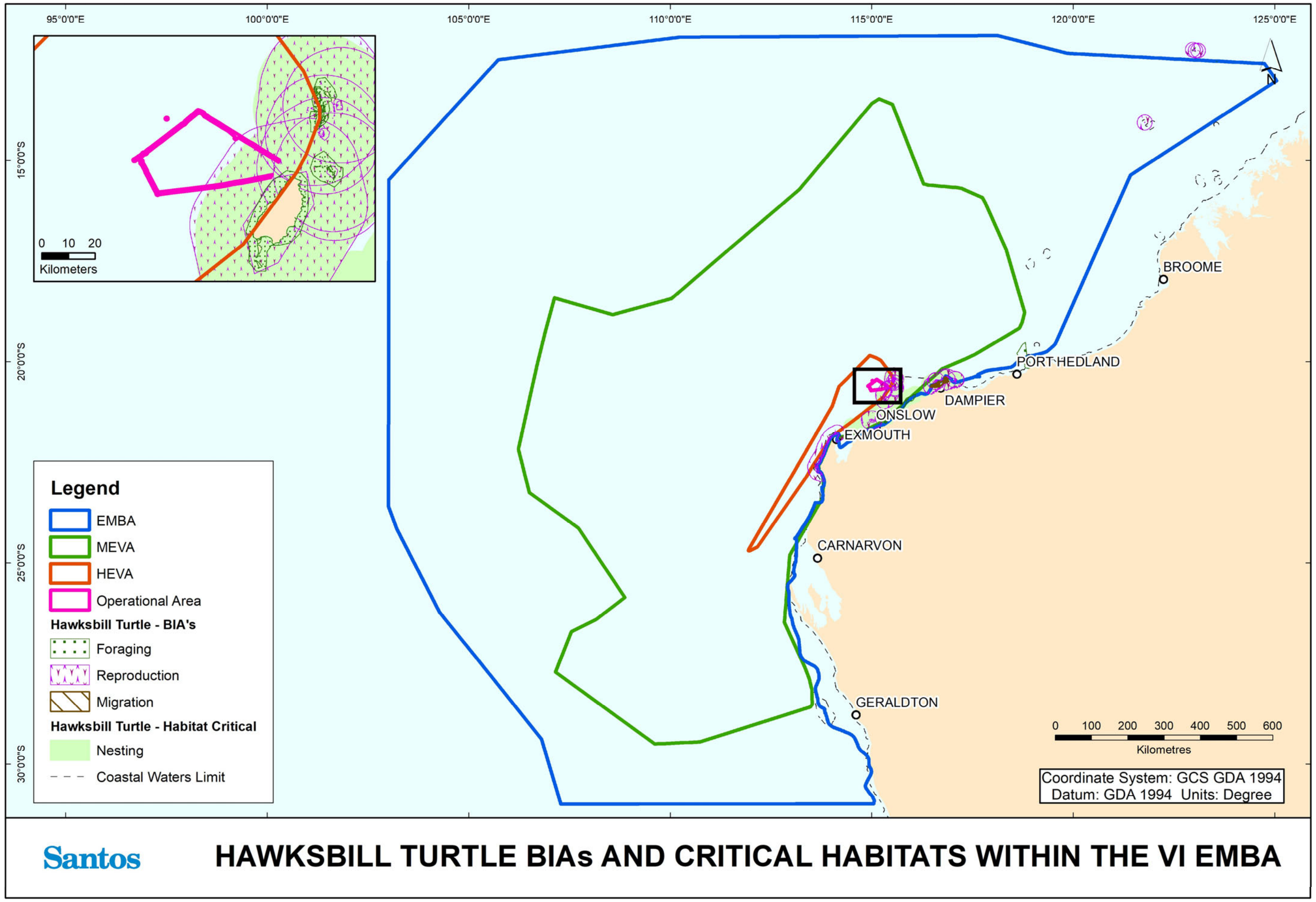


Figure 7: Biologically Important Areas and Habitat Critical for the Hawksbill Turtle in the Vicinity of the EMBA and Operational Area

6.1.4. 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). NT populations are typically found in the Gulf of Carpentaria, western Torres Strait, Wellesley Islands Group and Sand Islet.

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 8 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).

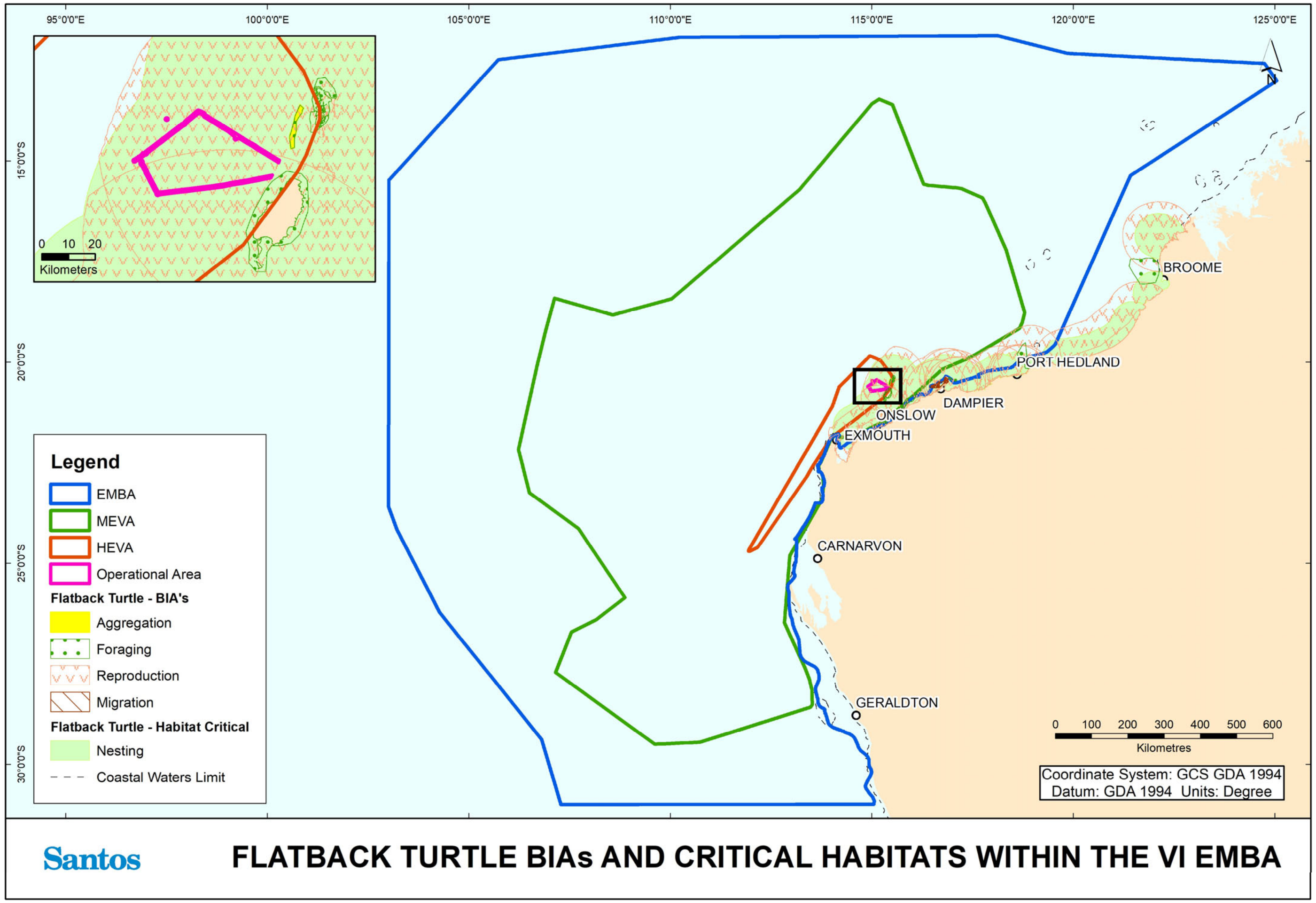


Figure 8: Biologically Important Areas and Habitat Critical for the Flatback Turtle in the Vicinity of the EMBA and Operational Area

6.1.5. 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 and NT, 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.

No BIAs for this species are found within the EMBA.

6.1.6. Olive Ridley Turtle

Olive ridley turtles (*Lepidochelys olivacea*) are the least common turtle species encountered with critical nesting habitat occurring near Vulcan Island, Darcy Island, Prior Point and Llanggi and Cape Leveque (Commonwealth of Australia 2017). They are also known to nest on Tiwi Islands, specifically on the west coast of Bathurst Island and the north coast of Melville Island. The turtles found nesting on the Tiwi Islands is the NT genetic stock whereby the long-term trends of this genetic stock are currently unknown (Commonwealth of Australia 2017). However, the number of females nesting on the Tiwi Islands are considered significant at the genetic stock, national and international level. Nesting of the NT genetic stock can occur year-round with a peak between April and June, and hatchling emergence peaking between June and August (Commonwealth of Australia, 2017).

Internesting habitat, critical to the survival of the olive ridley turtle, encompasses nearshore waters along the north, west and east coasts of the Tiwi Islands. Satellite tracking on a small sample of internesting olive ridley turtles in the region recorded that the individuals remained close to shore (waters depths typically less than 55 m deep) and within 37 km of the nesting beach during the internesting interval (Whiting et al. 2005).

The species is known to forage within the shallow benthic habitats of northern WA, the NT and Timor Sea (Limpus 2009), however, it displays unusual behaviour patterns compared to other sea turtles, in being capable of deeper (up to 140 m), benthic and exceptionally long (>2 hour) dives (McMahon et al*.,* 2007). This trait, combined with their long-distance movement patterns (Polovina et al., 2004) is thought to be indicative of less specialist foraging (McMahon et al*.,* 2007). Olive Ridley turtles forage as far south as the Dampier Archipelago-Montebello Islands and have also been sighted in the Christmas and Cocos (Keeling) Islands in the north of the EMBA and is thought to feed primarily on gastropods and small crabs within the benthic, soft-bottomed communities of the continental shelf (Limpus 2009). Their extensive movements and variability in migration patterns suggest this species may be susceptible to a wide range of human activities (McMahon et al*.,* 2007).

No BIAs for this species are found within the EMBA.

6.2. 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 and NT waters (Appendix D of the VI Hub Operations 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 Minton 1975). 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. However, both Ashmore Reef and Cartier Island are characterised for both a high density and high diversity of seasnakes (DSEWPaC 2012b). The limited evidence available suggests that there are no sea snakes in at least the coastal waters of Cocos (Keeling) Islands, and few sea snake sightings in the waters of the Christmas Island territory (Brewer et al., 2009).

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 VI Hub Operations EP):

- Short-nosed seasnake (*Aipysurus apraefrontalis*)
- Leaf-scaled seasnake (*Aipysurus foliosquama*).

6.2.1. 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.

6.2.2. 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 (Minton and Heatwole 1975). The leaf-scaled seasnake forages by searching in fish burrows on the reef flat (DoE 2014).

6.3. 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 13.2**.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.

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*	Nesting, migration, foraging and reproduction – islands and coastline of the Kimberley region and islands of the North West Shelf, Ningaloo coast and Jurabi coast	De Grey River to Bedout Island Dirk Hartog Island Gnarloo Bay Lowendal IslandMontebello Island Muiron Island Ningaloo Coast and Jurabi coast Rosemary Island	Exmouth and Ningaloo coast. 20 km internesting buffer Gnarloo Bay and beaches. 20 km internesting buffer Shark Bay, all coastal and island beaches out the to the northern tip of Dirk Hartog Island. 20 km internesting buffer
Green turtle	*Chelonia mydas*	Nesting, migration foraging, aggregation, mating, basking and reproduction – Offshore islands in the Browse Basin, North West Shelf and Kimberley/Pilbara coastlines Mating/nesting – Dampier Archipelago Basking – Middle Island	Barrow Island Cartier 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) De Grey River area to Bedout Island Delambre Island Greens - inshore tidal and shallow subtidal areas around Barrow Island West Coast Barrow Island West Coast and North Coast Montebello Island - Hermite Island, Trimouille Island Montebello Islands North and South Muiron Island North Turtle Island North West Cape Scott Reef Scott Reef - Sandy Islet Seringapatam Reef String of islands between Cape Preston and Onslow, inshore of Barrow Island	Cartier Reef. 20 km internesting buffer Scott Reef. 20 km internesting buffer Dampier Archipelago. 20 km internesting buffer Barrow Island, Montebello Islands, Serrurier Island and Thevenard Island. 20 km internesting buffer Exmouth Gulf and Ningaloo coast. 20 km internesting buffer
Hawksbill turtle	*Eretmochelys imbricata*	Nesting, migration, mating, foraging and reproduction – Offshore islands in the Browse Basin, North West Shelf and Kimberley/Pilbara coastlines Mating/ nesting/ reproduction – Lowendal group, Montebello Islands	Ah Chong and South East Island Barrow Island Cartier Island Dampier Archipelago (islands to the west of the Burrup Peninsula) De Grey River area to Bedout Island Delambre Island Delambre Island (and other Dampier Archipelago Islands) Hawksbills - shallow water coral reef and artificial reef (pipeline) habitat Lowendal Island Group Montebello Island - Hermite Island, Trimouille Island Ningaloo coast and Jurabi coast Rosemary Island Scott Reef String of islands between Cape Preston and Onslow, inshore of Barrow Island Thevenard Island Varanus 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
Flatback turtle	*Natator depressus*	Nesting, migration, mating, aggregation, foraging, reproduction – Islands of the North West Shelf and the Pilbara/ Kimberley coastlines Mating, nesting – Barrow Island	Eighty Mile beach 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) De Grey River area to Bedout Island Delambre Island Lacepede Island Montebello Island - Hermite Island, Trimouille Island North Turtle Island String of islands between Cape Preston and Onslow, inshore of Barrow Is Thevenard Island - South coast	Lacepede Islands. 60 km internesting buffer Eighty-mile Beach - coastal beach. 60 km internesting buffer 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

7. Marine Mammals

Forty species of listed marine mammals are known to occur in the EMBA, according to the Protected Matters search (Appendix D of the VI Hub Operations EP).

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		
Sei whale (*Balaenoptera borealis*)	Vulnerable Migratory	Endangered	-	Foraging, feeding or related behaviour likely to occur within area	None - No BIA defined
Blue whale (*Balaenoptera musculus*)	Endangered Migratory	Endangered	-	Migration route known to occur within area. Overlap with BIA for migration and foraging	Yes – Refer to **Table 9**
Fin whale (*Balaenoptera physalus*)	Vulnerable Migratory	Endangered	-	Foraging, feeding or related behaviour likely to occur within area	None - No BIA defined
Southern right whale (*Eubalaena australis*)	Endangered Migratory	Vulnerable	-	Species or species habitat likely to occur within area	None - BIA not found in EMBA
Humpback whale (*Megaptera novaeangliae*)	Migratory	Special conservation interest and Migratory	-	Congregation or aggregation known to occur within area. Overlap with BIA for migration and resting.	Yes – Refer to **Table 9**
Sperm whale (*Physeter macrocephalus*)	Migratory	Vulnerable	-	Species or species habitat may occur within area	None - BIA not found in EMBA
Antarctic minke whale (*Balaenoptera bonaerensis*)	Migratory	Migratory	-	Species or species habitat likely to occur within area	None - No BIA defined
Bryde's whale (*Balaenoptera edeni*)	Migratory	Migratory	- -	Species or species habitat likely to occur within area	None - No BIA defined

Species	Conservation Status			Likelihood of occurrence in EMBA	BIA in EMBA
	EPBC Act 1999	BC Act 2016	Other WA Conservation Code		
Pygmy right whale (*Caperea marginata*)	Migratory	Migratory	-	Species or species habitat may 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 known to occur within area	None - BIA not found in EMBA
Australian sea lion (*Neophoca cinerea*)	Endangered	Endangered	-	Breeding known to occur within area. Overlaps with BIA for foraging.	Yes – Refer to **Table 9**
Dugong (*Dugong dugon*)	Migratory	Migratory	-	Breeding known to occur within area Overlaps with BIA for foraging and reproduction, calving and nursing	Yes – Refer to **Table 9**

7.1. Threatened and Migratory Species

7.1.1. 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).

7.1.2. 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 2008a). 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, Craig 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 and the Perth Canyon (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 2015a). 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 that overlap the EMBA are detailed in Table 9 and depicted in **Figure 9.** 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/reproduction) 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).

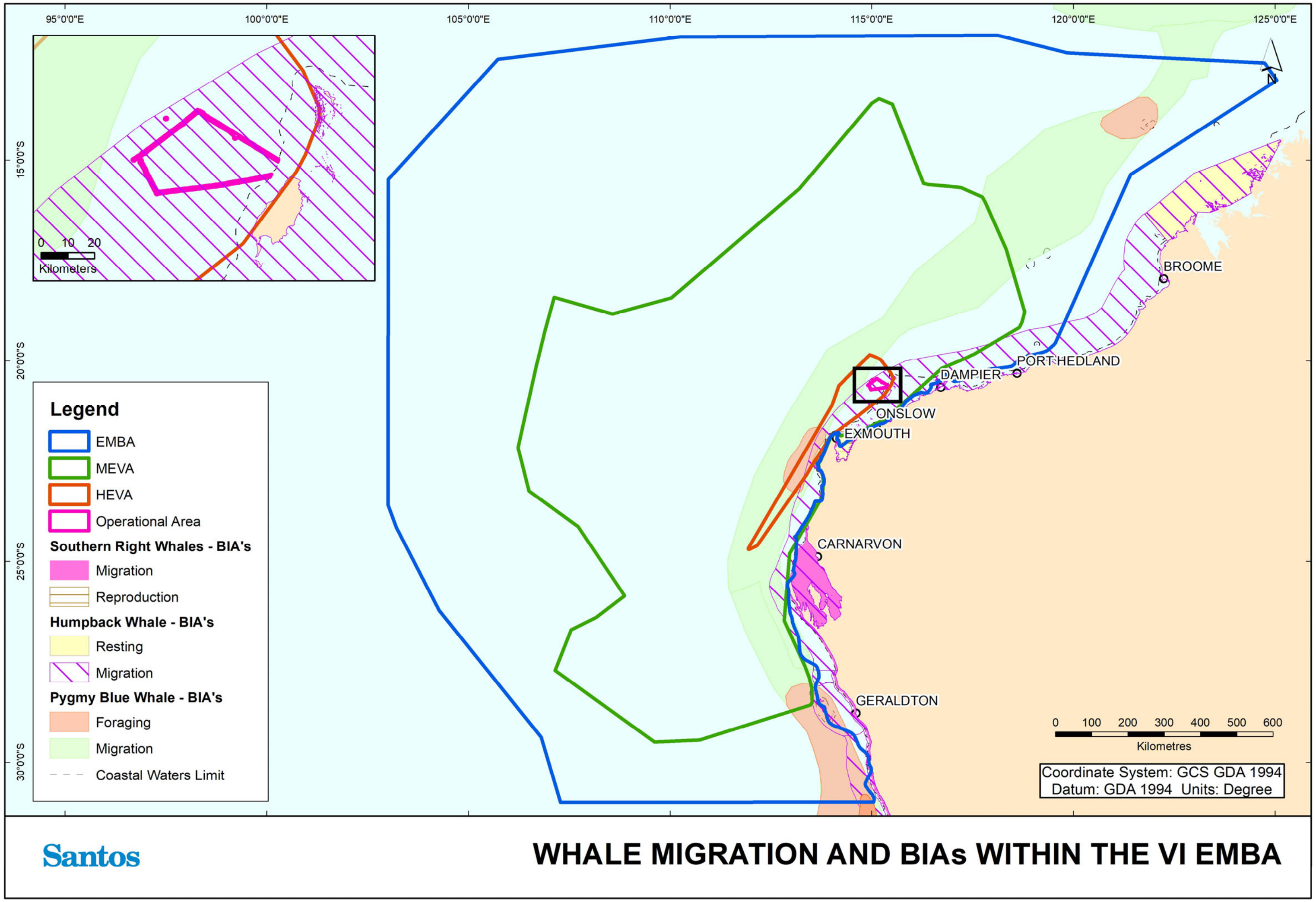


Figure 9: Biologically Important Areas for EPBC Protected Whale Species in the Vicinity of the EMBA and Operational Area

7.1.3. 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. During summer and autumn this species has been recorded acoustically at the Rottnest Trench.

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).

7.1.4. 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 reproduction 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). Details of BIAs that overlap the EMBA for this species are provided in **Table 9** are shown in **Figure 9**.

7.1.5. 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 (Ivine & 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 that overlap the EMBA are provided in **Table 9**.

7.1.6. Sperm Whale

Sperm whales typically occur in WA along the southern coastline between Cape Leeuwin and Esperance (Bannister et al. 1996). Sperm whales are distributed worldwide in deep waters (greater than 400 m) off continental shelves and sometimes near shelf edges, averaging 20 to 30 nautical miles offshore (Hooker et al.1999, Pirotta et al., 2011). The sperm whale is known to migrate northwards in winter and southwards in summer, however, detailed information on the distribution of sperm whales is not available for the timing of migrations. Sperm whales have been recorded in deep water off the North West Cape on the west coast of Western Australia (RPS 2010b) and appear to occasionally venture into shallower waters in other areas (RPS 2010b). No BIAs for this species are within the EMBA**.**

7.1.7. Antarctic Minke Whale

The Antarctic minke whale is distributed throughout the Southern Hemisphere from 55°S to the Antarctic ice edge during the austral summer and has been recorded in all Australian States (Bannister et al. 1996; Perrin & Brownell 2002). Detailed information on timing and location of migrations and breeding grounds on the west coast of Australia is largely unknown. However, it is believed that the Antarctic minke whale migrates up the WA coast to approximately 20°S during Australian winter to feed and possibly breed (Bannister et al. 1996).

7.1.8. 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.

7.1.9. Pygmy Right Whale

The pygmy right whale is considered the most elusive baleen whale and as a result very little is known about the whale's distribution in Australian waters. Records of the pygmy right whale in Australian waters are distributed between 32°S and 47°S and are restricted in the west by the Leeuwin current (Kemper 2002). It is possible that the pygmy right whale will be encountered in the southern extent of the EMBA, particularly in coastal areas of upwelling (Kemper 2002).

7.1.10. 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.

7.1.11. 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). No BIAs for this species are within the EMBA.

7.1.12. 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.

No BIAs for this species are within the EMBA.

7.1.13. Australian Sea Lion

The Australian sea lion is endemic to Australia. Breeding colonies are found only in South Australian and Western Australian waters. There are currently 76 known Australian sea lion pupping locations along the coast and offshore islands between the Houtman Abrolhos Islands in Western Australia to the Pages Islands in South Australia (DSEWPaC 2013c). The species has also been recorded at Shark Bay (DoE 2014a).

BIAs for foraging, haul-out and reproduction sites identified by the National Conservation Values Atlas are located south of the waters from Busselton to the NT (DAWE 2020b). Male Australian sea lions have been recorded foraging in areas up to 60 km away from their birth colonies, with potentially larger dispersal ranges up to 180 km (Hamer et al. 2011). However, female Australian sea lions have restricted home ranges, with high rates of natal site fidelity and limited gene flow with other regions (Campbell 2005). The Australian sea lion BIA in the EMBA is outlined in **Table 9** and is depicted in **Figure 10.**

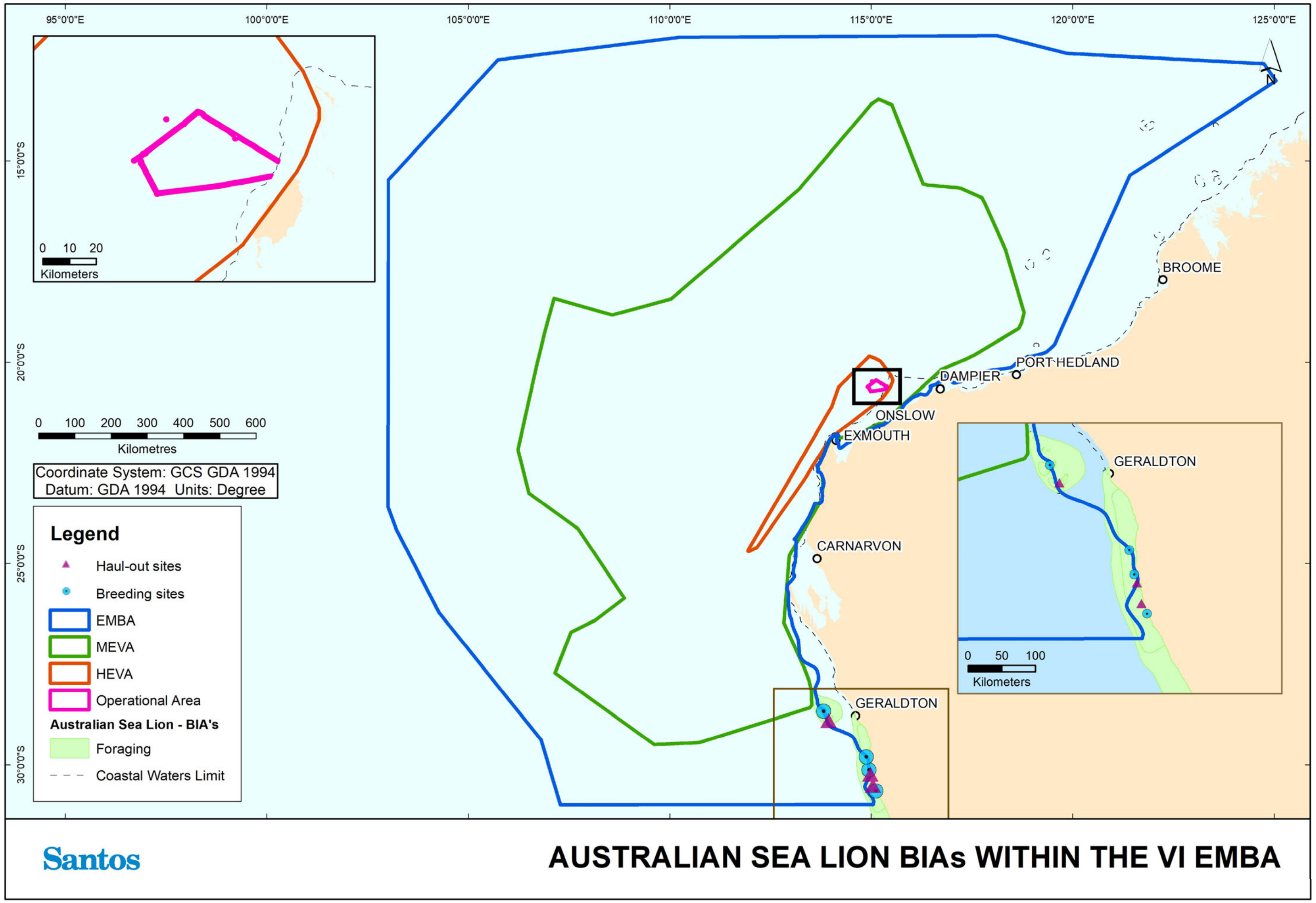


Figure 10: Biologically Important Areas for the Australian Sea Lion in the Vicinity of the EMBA and Operational Area

7.1.14. 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). Satellite-tracking data from dugongs tagged as part of the INPEX Ichthys Project baseline surveys observed that dugongs around the Vernon Islands, south of Melville Island, spent time in Darwin Harbour and around the Tiwi Islands (INPEX, 2010). Routine sightings occur in various locations along the NT coastline, including within Darwin Harbour, to the south of Melville Island.

The dugong BIAs in the EMBA are detailed in **Table 9** and shown **in Figure 11.**

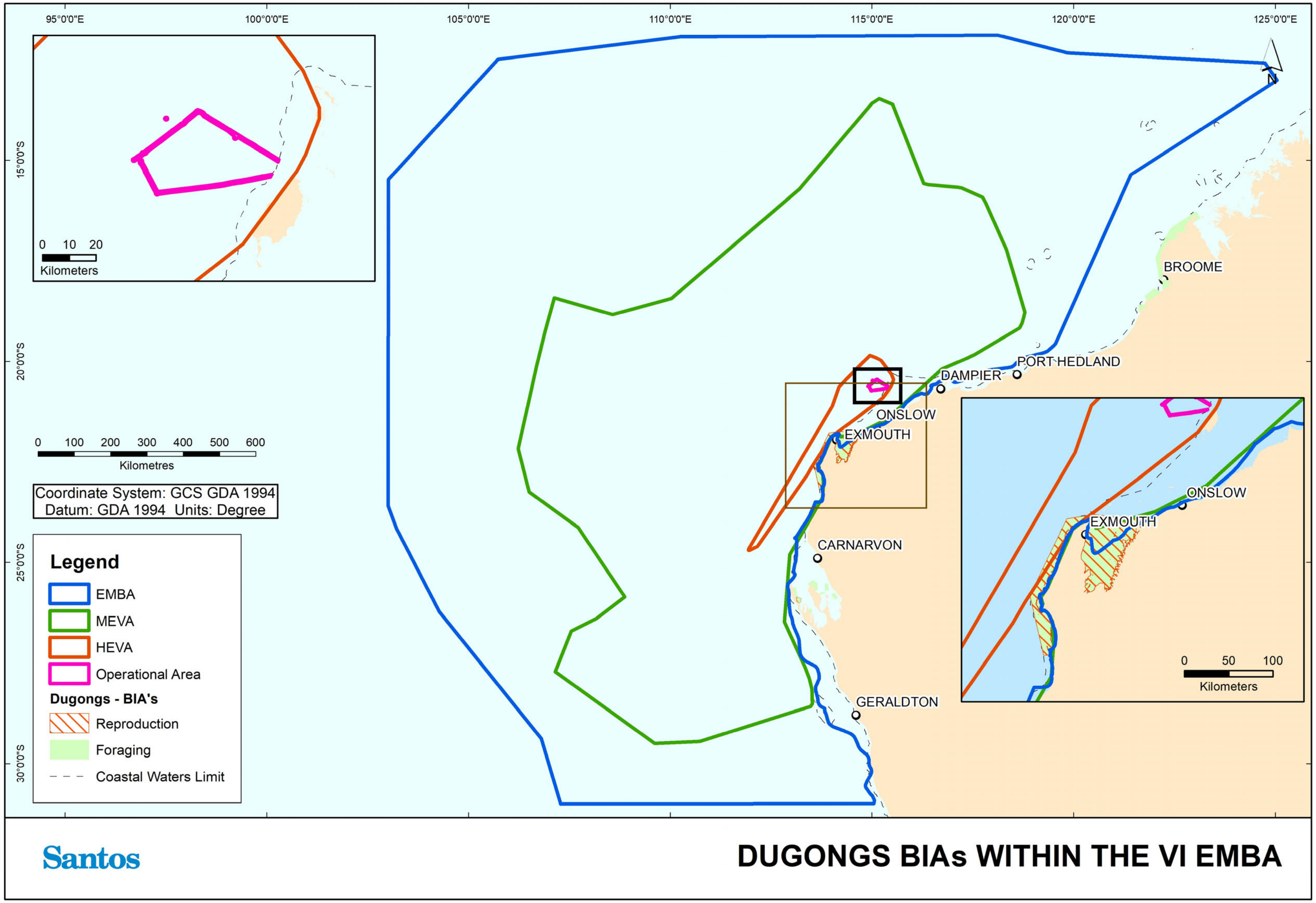


Figure 11: Biologically Important Areas for Dugongs in the Vicinity of the EMBA and Operational Area

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	Humpback whale	Australian sea lion
Species expected in area	Unknown	Yes	Unknown	Unlikely, southern distribution	Yes	Unlikely, southern distribution
Migration depth (m)	Unknown, prefers offshore waters	500-1,000	Unknown	n/a	Up to 100	n/a
Migration seasonality	Unknown	Apr to Aug (north), Oct to Jan (south)	Unknown	Apr to Oct	Jun to Nov	n/a

7.2. 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 13.2**.

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
Blue and 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.	south of Jurien Bay Pygmy blue whale - 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
Southern right whale	*Eubalaena australis*	Breeding/calving – along the south west and southern coastline of WA/SA, Exmouth Gulf Migration – along south west coast up to Exmouth Gulf	Exmouth Gulf
Humpback whale	*Megaptera novaeangliae*	Reproduction/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	Houtman Abrolhos Exmouth Gulf Houtman Abrolhos Islands North of Houtman Abrolhos Shark Bay 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.
Australian sea lion	*Neophoca cinerea*	Foraging – male and female – Houtman Abrolhos Island, mid-west coast (more restricted spatial extent than males) Foraging – males Houtman Abrolhos Island, mid-west coast down to Perth	Houtman Abrolhos Islands Mid-west coast, includes Beagle Island, , Jurien Bay,

Species	Scientific name	Aggregation area and use	BIAs within EMBA
		Reproduction – Buller Island, North Fisherman Island, Beagle Island, Abrolhos Island Haul Out Sites – North Cervantes Island, Sandland Island, Abrolhos Island	
Dugong	*Dugong dugon*	Foraging –Dampier Peninsula, Roebuck Bay, Shark Bay, Exmouth and Ningaloo coastline Migration – Roebuck Bay and North East Peron Peninsula, Shark Bay Reproduction/calving/nursing – Exmouth and the Ningaloo coastline	Dirk Hartog Island, Shark Bay Exmouth Gulf South Passage, Shark Bay

8. 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. Resident coastal and terrestrial species include osprey (*Pandion cristatus*), white-bellied sea eagle (*Haliaeetus leucogaster*), silver gull (*Larus novaehollandiae*) and eastern reef egret (*Egreta sacra*) (DEWHA 2008a).

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, including oystercatchers are resident (Surman & Nicholson 2013). 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 9.2**.

8.1. Regional Surveys

8.1.1. Abrolhos Islands

The Abrolhos Islands are one of the most significant seabird nesting areas in the eastern Indian Ocean with over two million birds breeding on the islands and small rocky atolls in the Abrolhos (DoF 2012). The mixture of species is unique, as subtropical and tropical species, and littoral and oceanic foragers, share the breeding islands. A total of 95 bird species have been recorded as residents or visitors to the Abrolhos Islands. Of these 35 species are known to breed at the Abrolhos (DoF, 2012):

- Common noddy (rookery – Pelseart Island): The Abrolhos supports 80% of the Australian breeding population of the common noddy (*Anous stolidus*) with up to 250,000 common noddies breed at Pelsaert Island. These birds lay their eggs in spring, but the actual month can vary, depending on their food supply and the weather conditions existing in offshore waters (DoF 2012)
- Caspian tern (rookeries – Leo Island, West Wallabi Island and Pelsaert Island): Unlike other more social terns, Caspian terns (*Hydroprogne caspia*) are usually solitary nesters. There are less than 150 of these breeding at the Abrolhos, across 22 islands (DoF 2012)
- Wedge-tailed shearwaters (rookeries): The Abrolhos are the most important breeding sites in Australia for the wedge tailed shearwater (*Ardenna pacifica*), with between 500,000 and 1,000,000 of these birds breeding there every year, predominantly on West Wallabi Island. The wedge-tailed shearwater breeding colonies at the Abrolhos are the largest in Australia (DoF 2012)
- Bridled tern (rookeries – Gun Island, Leo Island, Pelsaert Island, Little North Island, Fisherman Islands, Beagle Islands and Penguin Island): Bridled terns (*Onychoprion anaethetus*) breed on 90 islands throughout the Abrolhos. These birds fly north for the winter, through Indonesia to waters around the Philippines. There are approximately 4,000 bridled terns who return to the Abrolhos around October every year to lay their eggs. Bridled terns nest on more islands in the Abrolhos than any other bird species (DoF, 2012)

- Osprey (nesting area – Pelseart Island): Up to 100 eastern ospreys (*Pandion cristatus*) nest at a number of sites throughout all three island groups at the Abrolhos, including nesting platforms made from converted rock lobster pots and stacked fishing equipment on jetties (DoF 2012)
- White-bellied Sea eagle (nesting area – West Wallabi Island): At the Abrolhos, there are up to 50 breeding white-bellied sea eagles (*Haliaeetus leucogaster*), spread across all three island groups (DoF 2012)
- Australian lesser noddy (feeding area and rookeries Morley Island, Wooded Island and Pelseart Island): In Australia the Australian lesser noddy is only known to breed in this area and is known to forage between the islands and the continental shelf edge
- Other areas rookeries identified for both the wedge-tailed shearwater and bridled tern within the south west area include Lancelin Island, Rottnest Island and Safety Bay.

8.1.2. 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).

8.1.3. 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).

8.1.4. 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 2005).

8.1.5. 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).

8.1.6. 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.

8.2. Threatened Species

A Protected Matters search of the EMBA identified 43 bird species (Appendix D of the VI Hub Operations EP) listed as threatened under the EPBC Act.

An examination of the Species Profile and Threats database (DAWE 2020a) 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 10** along with their WA conservation status (as applicable) and discussed below. There are an additional 36 migratory species listed under the EPBC Act, with these detailed in **Table 12.** BIAs for birds are detailed in **Table 16** and depicted in **Figure 12.**

Table 10: 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*)	Endangered, 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
Great knot[8] (*Calidris tenuirostris)*	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 may occur within area	None - No BIA defined
Northern Siberian bar-tailed godwit (*Limosa lapponica menzbieri)*	Critically endangered, Migratory[6]	Critically endangered, Specially protected (migratory)[6]	-	Critically endangered	Species or species habitat may occur within area	None - No BIA defined
Eastern curlew[8] (*Numenius madagascariensis)*	Critically endangered, Migratory	Critically endangered	-	Critically endangered	Species or species habitat may 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
Seabirds						
Australian lesser noddy (*Anous tenuirostris melanops)*	Vulnerable	Endangered	-	-	Foraging, feeding or related behaviour known to occur within area. Overlaps with foraging BIA	Yes – refer to **Table 16**
Fairy prion (southern) (*Pachyptila tutur subantarctica)*	Vulnerable	-	-	-	Species or species habitat may occur within area	None - No BIA defined
Southern royal albatross (*Diomedea epomophora)*	Vulnerable, Migratory	Vulnerable	-	-	Species or species habitat likely to occur within area	None - No BIA defined
Amsterdam albatross (*Diomedea amsterdamensis*)	Endangered, Migratory	Critically endangered	-	-	Species or species habitat likely to occur within area	None - No BIA defined
Sooty Albatross (*Phoebetria fusca)*	Vulnerable, Migratory	Endangered	-	-	Species or species habitat may occur within area	None - No BIA defined

Species	Conservation Status				Likelihood of occurrence in EMBA	BIAs in EMBA
	EPBC Act 1999	BC Act 2016	Other WA Conservation Code	TPWC Act 1976		
Wandering albatross (*Diomedea exulans)*	Vulnerable, Migratory	Vulnerable	-	-	Species or species habitat likely to occur within area	None - BIA not found in EMBA
Christmas Island frigatebird (*Fregata andrewsi)*	Endangered, Migratory	Specially protected (migratory)	-	Endangered	Foraging, feeding or related behaviour may occur within area	None - No BIA defined
Southern giant petrel (*Macronectes giganteus)*	Endangered, Migratory	Specially protected (migratory)	-	-	Species or species habitat may occur within area	None - BIA not found in EMBA
Northern giant petrel (*Macronectes halli)*	Vulnerable, Migratory	Specially protected (migratory)	-	-	Species or species habitat may occur within area	None - BIA not found in EMBA
Abbott's booby (*Papasula abbotti)*	Endangered	-	-	Endangered	Species or species habitat may occur within area	None - No BIA defined
Soft-plumaged petrel (*Pterodroma mollis)*	Vulnerable	-	-	-	Foraging, feeding, or related behaviour known to occur within area. Overlaps with foraging BIA	Yes – refer to **Table 16**
Blue petrel (*Halobaena caerulea)*	Vulnerable	-	-	-	Species or species habitat may occur within area	None - No BIA defined
Australian fairy tern (*Sternula nereis nereis)*	Vulnerable	Vulnerable	-	-	Breeding known to occur within area Overlaps with reproduction and feeding BIAs	Yes – refer to **Table 16**
Indian yellow-nosed albatross (*Thalassarche carteri)*	Vulnerable, Migratory	Endangered	-	-	Foraging, feeding or related behaviour may occur within area	None - BIA not found in EMBA
Shy albatross (*Thalassarche cauta)*	Endangered, Migratory	Vulnerable	-	-	Species or species habitat may occur within area	None - BIA not found in EMBA
White-capped albatross (*Thalassarche steadi)*	Vulnerable, Migratory	Vulnerable	-	-	Foraging, feeding or related behaviour likely to occur within area	None - BIA not found in EMBA
Black-browed albatross (*Thalassarche melanophris)*	Vulnerable, Migratory	Endangered	-	-	Species or species habitat may occur within 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		
Campbell albatross (*Thalassarche impavida)*	Vulnerable, Migratory	Vulnerable	-	-	Species or species habitat may occur within area	None - BIA not found in EMBA
Christmas Island white-tailed tropicbird (*Phaethon lepturus fulvus)*	Endangered	-	-	-	Species or species habitat may occur within area	None - No BIA defined

8.2.1. Shorebirds

Red Knot (New Siberian Islands and north-eastern Siberia)

The red knot 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 species is a migratory 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).

Great Knot

The great knot is a migratory shorebird with a global distribution, breeding in north-east Siberia and spending the non-breeding season along coasts from Arabia to Australia. Non-breeding birds migrate to inlets, bays, harbours, estuaries and lagoons with large intertidal mud and sand flats where they feed on bivalves, gastropods, crustaceans and other invertebrates (Higgins & Davies 1996 in Garnet et al. 2011).

Greater Sand Plover

The greater sand plover and lesser are congeners that breed in China, Mongolia and Russia. The greater sand plover spends the non-breeding season along coasts from Japan through southeast Asia to Australasia. 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 (Western Alaskan and 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 western Alaskan subspecies occurs especially on the north and east coasts of Australia whilst the northern Siberian subspecies occurs especially along the coasts of north Western Australia (DAWE 2020a).

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 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 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).

8.2.2. Seabirds

Australian Lesser Noddy

This species is usually found only around its breeding islands in the Houtman Abrolhos Islands in Western Australia (Storr et al. 1986). The Australian lesser noddy occupies coral-limestone islands that are densely fringed with white mangrove *Avicennia marina*, and it occasionally occurs on shingle or sandy beaches (Higgins & Davies 1996 in DAWE 2020a). This species is thought to be sedentary or resident, staying near to its breeding islands in the non-breeding season. It may leave nesting islands for short periods during the non-breeding season, and probably forages widely (Higgins & Davies 1996 in DAWE 2020a).

Breeding apparently occurs only on Morley, Wooded and Pelsaert Islands at the Houtman Abrolhos Islands (Higgins and Davies 1996 in DoE 2014b). Mangrove stands support approximately 68,000 breeding pairs spread over the three islands (Surman & Nicholson 2006). Breeding may also occur on Ashmore Reef (Stokes & Hinchey 1990). The breeding season extends from mid-August to early April (Higgins & Davies 1996 in DoE 2014b).

The National Conservation Values Atlas identifies BIAs for this species in the area of the Houtman Abrolhos islands (**Table 16**). The Species Group Report Card – Seabirds (DSEWPaC 2012b) states that the entire Australian population of this species breeds in the South-west Marine Region, south of Busselton.

Albatrosses

A Protected Matters search of the waters in the EMBA (Appendix D of the VI Hub Operations EP) identified several albatross species that may occur in the area, comprising of the southern royal albatross, northern royal albatross, Amsterdam albatross, wandering albatross, Indian yellow-nosed albatross, shy albatross, sooty albatross, white-capped albatross and Campbell albatross. All these species predominantly occur in subantarctic to subtropical waters and breed on islands in the southern oceans (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 these species in the area from Busselton to the NT border. However, a BIA for the Indian yellow-nosed albatross is identified for foraging north to Shark bay and extending east into Bass Strait.

Christmas Island Frigatebird

The Christmas Island frigatebird is a very large seabird. Breeding colonies of the Christmas Island frigatebird is currently confined to Christmas Island in the Indian Ocean (Birdlife International 2019) but forages and roosts widely in south-east Asia and Indian Ocean No breeding colonies have ever been found away from Christmas Island. The Christmas Island Frigatebird predominantly nests in forests on shore terraces that are protected from prevailing south-east trade winds (TSSC 2020a). All forest containing nesting and roosting sites, including currently known nesting and roosting colonies and any other smaller groups of nests and roosts on Christmas Island is considered critical habitat (TSSC 2020a).

Southern Giant Petrel

The southern giant petrel 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 EMBA.

Northern Giant Petrel

The northern giant petrel occupies the Antarctic Polar Front. In summer, it occurs predominantly in sub-Antarctic to Antarctic waters, usually between 40 and 64° The northern giant-petrel breeds on sub-Antarctic islands. Its breeding range extends into the Antarctic zone at South Georgia. It nests in coastal areas where vegetation or broken terrain offers shelter, on sea-facing slopes, headlands, in the lee of banks, under or against vegetation clumps, below cliffs or overhanging rocks, or in hollows. On Campbell Island, it nests on the edge of the coastal plateau. Tussock-grass is widespread at many breeding sites. Its nests are built in secluded, coastal sites, sheltered by heavy vegetation. On Antipodes Island, it nests under *Senecio antipoda* (DoE 2014d).

The National Conservation Values Atlas (DAWE 2020b) does not identify any BIAs for this species in the EMBA.

Soft-Plumaged Petrel

The soft-plumaged petrel is generally found over temperate and subantarctic waters in the South Atlantic, Southern Indian and western South Pacific Oceans. The species breeds colonially on islands in the southern oceans. Breeding occurs from August to May (Marchant & Higgins 1990 in DAWE 2020a).

A BIA for this species is identified for foraging in seas north to 21°30’S off WA.

Blue Petrel

The blue petrel is marine species of the Sub Antarctic and Antarctic seas. In summer, it occurs mainly over waters of -2 to 2° C in surface temperature, but it also ranges south to the edge of the pack-ice and north to approximately 30° south, or further north over cool currents (DoE 2014e). In the Antarctic, it generally avoids the pack-ice, and only occasionally approaches the edge of the ice. Given the location of the EMBA, this species is unlikely to occur.

The National Conservation Values Atlas (DAWE 2020b) does not identify any BIAs for this species in the EMBA.

Abbott’s Booby

Currently, Abbott's booby is only known to breed on Christmas Island and to forage in the waters surrounding the island and south-east Asia (TSSC 2020b). Within Christmas Island, most nests are found in the tall plateau forest on the central and western areas of the island, and in the upper terrace forest of the northern coast.

The National Conservation Values Atlas (DoEE 2019b) does not identify any BIAs for this species in the area spanning SW WA to the NT border. Critical habitat is considered all known nesting trees and all forest vegetation within a 200m radius of known nesting trees on Christmas Island (TSSC 2020).

Australian Fairy Tern

The Australian fairy tern 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) as a BIA for foraging. Biologically important breeding areas were also identified scattered along the coast between Shark Bay and the Pilbara (**Table 16**).

Christmas Island White-tailed Tropicbird

The Christmas Island white-tailed tropicbird is endemic to Christmas Island and leaves the island to forage in the warm waters of the Indian Ocean (Garnett 2011). The white-tailed tropicbird roots at sea; only incubating or brooding adults remain on nests on the island at night (Stokes 1988).

The National Conservation Values Atlas (DAWE 2020b) does not identify any BIAs for this species within the EMBA.

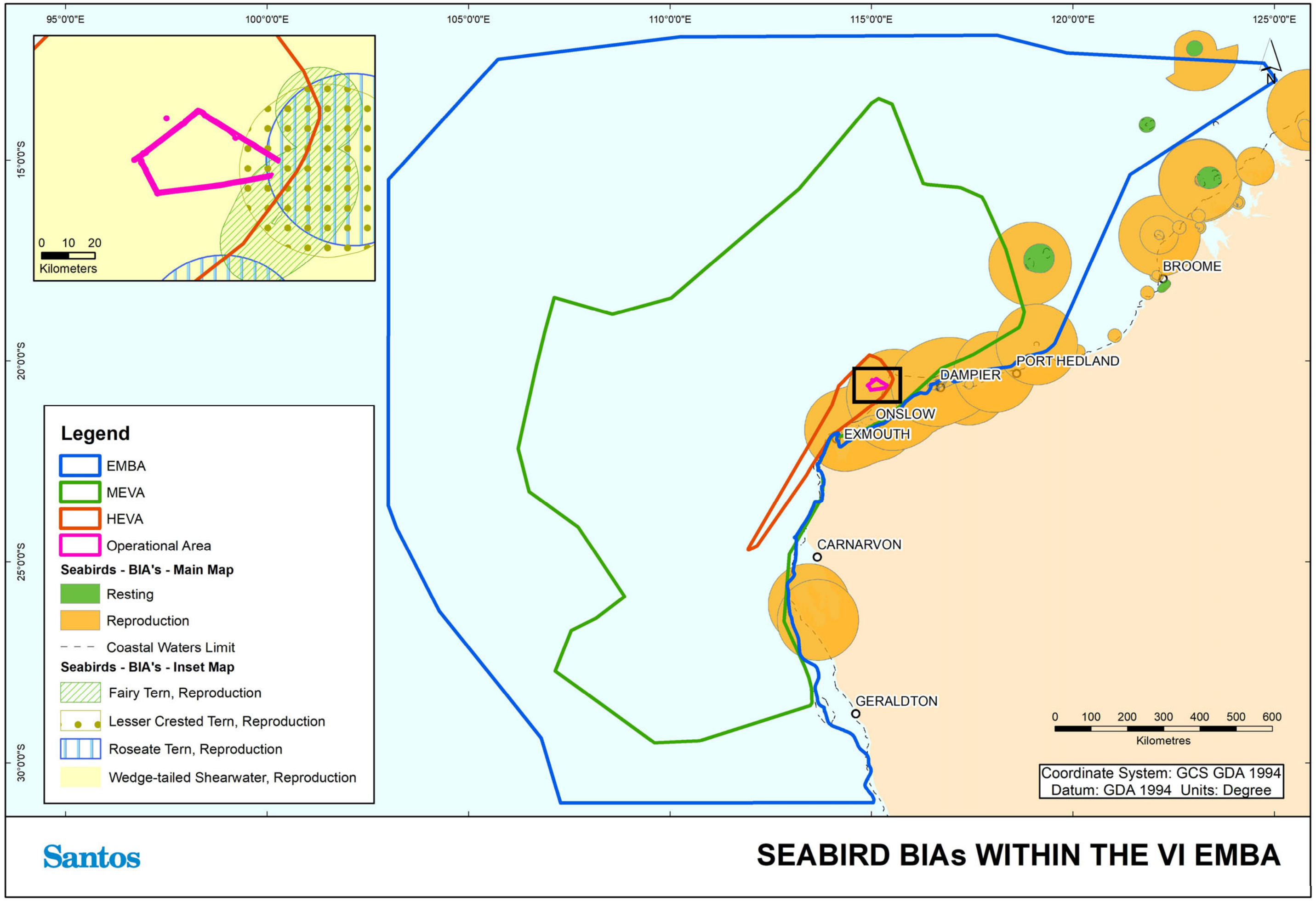


Figure 12: Biologically Important Areas for EPBC Protected Seabird Species in the Vicinity of the EMBA and Operational Area

Table 11: 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
Great knot[8]	Yes	No	Bivalves, gastropods, crustaceans and other invertebrates taken from shorelines
Greater sand plover/lesser sand plover	Yes	No	Marine invertebrates taken from shorelines
Bar-tailed godwit	Yes	No	Annelids, bivalves and crustaceans taken from shorelines
Eastern curlew[8]	Yes	No	Marine invertebrates associated with seagrass
Australian painted snipe	Yes	No	Seeds and small invertebrates
Northern Siberian bar-tailed godwit	Yes	No	Worms, molluscs, crustaceans, insects and some plant material
Seabirds			
Australian lesser noddy	May forage from Kalbarri to Shark Bay	No	Small fish taken from marine and coastal waters (DoE 2014b)
Amsterdam albatross	Low densities	No	Cephalopods, fish and crustaceans taken from marine and coastal waters.
Black-browed albatross	Low densities	No	Cephalopods, fish and crustaceans taken from marine and coastal waters.
Campbell albatross	Low densities	No	Cephalopods, fish, salps, jellyfish and crustaceans taken from marine and coastal waters.
Indian yellow-nosed albatross	Low densities	No	Cephalopods, and fish taken from marine and coastal waters.
Northern royal albatross	Low densities	No	Cephalopods, fish, salps and crustaceans taken from marine and coastal waters.
Shy albatross	Low densities	No	Cephalopods, fish and crustaceans taken from marine and coastal waters.
Sooty albatross	Low densities	No	Cephalopods, fish, crustaceans, siphonophores and penguin carrion taken from marine waters.
Southern royal albatross	Low densities	No	Cephalopods, and fish taken from marine and coastal waters.
Wandering albatross	Low densities	No	Cephalopods, fish and crustaceans taken from marine and coastal waters.

Species	Species Expected in EMBA	Breeding in the Area/ Seasonality	Foraging
White-capped albatross	Low densities	No	Cephalopods and fish taken from marine and coastal waters.
Southern & Northern 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)
Soft-plumaged petrel	Low densities	No	Cephalopods, fish and crustaceans taken from marine and coastal waters (DoE 2014b)
Australian fairy tern	Yes	Yes Aug to Feb	Bait fish taken from coastal waters
Christmas Island frigatebird	Low densities	No	Planktonic crustaceans, fish and squid
Abbott's booby	Low densities	No	Fish and squid
Blue petrel	Low densities	No	Crustaceans, small fish and squid
Christmas Island white-tailed tropicbird	Very low densities	No	Squid and flying fish

[8] Species listed under the East Asian-Australasian Flyway Partnership

8.3. Migratory Species

The EPBC PMST search identified an additional 36 species listed as migratory under the EPBC Act that may occur within the EMBA. These species are listed in **Table 12**. All of these species are also listed as migratory under the BC Act, with the exceptions of:

- the flesh-footed shearwater, which is listed as vulnerable under the BC Act.
- the grey-tailed tattler and red-tailed tropicbird which are listed as migratory under the EPBC Act and migratory and a Priority 4 under the BC Act.
- the wandering tattler, which is not listed under the BC Act.

Those species that are listed as both migratory and threatened under either the EPBC Act and/or BC Act are outlined in **Table 10** and are not repeated within **Table 12**.

Table 12: Summary of migratory birds that may occur within the EMBA

Species	Common Name	Likelihood of occurrence in EMBA
Limnodromus semipalmatus	Asian dowitcher[8]	Species or species habitat may occur within area
Limosa lapponica	Bar-tailed godwit	Species or species habitat may occur within area
Limosa limosa	Black-tailed godwit[8]	Species or species habitat known to occur within area
Onychoprion anaethetus	Bridled tern	Breeding known to occur within area Overlaps foraging BIA
Sula leucogaster	Brown booby	Breeding known to occur within area
Hydroprogne caspia	Caspian tern	Breeding known to occur within area

Species	Common Name	Likelihood of occurrence in EMBA
Tringa nebularia	Common greenshank	Species or species habitat likely to occur within area
Anous stolidus	Common noddy	Species or species habitat likely to occur within area. Overlaps foraging BIA (provisioning young)
Actitis hypoleucos	Common sandpiper	Species or species habitat known to occur within area
Ardenna carneipes	Flesh-footed shearwater	Foraging, feeding or related behaviour likely 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
Pluvialis squatarola	Grey plover	Species or species habitat known to occur within area
Tringa brevipes	Grey-tailed tattler	Species or species habitat known to occur within area
Fregata ariel	Lesser frigatebird	Species or species habitat known to occur within area Overlaps with reproduction, feeding BIA
Sternula albifrons	Little tern	Congregation or aggregation known to occur within area
Sula dactylatra	Masked booby	Breeding known to occur within area
Charadrius veredus	Oriental plover	Species or species habitat may occur within area
Glareola maldivarum	Oriental pratincole	Species or species habitat may occur within area
Pandion haliaetus	Osprey	Breeding known to occur within area
Calidris melanotos	Pectoral sandpiper	Species or species habitat may occur within area
Sula sula	Red-footed booby	Breeding known to occur within area
Calidris ruficollis	Red-necked stint	Species or species habitat known to occur within area
Cecropis daurica	Red-rumped swallow	Species or species habitat may occur within area
Phaethon rubricauda	Red-tailed tropicbird	Breeding known to occur within area
Sterna dougallii	Roseate tern	Breeding known to occur within area
Arenaria interpres	Ruddy turnstone	Species or species habitat known to occur within area
Calidris alba	Sanderling	Species or species habitat known to occur within area
Calidris acuminata	Sharp-tailed sandpiper	Species or species habitat known to occur within area
Calonectris leucomelas	Streaked shearwater	Species or species habitat likely to occur within area
Xenus cinereus	Terek sandpiper	Species or species habitat known to occur within area
Ardenna pacifica	Wedge-tailed shearwater	Breeding known to occur within area. Overlaps with reproduction and feeding BIA
Numenius phaeopus	Whimbrel	Species or species habitat known to occur within area
Phaethon lepturus	White-tailed tropicbird	Species or species habitat likely to occur within area Overlaps reproduction BIA
Tringa glareola	Wood sandpiper	Species or species habitat known to occur within area

[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 13**.

Table 13: 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	Great knot, red knot, bar-tailed godwit, black-tailed godwit, Asian dowitcher
Along sandy sea edges or near tidal creeks	Tactile hunters of microbenthos	Curlew sandpiper, red-necked stint, broad-billed sandpiper, marsh sandpiper, sharp-tailed sandpiper
Reefs or mangrove fringes	Visual hunters of slow surface-dwelling prey	Common sandpiper, sooty oystercatcher, pied oystercatcher, silver gull, ruddy turnstone
Sandier western parts of Roebuck Bay, often near-shore	Visual hunters of small fast prey	Grey plover, red-capped plover, greater sand plover, lesser sand plover, grey-tailed tattler, terek sandpiper
Soft mudflats in north-east Roebuck Bay	Visual hunters of fast large prey	Eastern curlew, whimbrel, greenshank, striated heron and black-necked stork
Soft mudflats in north-east Roebuck Bay	Kleptoparasites	Gull-billed tern (robs large crabs from whimbrels)

Feeding habitat	Feeding guild	Species
Creek-lines in eastern Roebuck Bay	Pelagic hunters of nekton (animals of the pelagic zone) and neuston (animals that live on the surface film)	Black-winged stilt, red-necked avocet, reef egret, little egret, great white egret, white-faced heron, royal spoonbill

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 14: Birds subject to the Wildlife Conservation Plan for Migratory Shorebirds 2015

Migratory species	DCCEEW SPRAT information on distribution
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 the NT, the Asian dowitcher is found in Darwin and Arnhem Land. 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	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. In the NT populations have been recorded from Darwin and Melville Island. Sites of international importance from WA and the NT include: • Eighty Mile Beach, WA (110,290 individuals) • Roebuck Bay, WA (65,000 individuals) • Milingimbi coast, NT (7,000 individuals) • Elcho Island, NT (5,000 individuals).
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. The population that inhabits Roebuck Bay is approximately 7,374 (>1% of the species total population).
Broad-billed sandpiper	In WA, few records occur in the south-west, but the broad-billed sandpiper may be regular in small numbers at scattered locations, from Warden Lake Nature Reserve and Coramup Creek to Guraga Lake Nature Reserve and Hurstview Lake. Individuals mostly occur on the coasts of the Pilbara and Kimberley between Onslow and Broome but are also recorded north to the mouth of Lawley River, and inland at Lake Daley.
Common greenshank	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: • Eighty Mile Beach (2,240 individuals) • Wilson Inlet (568 individuals) • Roebuck Bay (560 individuals). The NT does not have any sites of international importance.
Common redshank	In Western Australia (WA), the species is vagrant to the south-west with records at Peel Inlet, Coodanup, the Gascoyne region, Coral Bay and Carnarvon.
Common sandpiper	WA distribution includes: • Roebuck Bay • Nuytsland Nature Reserve • NT distribution includes: • Kakadu National Park • Darwin area.
Double-banded plover	The double-banded plover can be found in both coastal and inland areas. There are no nationally significant sites within WA.
Great knot[8]	The great knot has been recorded around the entirety of the Australian coast, with a few scattered records inland. The greatest numbers are found in northern Australia; where the species is common on the coasts of the Pilbara and Kimberley, from the Dampier Archipelago to the Northern Territory border. Important sites for great knot in Western Australia include: • Eighty Mile Beach (169,044 individuals) • Roebuck Bay (22,600 individuals).
Greater sand plover	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 and are sparsely scattered records from the largely inaccessible area between Roebuck Bay and Darwin. Internationally important sites within Western Australia include: • Eighty Mile Beach (64,548 individuals) • Roebuck Bay (26,900 individuals) • Ashmore Reef (1,196 individuals).
Grey plover	In Australia, the grey plover has been recorded in all states, where it is found along the coasts and are recorded frequently between Albany and the northern Kimberley coast. Internationally important sites include: • Eighty Mile Beach (1,650 individuals) • Roebuck Bay (1,300 individuals) • Peel Inlet (600 individuals) • Nuytsland Nature Reserve (409 individuals).
Grey-tailed tattler	A recent review of the species indicated an estimated 90% of the East Asian-Australasian Flyway population (approximately 45 000 individuals) spend the non-breeding season in Australia (Bamford et al. 2008). There are a few scattered records for the species along the south coast near the Eyre Bird Observatory, Point Malcolm, Rossiter Bay, Shark Lake Nature Reserve and surrounding swampland. It is found in the south-west between Augusta and Cervantes. The grey-tailed tattler is widespread from Houtman Abrolhos and the mainland adjacent to the Kimberley Division. It has also been recorded inland at Lake Argyle and on islands off the coast.
Lesser sand plover	Within Australia, the lesser sand-plover is widespread in coastal regions and has been recorded in all states. It mainly occurs in northern and eastern Australia, in south-eastern parts of the Gulf of Carpentaria, western Cape York Peninsula and islands in Torres Strait, and along the entire east coast, though it occasionally also occurs inland. In Western Australia, the following are important sites: • Eighty Mile Beach (1,575 individuals) • Roebuck Bay (1,057 individuals) • Broome (745 individuals) • Port Hedland Saltworks (668 individuals).
Little curlew	Little Curlews generally spend the non-breeding season in northern Australia from Port Hedland in Western Australia to the Queensland coast. There are records of the species from inland Australia, and widespread but scattered records on the east coast. The species has also been recorded on Lord Howe Island, Cocos-Keeling Island and Christmas Island. The species is recorded in Australia between September and April and there are few winter records. Sites of international importance for the Little Curlew within Australia, with maximum counts, include (Bamford et al. 2008): • Kakadu National Park, Northern Territory (NT), 180 000 • Roebuck Plains, Western Australia (WA), 52 000 • Anna Plains, WA, 12 000 • Derby Sewage Ponds, WA, 5000

Migratory species	DCCEEW SPRAT information on distribution
	• Parry floodplain, Wyndham, WA, 3000.
Little greenshank/ Marsh sandpiper	The marsh sandpiper is found on coastal and inland wetlands throughout Australia found mainly on the coast in Western Australia. National sites of importance within Western Australia include: • Port Hedland Saltworks (500 individuals) • Peel inlet (276 individuals) • Eighty Mile Beach (140 individuals).
Little ringed plover	Discrete populations around Perth (WA) and Darwin (NT).
Long-toed stint	In Western Australia, the species is found mainly along the coast, with a few scattered inland records. On the south coast the Long-toed Stint is found from Esperance to Albany and inland to Lake Cassencarry and Dumbleyung. On the south-west coast the species is known from the Vasse River estuary, Guraga Lake and the Namming Nature Reserve. The species has occasionally been recorded in the Gascoyne Region, around Lake Wooleen, Meeberrie Station and McNeill Claypan. It is widespread around the Pilbara region and the Kimberley Division between Karratha and Wyndham-Kununurra. Inland records include Lake Brown, Hannan Lake, Lake Biolet, Newman Sewage Farm and Lake Gregory.
Oriental plover	Internationally important marine sites: • Eighty Mile Beach, WA (approximately 57 619 individuals) • Roebuck Bay, WA (Approximately 8 750 individuals).
Oriental pratincole	Internationally important site: • 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.
Pacific golden plover	In Western Australia, the species is seldom recorded along the southern or south-western coasts but is more widespread along the Pilbara and Kimberley coasts between North-West Cape.
Pectoral sandpiper	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.
Pin-tailed snipe	The Pin-tailed Snipe breeds in Russia from the northern Ural Mountains, south to the Yamal Peninsula, south-east to Transbaikalia and northern Mongolia (between Tannu-Ola and Lake Baikal. The species also breeds in the north-east, through southern Amur to the coast west of the sea of Okhotsk (it is absent from the Kamchatka Peninsula). The species breeding range also extends from north to west along the Chukotsky Peninsula as well as the Kolyma River delta. The non-breeding distribution occurs mostly in south and south-east Asia, from eastern Pakistan, through the Indian subcontinent and the Indian Ocean islands. It is also found east through Bangladesh, Burma, Thailand and Indochina, south through the Malay Peninsula through to Indonesia. The species is rare in the Philippines. The species is vagrant to east Africa and rare in Japan (Higgins & Davies 1996)
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).
Red-necked phalarope	The red-necked phalarope is a regular at the Port Hedland Saltworks and Rottnest Island, Western Australia. The species is also found at the ICI Saltworks in South Australia.
Red-necked stint	The red-necked stint has been recorded in all coastal regions and found inland in all states when conditions are suitable. The red-necked stint probably travels in flocks and has been observed to feed in dense flocks. The Australian population was estimated at 353,000. Internationally important sites include: • Eighty Mile Beach (60,000 individuals) • Port Hedland Salt Works (23,000 individuals) • Roebuck Bay (19,800 individuals) • Wilson Inlet (15,252 individuals) • Alfred Cove Nature Reserve (10,000 individuals) • Lake Macleod (8,312 individuals) • Peel Inlet (8,063 individuals).
Ruddy turnstone	The ruddy turnstone is widespread within Australia during its non-breeding period of the year. Australian sites of international importance include: • Eighty Mile Beach (3,480 individuals) • Ashmore Reef (2,230 individuals) • Roebuck Bay (2,060 individuals) • Barrow Island (1,733 individuals) • Lacepede Islands (1,050 individuals).
Ruff (reeve)	In Western Australia, the species has been recorded at the lower King River and it is mostly found in the south-west region of the state. It has been sighted at the Vasse River estuary, north to Namming Lake and Lake McLarty. It has been periodically recorded at Port Hedland, Kununurra and the Argyle Diamond Mine. There are unconfirmed reports at Curlewis Camp, Millstream Chichester, Broome and Roebuck Bay.
Sanderling	They occur on most of the coast from Eyre to Derby, and also around Wyndham. They are more often recorded on the south and southwest coasts, north to around southern Shark Bay, with more sparsely scattered records further north in Gascoyne and Pilbara Regions and the Kimberley Division. Important sites include: • Eighty Mile Beach (2,230 individuals) • Ashmore Reef (1,132 individuals) • Roebuck Bay (1,510 individuals).
Sharp-tailed sandpiper	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: • Eighty Mile Beach (25 000 individuals) • Port Hedland Saltworks (20 000 individuals) • Lake Gregory (10 000 individuals) • Peel-Harvey system (4 030 individuals).
Swinhoe's snipe	No conclusive records exist for this species in Australia so the number of individuals that appear in Western Australia are unknown. In WA the species has been recorded in parts of the Pilbara, the Kimberley, Mount Goldsworthy, Mount Blaize. It has also been found in the north west-regions around the Mitchell Plateau

Migratory species	DCCEEW SPRAT information on distribution
Terek sandpiper	In Western Australia (WA), the terek sandpiper is rarely seen on the south coast: occasionally around Eyre and several records around Albany. On Swan River plain, it has been recorded between Bunbury and the mouth of the Moore River. The species is widespread in the Pilbara region and Kimberley Division, from Dampier to Wyndham, with occasional records around Shark Bay. Internationally important sites include: • Eighty Mile Beach (8,000 individuals) • Roebuck Bay (1,840 individuals).
Wandering tattler	Discrete population in Darwin (NT).
Whimbrel	It is common and widespread from Carnarvon to the north-east Kimberley Division, Western Australia. It is occasionally seen on the south coast of Western Australia and has occasionally been recorded in south-west Western Australia and further north to Shark Bay. Internationally important sites include: • Roebuck Bay (1,020 individuals).
Wood sandpiper	The wood sandpiper has its largest numbers recorded in north-west Australia, with all areas of national importance located in Western-Australia: • Parry Floodplain (Wyndham) (355 individuals) • Camballin (185 individuals) • Lake Argyle (90 individuals) • Shark Bay area, (80 individuals) • Vasse-Wonnerup estuary (61 individuals) • Lake McLarty (64 individuals) • Kogolup Lakes (60 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 2020) 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 2020).

Table 15: Birds (migratory) subject to the Wildlife Conservation Plan for Seabirds 2020

Migratory species	DCCEEW SPRAT information on distribution
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.
Broad-billed prion	The species has an extremely large range extending from the Southern Ocean to the South Atlantic Ocean. Adults are thought to remain in waters adjacent to breeding colonies, however, young birds seem to occur farther north to Australia and South Africa. The global population has been estimated to exceed 15 million individuals (Brooke 2004). The population is suspected to be decreasing owing to predation from invasive species.
Fairy prion	Two subspecies breed in Australia, *turtur* and *subantarctica*. The subspecies *subantarctica* has previously been detected breeding on two rock stacks off Macquarie Island in 1979 and Bishop and Clerk Island in 1993.
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.
Flesh-footed shearwater	The flesh-footed shearwater is a locally common visitor to waters of the continental shelf and continental slope off south-western Western Australia to south-eastern Queensland and around Lord Howe Island. Pairs breed on 41 islands off the coast of south-western Western Australia and Lord Howe Island in south-western Western Australia. Flesh-footed Shearwaters have been recorded as vagrants at Norfolk Island and are possibly regular visitors to Norfolk from breeding colonies on Lord Howe Island and around New Zealand (Moore 1985).
Sooty shearwater	In Australia, there are known colonies on 17 islands, all of which contain fewer than 1,000 pairs, however; Population estimates and trends are unknown.

Migratory species	DCCEEW SPRAT information on distribution
Short-tailed shearwater	This species breeds on Tasmanian offshore islands and off the coast of southern Australia, with the bulk of the population in the south-east. National trends are unknown; however the species is monitored at some locations in Tasmania, Victoria and NSW.
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.
Great frigatebird	Important populations in Western Australian seas include those at North Keeling Island,the islands of Ashmore Reef Marine Park and Adele Island.
Masked booby	In Australia, the masked booby ranges from the Dampier Archipelago in Western Australia (WA), along the entire north coast and east coast to Brisbane. Individuals regularly occur on islands off Australia, including Lord Howe, Norfolk, Kermadec and the Cocos-Keeling Islands. The total Australian masked booby population is estimated to be between 3,750–4,270 breeding pairs.
Red-footed booby	This red-footed booby is found in tropical islands in most oceans, excluding the eastern Atlantic. It winters at sea in the same area, ranging north of the Tropic of Cancer and south of the Tropic of Capricorn. This species is largely pelagic occurring farther from land than other booby species. The most important breeding population in Australia occurs in Pulu Keeling National Park in the Indian Ocean, which regularly supports more than 30,000 pairs.
Brown booby	In Australia, the brown booby is found from Bedout Island in Western Australia, around the coast of the Northern Territory to the Bunker Group of islands in Queensland with occasional reports further south in New South Wales (NSW) and Victoria. The species is reported further south to Tweed Heads, NSW, and to near Onslow, Western Australia and may be becoming more common in these areas. Within Australian seas, including Christmas and Cocos-Keeling Islands in the eastern Indian Ocean, the total breeding population was 59 940–73 900 pairs in a 1996–97 survey. The global population estimate for the species is 200 000.
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.

Migratory species	DCCEEW SPRAT information on distribution
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.
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.

8.4. Biologically Important Areas / Critical Habitat–Birds

Table 16 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 13.2**[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 5.4.

Table 16: 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. Reproduction– Pilbara and Gascoyne coasts and islands	Found in the vicinity of lower north-west coast (north to Dampier Archipelago), including islands (as far offshore as Trimouille Island and Houtman Abrolhos). Pilbara and Gascoyne coasts and islands
Australian lesser noddy	*Anous tenuirostris melanops*	Foraging - Houtman Abrolhos Islands	Houtman Abrolhos Islands
Lesser crested tern	*Sterna bengalensis*	Reproduction, foraging - Kimberley, Pilbara and Gascoyne coasts and	Kimberley, Pilbara and Gascoyne coasts and islands
Roseate tern	*Sterna dougallii*	Reproduction, foraging– Islands and coastline in the Kimberley, Pilbara and Gascoyne regions 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 the Houtman Abrolhos.	Kimberley, Pilbara and Gascoyne coasts and islands Houtman Abrolhos.
Wedge-tailed shearwater	*Ardenna pacifica*	Reproduction, foraging – west coast from Ashmore Reef to Carnac I. Kimberley, Pilbara, Gascoyne coasts	Reproduction 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

9. Protected Areas

A number of areas in the EMBA are protected under state and federal legislation. Protected areas include World Heritage Areas, Wetlands of International Importance (Ramsar), 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 17**, and shown **in Figure 15** and **Figure 16,** and discussed below. Other protected areas include Key Ecological Features (discussed in **Section 10**) and State and Commonwealth Marine Parks/Reserves (discussed in **Section 11** and **Section 12**). A

Table 17: Summary of protected areas in waters within the EMBA

Area type	Title
World Heritage Area	Shark Bay
	The Ningaloo Coast
National Heritage Place	HMAS Sydney II and HSK Kormoran Shipwreck Sites (Historic)
	Dirk Hartog Landing Site 1616 - Cape Inscription Area (Historic)
	Dampier Archipelago (including Burrup Peninsula) (Indigenous)
	The Ningaloo Coast (Natural)
	Shark Bay (Natural)
Commonwealth Heritage Place	Scott Reef and Surrounds – Commonwealth Area
	Ningaloo Marine Area - Commonwealth Waters
	Mermaid Reef - Rowley Shoals

9.1. World Heritage Areas

There are two World Heritage Areas (WHA) located in marine waters off WA, both of which occur in the waters from the South Australian border to the NT border: the Ningaloo Coast and Shark Bay (DEC 2012). One WHA is within the EMBA adjacent to NT, although most of the area is terrestrial: Kakadu National Park.

9.1.1. Shark Bay

Shark Bay was included on the World Heritage List in 1991 and is one of the few properties inscribed for all four outstanding natural universal values:

- An outstanding example representing the major stages in the earth's evolutionary history
- An outstanding example representing significant ongoing ecological and biological processes
- An example of superlative natural phenomena
- Containing important and significant habitats for in situ conservation of biological diversity.

Since 1997, an agreement established the joint management of the Shark Bay WHA by the Australian Commonwealth government and the Western Australian state government, with the operational responsibility by the Western Australian agencies (DEWHA 2008a). This agreement also created a Community Consultative Committee and a Scientific Advisory Committee, both of which provide advice as required. The entire WHA encompasses islands and peninsulas, with an area of approximately 2.2 million ha (70 % of which is marine waters), and includes the following areas (UNESCO 2020):

- Hamelin Pool Marine Nature Reserve
- Francois Peron National Park

- Shell Beach Conservation Park
- Monkey Mia Reserve
- Monkey Mia Conservation Park
- Zuytdorp Nature Reserve
- Bernier, Dorre and Koks Islands Nature Reserves
- Dirk Hartog Island National Park
- Various pastoral leases.

The marine environment of the Shark Bay World Heritage Area is protected as a State Marine Reserve and is discussed further in **Section 12.3.2.**

9.1.2. The Ningaloo Coast

The Ningaloo Coast was included on the World Heritage List in 2011 and was inscribed for outstanding natural universal values as follows:

- An example of superlative natural phenomena and areas of exceptional natural beauty and aesthetic importance
- outstanding examples representing major stages of Earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features.
- the most important and significant natural habitats for in situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

The Ningaloo Coast WHA includes (DEWHA 2010b):

- Ningaloo Marine Park (Commonwealth waters)
- Ningaloo Marine Park (Western Australia state waters)
- Muiron Island Marine Management Area (including the Muiron Islands)
- Jurabi Coastal Park
- Bundegi Coastal Park
- Cape Range National Park
- Learmonth Air Weapons Range.

The Ningaloo Coast World Heritage Area (including the Muiron Islands) is managed under a plan that is consistent with the World Heritage Convention and Australia's World Heritage management principles. World Heritage Management principles are set out in regulations and cover matters relevant to the preparation of management plans, the environmental assessment of actions that may affect the property and community consultation processes.

The Australian World Heritage management principles are outlined under Schedule 5 of the EPBC regulations (2000). The objective is to ensure that any likely impact of an action on the World Heritage values of the property should be considered. Any action should be consistent with the protection, conservation, presentation or transmission to future generations of the World Heritage values of the property.

The marine environment of the Ningaloo Coast World Heritage Area is protected as a State Marine Park, a Commonwealth Marine Park, and is discussed further in **Section 11.1.2** and **Section 12.3.4** respectively.

9.2. National Heritage Places

Natural, historic, and indigenous places that are of outstanding heritage value to the Australian nation are recorded as National Heritage Places. Eleven National Heritage Places are found in waters from the South

Australian border to the NT, with five of these occurring within the EMBA. Shark Bay and The Ningaloo Coast are listed as both World Heritage Areas and National Heritage Places and are discussed in **Section 9.1**.

9.2.1. HMAS Sydney II and HSK Kormoran Shipwreck Sites

The naval battle fought in 1941 between the Australian warship HMAS Sydney II and the German commerce raider HSK Kormoran off the Western Australian coast during World War II was a defining event in Australia's cultural history. The loss of HMAS Sydney II, along with its entire crew of 645 following the battle with HSK Kormoran, remains Australia's worst naval disaster (DoE 2014d).

The shipwreck sites are comprised of two areas located approximately 290 km west-southwest of Carnarvon. The shipwrecks of the HMAS Sydney II and HSK Kormoran are located on the seabed approximately 22 km apart (DoE 2014d).

9.2.2. The Ningaloo Coast

See the Ningaloo Coast World Heritage Area (**Section 9.1.2**).

9.2.3. Shark Bay

See Shark Bay World Heritage Area (**Section 9.1.1**).

9.2.4. Dirk Hartog Landing Site 1616 - Cape Inscription Area

Cape Inscription is the site of the oldest known landings of Europeans on the Western Australian coastline (from Dirk Hartog of the Dutch East India Company's ship the Eendracht in October 1616) and is associated with a series of landings and surveys by notable explorers over a 250-year period (DoEE 2019b). The landing site forms part of the Dirk Hartog Island and is about 1,110 ha located 100 km south west of Carnarvon (DoEE 2019b).

9.2.5. 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).

9.3. Commonwealth Heritage Places

The Commonwealth Heritage Places List comprises natural, indigenous, and historic heritage places which are either entirely within a Commonwealth area, or outside the Australian jurisdiction and owned or leased by the Commonwealth or a Commonwealth Authority. Four Commonwealth Heritage Places are found in or adjacent to the EMBA. Two of these places (Mermaid Reef, and the Ningaloo Marine Area – Commonwealth Waters) are found in Marine Parks and are discussed further in **Section 12**. The HMAS Sydney II and HSK Kormoran Shipwreck Sites is listed under both National and Commonwealth Heritage Lists and discussed in **Section 9.2.1**.

9.3.1. Scott Reef and Surrounds – Commonwealth Area

Scott Reef is a large, emergent shelf atoll located on the edge of the broad continental shelf, about 300 km from mainland north-western Australia. The listing comprises the areas of Scott Reef that are within Commonwealth waters to the 50 m BSL bathymetric contour. This includes North Reef, an annular reef, 16.3 km long and 14.4 km wide and parts of the lagoon of South Reef, a crescent shaped reef 17 km across (DoE 2014d).

The place is regionally significant both because of its high representation of species not found in coastal waters off Western Australia and for the unusual nature of its fauna which has affinities with the oceanic reef habitats of the Indo-West Pacific as well as the reefs of the Indonesian region (DoE 2014d).

9.3.2. Mermaid Reef – Rowley Shoals

See the Mermaid Reef Marine Park (**Section 12.3.9**).

9.3.3. Ningaloo Marine Area – Commonwealth Waters

See the Ningaloo Coast World Heritage Area (**Section 9.1.2**).

9.3.4. HMAS Sydney II and HSK Koromon Shipwreck Sites

See National Heritage Places (**Section 9.2.1**).

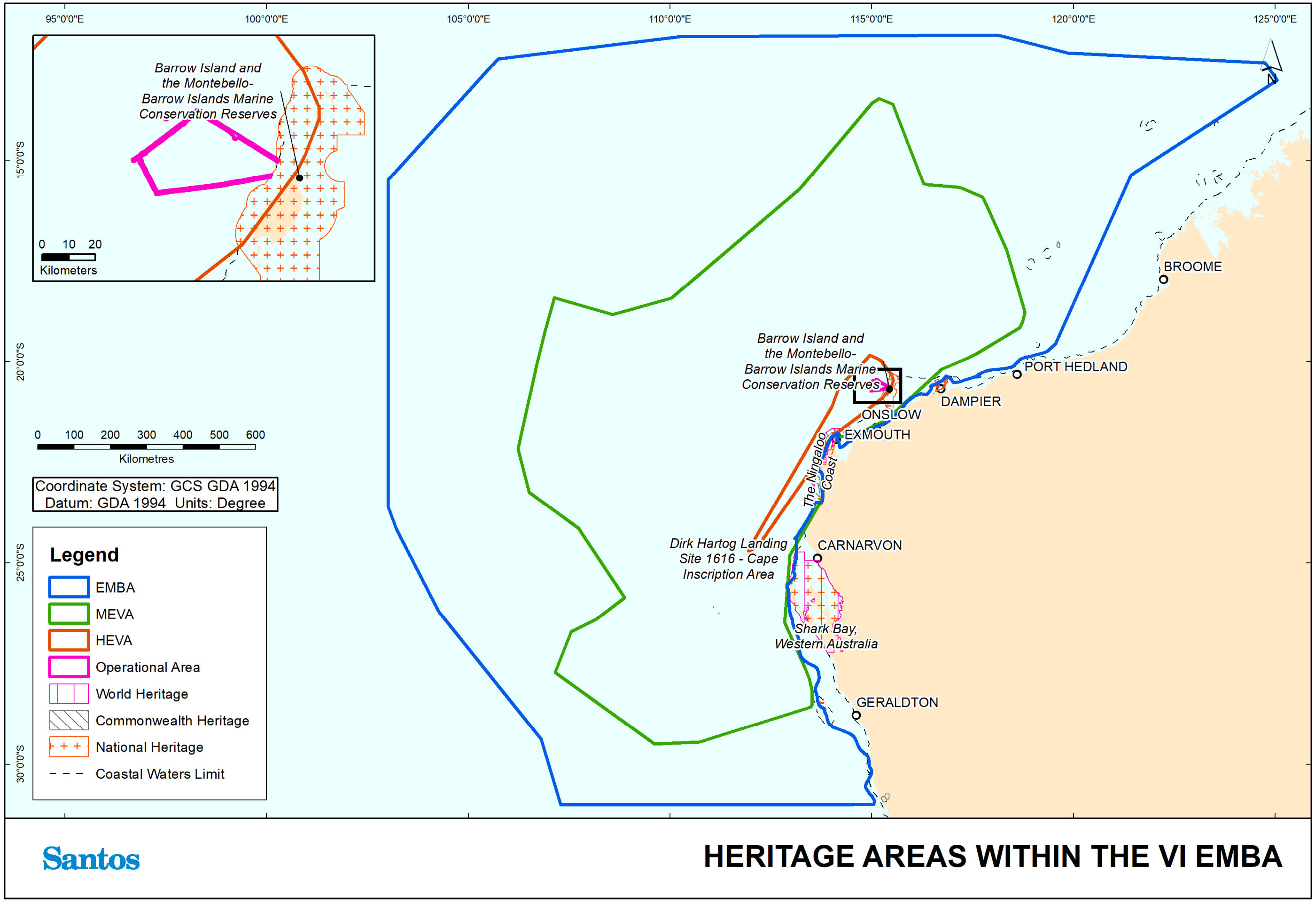


Figure 13: Heritage areas in and near the EMBA and Operational Area

10. Key Ecological Features

10.1. Introduction

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.

Seventeen ecological features of the Commonwealth waters in the EMBA have been identified in the protected matters search (**Figure 14**) and are discussed in this section. **Sections 1** and **2** provide an overview of the geomorphology and oceanography of the Indian Ocean. Individual EPs will describe specific ecological features outside of the Commonwealth waters that are within that activity's EMBA.

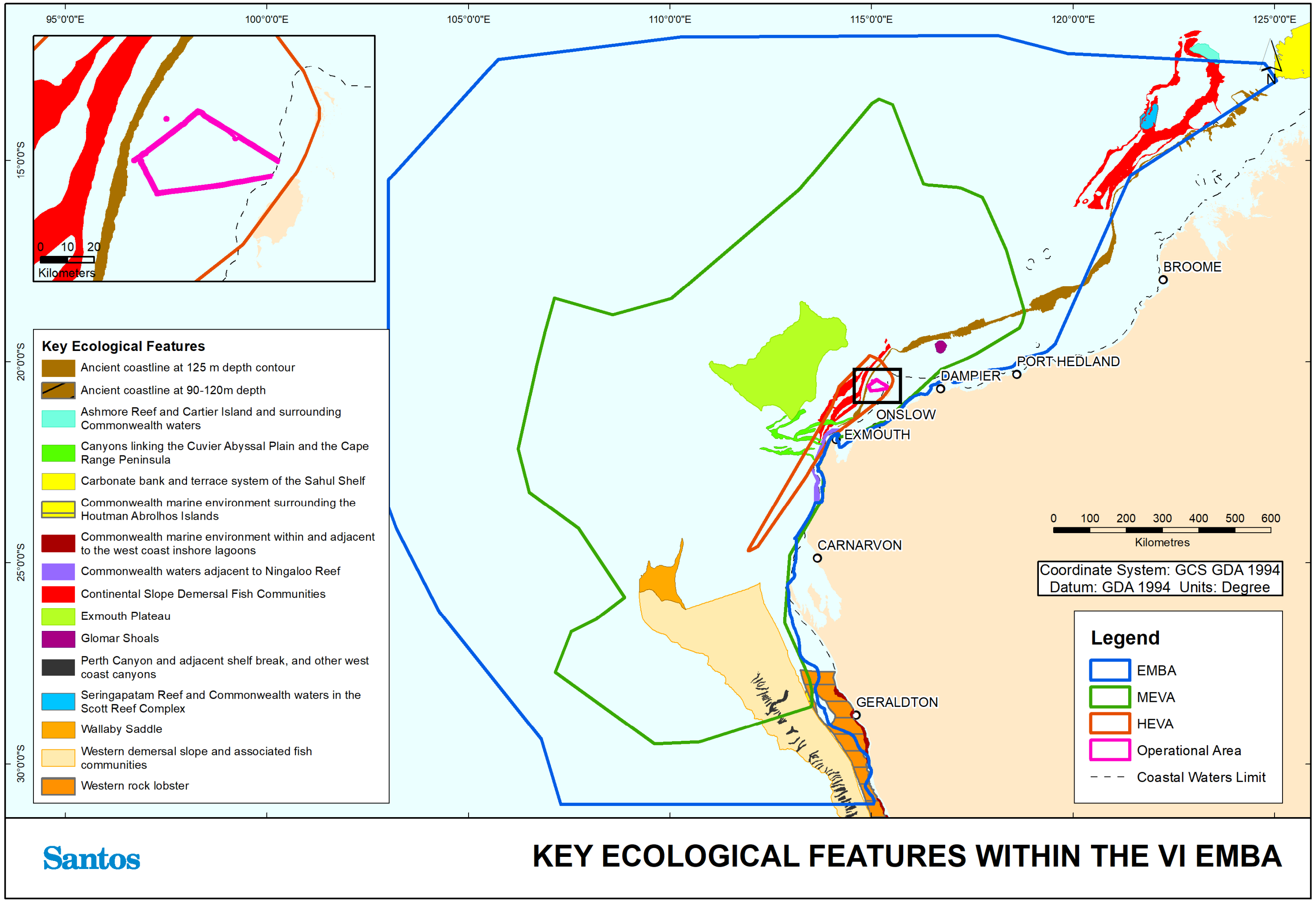


Figure 14: Key Ecological Features in and near the EMBA and Operational Area

10.1.1. Commonwealth Marine Environment Surrounding the Houtman Abrolhos Islands (and Adjacent Shelf Break)

The Commonwealth marine environment surrounding the Houtman Abrolhos Islands (and adjacent shelf break) is defined as a KEF for its high levels of biodiversity and endemism in benthic and pelagic habitats. The Houtman Abrolhos Islands and surrounding reefs support a unique mix of temperate and tropical species, resulting from the southward transport of species by the Leeuwin Current over thousands of years. The reefs are composed of 184 known species of corals that support about 400 known species of demersal fish, 492 known species of molluscs, 110 known species of sponges, 172 known species of echinoderms and 234 known species of benthic algae (DEWHA 2008b). The Houtman Abrolhos Islands are the largest seabird breeding station in the eastern Indian Ocean (DSEWPaC 2012a). They support more than one million pairs of breeding seabirds. The Houtman Abrolhos Islands and surround waters are also BIAs for Australian sea lions for foraging and breeding (DEWHA 2010b).

10.1.2. Perth Canyon and Adjacent Shelf Break, and other West-Coast Canyons

The Perth Canyon is defined as a KEF for its high biological productivity and aggregations of marine life and unique sea floor features with ecological properties of regional significance. The Perth Canyon is the largest known undersea canyon in Australian waters. In the Perth Canyon, interactions between the Leeuwin Current and the Canyon topography induce clockwise-rotating eddies that transport nutrients upwards in the water column from greater depths (DoEE 2019a). Due to the Canyon's depth and Leeuwin Current's barrier effect, this remains a subsurface upwelling which supports ecological complexity that is typically absent from canyon systems in other areas (Pattiaratchi 2007). This nutrient-rich cold-water habitat attracts feeding aggregations of deep-diving mammals, such as pygmy blue whales and large predatory fish that feed on aggregations of small fish, krill and squid (DSEWPaC 2012a). The Perth Canyon also marks the southern boundary for numerous tropical species groups on the shelf, including sponges, corals, decapods and xanthid crabs (DoEE 2017a).

10.1.3. Commonwealth Marine Environment within and adjacent to the West-Coast Inshore Lagoons

This key ecological feature is composed by a chain of inshore lagoons of limestone reef (as deep as 30 m) extending along the Western Australian coast from south of Mandurah to Kalbarri. The mix of sheltered and exposed seabeds form a complex mosaic of habitats. The lagoons are dominated by seagrass and epiphytic algae (Dambacher et al. 2009). Although macroalgae (principally Ecklonia spp.) and seagrass appear to be the primary source of production, scientists suggest that groundwater enrichment may supplement the supply of nutrients to the lagoons. The lagoons are associated with high biodiversity and endemism, containing a mix of tropical, subtropical and temperate flora and fauna.

The inshore lagoons are important areas for the recruitment of the commercially and recreationally important western rock lobster, dhufish, pink snapper, breaksea cod, baldchin and blue gropers, abalone and many other reef species. The area includes breeding and nursery aggregations for many temperate and tropical marine species (Goldberg & Collings 2006 in McClatchie et al. 2006). Extensive schools of migratory fish visit the area annually, including herring, garfish, tailor and Australian salmon.

10.1.4. Western Demersal Slope and associated Fish Communities

The Western Demersal Slope and associated Fish Communities, also known as the Demersal Slope and associated Fish Communities of the Central Western Province, is defined as a key ecological community for its high levels of biodiversity and endemism. It is located on the edge of the shelf to the limit of the exclusive economic zone from Perth to the northern boundary of the SWMR. The western demersal slope provides important habitat for demersal fish communities, with a high level of diversity and endemism. A diverse assemblage of demersal fish species below a depth of 400 m is dominated by relatively small benthic species such as grenadiers, dogfish and cucumber fish. Unlike other slope fish communities in Australia, many of these species display unique physical adaptations to feed on the sea floor (such as a mouth position adapted to bottom feeding), and many do not appear to migrate vertically in their daily feeding habits (DSEWPaC 2012a, Williams et al. 2001). A total of 480 fish species have been described that inhabit the slope of this bioregion with 31 considered to be endemic to the bioregion (DoEE 2019a). Demersal fish communities within the area have recorded higher diversity when compared to other oceanic regions which have been more intensively sampled. The increased diversity within the area has been attributed to the overlap of ancient and extensive Indo-west Pacific and temperate Australasian fauna (Williams et al. 2001).

10.1.5. Western Rock Lobster

The Western Rock Lobster KEF is defined due to its presumed ecological role on the West Coast Continental Shelf. This species is the dominant large benthic invertebrate in the region. The lobster plays an important trophic role in many of the inshore ecosystems of the South-west Marine Region. Western rock lobsters are an important part of the food web on the inner shelf, particularly as juveniles as they are preyed upon by octopus, cuttlefish, baldchin groper, dhufish, pink snapper, wirrah cod and breaksea cod (DEWHA 2008b, DSEWPaC 2012a). The high biomass of western rock lobsters and their vulnerability to predation suggest that they are an important trophic pathway for a range of inshore species that prey upon juvenile lobsters (DEWHA 2008b).

10.1.6. Wallaby Saddle

The Wallaby Saddle is defined as a KEF for its high productivity and aggregations of marine life. The Wallaby Saddle is an abyssal geomorphic feature located on the upper continental slope at a depth of 4,000–4,700 m (DSEWPaC 2012a). The feature connects the north-west margin of the Wallaby Plateau with the margin of the Carnarvon Terrace (Falkner et al. 2009 in DSEWPaC 2012a). The Wallaby Saddle is situated within the Indian Ocean water mass and is thus differentiated from systems to the north that are dominated by transitional fronts or the Indonesian Throughflow (DSEWPaC 2012a). Little is known about the Wallaby Saddle; however, the area is considered one of enhanced productivity and low habitat diversity (Brewer et al. 2007). The Wallaby Saddle is associated with historical aggregations of sperm whales (DEWHA 2008c).

10.1.7. Commonwealth Waters Adjacent to Ningaloo Reef

The Commonwealth Waters adjacent to Ningaloo Reef KEF is defined for high productivity and aggregations of marine life. The Ningaloo Reef extends almost 300 km along the Cape Range Peninsula to the Red Bluff and is globally significant as the only extensive coral reef in the world that fringes the west coast of a continent. Commonwealth waters adjacent to the reef are thought to support the rich aggregations of marine species at Ningaloo Reef through upwellings associated with canyons on the adjacent continental slope and interactions between the Ningaloo and Leeuwin currents (Brewer et al. 2007, DEWHA 2008d, DSEWPaC 2012a). The narrow continental shelf (10 km at its narrowest) means that the nutrients channelled to the surface via canyons are immediately available to reef species. Terrestrial nutrient input is low; hence this deep-water source is a major source of nutrients for Ningaloo Reef and therefore very important in maintaining this system (DEWHA 2008c).

The reef is known to support an extremely abundant array of marine species including over 200 species of coral and more than 460 species of reef fish, as well as molluscs, crustaceans and other reef plants and animals (DEWHA 2008c). Marine turtles, dugongs and dolphins frequently visit the reef lagoon. The Commonwealth waters around Ningaloo include areas of potentially high and unique sponge biodiversity (DEWHA 2008c). Upwellings on the seaward side support aggregations such as whale sharks and manta rays (these waters are the main known aggregation area for whale sharks in Australian waters). Humpback whales are seasonal visitors to the outer reef edge and seasnakes, sharks, large predatory fish and seabirds also utilise the reef and surrounding waters.

The Ningaloo Marine Park includes this Key Ecological Feature and is discussed in **Section 12.3.4**.

10.1.8. Canyons Linking the Cuvier Abyssal Plain with the Cape Range Peninsula

The Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula are defined as a KEF as they are unique sea floor features with ecological properties of regional significance.

Cape Range Peninsula and the Cuvier Abyssal Plain are linked by canyons, the largest of which are the Cape Range Canyon and Cloates Canyon. These two canyons are located along the southerly edge of Exmouth Plateau adjacent to Ningaloo Reef and are unique due to their close proximity to the North West Cape (DSEWPaC 2012a). The Leeuwin Current interacts with the heads of the canyons to produce eddies resulting in delivery of higher nutrient, cool waters from the Antarctic intermediate water mass to the shelf (Brewer et al. 2007). Strong internal tides also create upwelling at the canyon heads (Brewer et al. 2007). Thus, the canyons, the Exmouth Plateau and the Commonwealth waters adjacent to Ningaloo Reef interact to create the conditions for enhanced productivity seen in this region (Sleeman et al. 2007 in DSEWPaC 2012a). The canyons are also repositories for particulate matter deposited from the shelf and sides of the canyons and serve as conduits for organic matter between the surface, shelf and abyssal plains (DSEWPaC 2012a).

The soft bottom habitats within the canyons themselves are likely to support important assemblages of epibenthic species. Biological productivity at the head of Cape Range Canyon in particular, is known to support species aggregations, including whale sharks, manta rays, humpback whales, sea snakes, sharks, large predatory fish and seabirds. The canyons are thought to be significant contributors to the biodiversity of the adjacent Ningaloo Reef, as they channel deep water nutrients up to the reef, stimulating primary productivity (DEWHA 2008c).

10.1.9. Exmouth Plateau

The Exmouth Plateau is defined as a KEF as it is a unique sea floor feature with ecological properties of regional significance. The Exmouth Plateau covers an area of 49,310 km^2 and is located approximately 150 km northwest of Exmouth. The plateau ranges in water depths from 800 to 4,000 m (Heap & Harris 2008 in DSEWPaC 2012a). The plateau's surface is rough and undulating at 800–1,000 m depth. The northern margin is steep and intersected by large canyons (e.g. Montebello and Swan canyons) with relief greater than 50 m. The western margin is moderately steep and smooth, and the southern margin is gently sloping and virtually free of canyons (Falkner et al. 2009 in DSEWPaC 2012a).

The Exmouth Plateau is a regionally and nationally unique tropical deep-sea plateau. It that may serve an important ecological role by acting as a topographic obstacle that modifies the flow of deep waters that generate internal tides, causing upwelling of deeper water nutrients closer to the surface (Brewer et al. 2007). Sediments on the plateau suggest that biological communities include scavengers, benthic filter feeders and epifauna. Whaling records from the 19th century suggest that the Exmouth Plateau may have supported large populations of sperm whales (Bannister et al. 2007). Fauna in the pelagic waters above the plateau are likely to include small pelagic species and nekton (Brewer et al. 2007).

10.1.10. Mermaid Reef and Commonwealth Waters surrounding Rowley Shoals

Mermaid Reef and Commonwealth waters surrounding Rowley Shoals is defined as a KEF for its enhanced productivity and high species richness. The Rowley Shoals are a group of three atoll reefs—Clerke, Imperieuse and Mermaid reefs—located about 300 km north-west of Broome. Mermaid Reef lies 29 km north of Clerke and Imperieuse reefs and is totally submerged at high tide. Mermaid Reef and Commonwealth Waters surrounding Rowley Shoals are regionally important in supporting high species richness, higher productivity and aggregations of marine life associated with the adjoining reefs themselves (Done et al. 1994). Rowley shoals contain 214 coral species and approximately 530 species of fishes (Gilmour et al. 2007), 264 species of molluscs and 82 species of echinoderms (Done et al. 1994; Gilmour et al. 2007). Both coral communities and fish assemblages differ from similar habitats in eastern Australia (Done et al. 1994).

Mermaid Reef falls under Commonwealth jurisdiction and forms the Mermaid Reef Commonwealth Marine Park. Clerke and Imperieuse reefs constitute the Rowley Shoals Marine Park, which falls under Western Australian Government jurisdiction (EA 2000). The Rowley Shoals are discussed with the Commonwealth and State Marine Park (**Sections 11.1.7** and **12.3.9**).

10.1.11. Glomar Shoals

The Glomar Shoals are a submerged feature situated at a depth of 33–77 m, approximately 150 km north of Dampier on the Rowley Shelf (Falkner et al. 2009 in DSEWPaC 2012a). They consist of a high percentage of marine-derived sediments with high carbonate content and gravels of weathered coralline algae and shells (McLoughlin & Young 1985 in DSEWPaC 2012a). The area's higher concentrations of coarse material compared to surrounding areas are indicative of a high energy environment subject to strong sea floor currents (Falkner et al. 2009 in DSEWPaC 2012a).

Biological communities found at the Glomar Shoals have not been comprehensively studied, however the shoals are known to be an important area for a number of commercial and recreational fish species such as rankin cod, brown striped snapper, red emperor, crimson snapper, bream, and yellow-spotted triggerfish. Catch rates at the Glomar Shoals are high, indicating that the area is a region of high productivity (Falkner et al. 2009, Fletcher & Santoro 2009 in DSEWPaC 2012a). It is unclear whether the removal of non-target species due to the commercial fishing over the shoals is having an impact on its value (DSEWPaC 2012a).

The Glomar Shoals are regionally important for their potentially high biological diversity and localised productivity. Biological data specific to the Glomar Shoals is limited, however the fish of the shoals are probably a subset of reef-dependent species and anecdotal evidence suggests they are particularly abundant (DSEWPaC 2012a).

10.1.12. Ancient Coastline at 125 m Depth Contour

The shelf of the North-west Marine Region contains several terraces and steps which reflect changes in sea level that occurred over the last 100,000 years. The most prominent of these features occurs at a depth of 125 m as an escarpment along the North West Shelf and Sahul Shelf (DSEWPaC 2012a). Where the ancient, submerged coastline provides areas of hard substrate it may contribute to higher biological diversity in areas otherwise dominated by soft sediments. Little detailed knowledge was available at the time of its designation, but it was thought that the hard substrate of the escarpment is likely to support sponges, crinoids, molluscs, echinoderms (DSEWPaC 2012a) and that changes in topography at these depths are critical points for the generation of internal waves (Holloway et al. 2001 cited in DEWHA 2008c), playing a minor role in aiding localised upwelling or at least regional mixing associated with the seasonal changes in currents and winds. It was hypothesised that this prominent floor feature could be important as a migratory pathway for cetaceans and pelagic species such as the whale shark and humpback whale, as they move north and south between feeding and breeding grounds (DEWHA 2008c). Enhanced productivity could potentially be attracting baitfish, which in turn provide food for the migratory species. The pressures of potential concern on the biodiversity value of this feature generally include ocean acidification as a result of climate change (DoEE 2019a).

Currey-Randall et al. (2021) investigated drivers of fish species richness and assemblage composition spanning six degrees of latitude along sections of the ancient coastline, categorised as ‘on’ and ‘off’ the ancient coastline at 125m KEF (AC125) based on depth, across a range of habitats and seafloor complexity (~60–180 m depth). While some surveyed sections of the AC125 had hard bottom substrate and supported enhanced fish diversity, including over half of the total species observed, species richness and abundance overall were not greater on the AC125 than immediately adjacent to the AC125. Instead, depth, seafloor complexity and habitat type explained patterns in richness and abundance, and structured fish assemblages at both local and broad spatial scales. Fewer fishes were associated with deep sites characterized by negligible complexity and soft-bottom habitats, in contrast to shallower depths that featured benthic biota and pockets of complex substrate. Drivers of abundance of common species were species-specific and primarily related to sampling areas, depth and substrate. Fishes of the ancient coastline and adjacent habitats are representative of mesophotic fish communities of the region, included species important to fisheries and conservation, and several species were observed deeper than their currently known distribution.

Wakeford et al. (2023) investigated the bathymetry, sedimentology and benthic habitats at 5 locations across the AC125 using multibeam sonar, sediment samples and towed video imagery. Approximately 98% of the seabed surveyed was comprised of unconsolidated soft sediment habitat (mud/sand/silt) supporting negligible epibenthic biota. The prevalence of soft sediment suggests that post-glacial sediments have infilled parts of the ancient coastline), with cross-shelf, probably tidal currents in the northern section of the study area responsible for some of the sediment mobilisation and southern study areas more influenced by oceanic conditions. Within study areas, total biotic cover ranged from 0.02% to 1.07%. Of the biota encountered, most comprised filter feeder organisms (including gorgonians, sponges, and whip corals) whose distribution was associated with pockets of consolidated hard substrate. Benthic community composition varied with both study area and position in relation to the predicted AC125. In general, consolidated substrate was proportionally higher in water shallower than the AC125 compared to on the AC125 or deeper than the AC125. Spatially continuous maps of predicted benthic habitat classes (pre-determined benthic communities) in each study area were developed to characterise biodiversity. Spatial modelling corroborated depth and large-scale structural complexity of the seafloor as surrogates for predicting likely habitat class. The study provided an important assessment of the AC125 and concluded that if a distinct coastline exists in the areas surveyed, it is now largely buried and as such does not provide a unique hard substrate habitat.

10.1.13. Ancient Coastline at 90-120 m Depth

This coastline is found in the South-west Marine Region and contains several terraces and steps reflecting a gradual increase in sea level across the shelf that occurred during the Holocene. Some of these features create escarpments of distinct elevation, creating topographic complexity through the exposure of rocky substrates. The most prominent of these occurs close to the middle of the continental shelf off the Great Australian Bight at a depth of 90-120 m, which provides a complex habitat for a number of species (DSEWPaC 2012c). The area has important conservation value due to its potential for high productivity, biodiversity and aggregations of marine life. Benthic biodiversity and productivity occur where the ancient coastline forms a prominent escarpment of exposed hard substrates, where it is dominated by sponge communities of significant biodiversity and structural complexity (DSEWPaC 2012c). These sponge communities have been recorded to contain sponges up to one metre across, which implies that some of the sponges in this region are likely to be many decades old (DSEWPC 2012c). It has been suggested that in certain places, the area may support some demersal fish species, travelling to the upper continental slope from across the continental shelf. The transportation of fine-grained sediments off shelf occurs as a physical process down to depths of approximately 120 m and influence the benthic invertebrate communities of the Great Australian Bight (DSEWPaC 2012c). Both species richness and biomass in the area, has been associated as declining with increasing depth and percentage of fines in sediment (Ward et al. 2006 cited in DSEWPaC 2012c).

10.1.14. Canyons Linking the Argo Abyssal Plain with Scott Plateau

The Scott Plateau connects with the Argo Abyssal Plain via a series of canyons, the largest of which are the Bowers and Oates canyons (DSEWPaC 2012a). The canyons are believed to be up to 50 million years old and excavated during the evolution of the region through sediment and water movements (DEWHA 2008d). The canyons cut deeply into the south-west margin of the Scott Plateau and act as conduits for transport of sediments from an approximate depth of 2,000–3,000 m to depths of more than 5,500 m (DSEWPaC 2012a). The water masses at these depths are deep Indian Ocean water on the Scott Plateau and Antarctic bottom water on the Argo Abyssal Plain. Both water masses are cold, dense and nutrient-rich (Lyne et al. 2006 in DSEWPaC 2012a). The high productivity of the region is believed to be led by topographically induced water movements through the canyons and the action of internal waves in these canyons as well as around islands and reefs. The canyons are therefore thought to be linked to small and periodic upwellings that enhance this biological productivity (DEWHA 2008d).

The Canyons linking the Argo Abyssal Plain and Scott Plateau are likely to be important features due to their historical association with sperm whale aggregations (DSEWPaC 2012a). Historical records of whaling in the Timor region indicate that the number of sperm whales was high in the region in the past. Though current numbers are unknown, it is possible that they congregate around the canyon heads adjacent to the Scott Plateau, encouraged by the high biological productivity, supporting stocks of their prey (DEWHA 2008d). There is anecdotal evidence that supports the idea that the Scott Plateau itself may be a breeding ground for sperm and beaked whales. It is also likely that important demersal communities occur in the canyons, as they do in the Scott Plateau supported by the localised upwelling, which in turn attract larger predatory fish, sharks and cetaceans (DEWHA 2008d).

10.1.15. Continental Slope Demersal Fish Communities

The Australian Continental Slope provides important habitat for demersal fish communities, characterised by high endemism and species diversity. Specifically, the continental slope between North West Cape and the Montebello Trough is the most diverse slope bioregion in Australia with more than 500 fish species, 76 of which are endemic (Last et al. 2005 in DSEWPaC 2012).

The Continental Slope consists of two distinct community types, associated with the upper and mid slope, 225 – 500 m and 750 – 1000 m respectively. The Timor Province and Northwest Transition bioregions are the second-richest areas for demersal fish across the entire continental slope (DSEWPaC 2012). The bacteria and fauna that is present in the system on the Continental Slope are the basis for the food web for demersal fish and higher order consumers in the system. Further information of this system has been poorly researched, though it has been suggested that it is a detritus-based system, where infauna and epifauna become prey for a range of teleost fish, molluscs and crustaceans (Brewer et al. 2007). The higher order consumers supported by this system are likely to be carnivorous fish, deep water sharks, large squid and toothed whales (Brewer et al. 2007). The pelagic production is known to be phytoplankton based, with hotspots located around oceanic reefs and islands (Brewer et al. 2007).

It is believed that the loss of the benthic habitat along this continental shelf region would likely lead to a decline in the species diversity and endemism that this feature is associated with (DoEE 2019a). The endemism of the region is not supported by large data sets and is scarce. It is consequently not well understood what interactions exist between the physical processes and trophic structures that lead to this high diversity of fish and the suggested presence of endemic species in the region (DoEE 2019a).

10.1.16. Seringapatam Reef and Commonwealth Waters in the Scott Reef Complex

Scott and Seringapatam reefs are part of a series of submerged reef platforms that rise steeply from the sea floor between the 300–700 m contours on the north-west continental slope and lie in the Timor Province (Falkner et al. 2009). Scott Reef consists of two separate reef formations, North Reef and South Reef. The total area of the key ecological feature is approximately 2,418 km². As two of the few offshore reefs in the north-west, they provide an important biophysical environment in the region.

Scott and Seringapatam reefs and the waters surrounding them attract aggregations of marine life including humpback whales on their northerly migration, Bryde's whales, pygmy blue whales, Antarctic minke whales, dwarf minke whales, minke whales, dwarf sperm whales and spinner dolphins (Jenner et al. 2008; Woodside 2009). Whale sharks and several species of sea snakes have also been recorded in this area (Donovan et al. 2008). Green and hawksbill turtles nest during the summer months on Sandy Islet on South Scott Reef. These species also internest and forage in the surrounding waters (Guinea 2006). Scott Reef is a particularly biologically diverse system and includes more than 300 species of reef-building corals, approximately 400 mollusc species, 118 crustacean species, 117 echinoderm species and around 720 fish species (Woodside 2009). Corals and fish at Scott Reef have higher species diversity than the Rowley Shoals (Done et al. 1994).

Scott Reef is listed as Commonwealth Heritage Places and is discussed in **Section 9.3.1.**

10.1.17. Ashmore Reef and Cartier Island and Surrounding Commonwealth Waters

Ashmore Reef and Cartier Island are situated on the shallow upper slope of the Sahul Shelf, north of Scott and Seringapatam reefs. Rising from a depth of more than 100 m, the reef platform is at the edge of the North West Shelf and covers an area of 239 km². Ashmore Reef Commonwealth Marine Reserve encloses an area of about 583 km² of seabed (EA 2002). Cartier Island lays about 350 km off Australia's Kimberley coast, 115 km south of the Indonesian island of Roti and 45 km south-east of Ashmore Reef Commonwealth Marine Reserve. Cartier Island Commonwealth Marine Reserve covers 167 km² (EA 2002). Species at Ashmore Reef and Cartier Island include more than 225 reef-building corals, 433 molluscs, 286 crustaceans, 192 echinoderms, and the most diverse variety of fish of any region in Western Australia with 709 species (EA 2002).

Sandy beaches provide important habitat for nesting green and hawksbill turtles throughout the year. Seagrass present at Ashmore Reef provides critical breeding (April–May) and foraging (throughout the year) habitat for a genetically distinct population of dugong with their range probably extending to other submerged shoals within the area (Brown & Skewes 2005; Whiting 1999). The emergent habitat at Ashmore also provides important nesting sites for seabirds, many of which are migratory. Ashmore's islands are regarded as supporting some of the most important seabird rookeries on the North West Shelf seasonally supporting up to 50,000 seabirds (26 species) and up to 2,000 waders (30 species, representing almost 70 % of wader species that regularly migrate to Australia) (Milton 2005). Large colonies of sooty terns, crested terns, bridled terns and common noddies breed on the east and middle islands. Smaller breeding colonies of little egrets, eastern reef egrets, black noddies and possibly lesser noddies also occur. Migratory wading birds include eastern curlews, ruddy turnstones, whimbrels, bar-tailed godwits, common sandpipers, Mongolian plovers, red-necked stints and tattlers, during October–November and March–April as part of the migration between Australia and the Northern Hemisphere (Milton 2005).

11. State Marine Conservation Reserves

11.1. Introduction

Marine parks and reserves have been progressively established in Western Australia since 1987 and the Northern Territory since 1983. 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 currently seven marine parks wholly or partially within the EMBA (refer **Figure 15** and **Figure 16**).

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. There are two marine management areas within the EMBA (described below).

11.1.1. Jurien Bay Marine Park

The Jurien Bay Marine Park is a Class A marine park located on the central west coast of Western Australia about 200 km north of Perth and covers an area of 82,375 ha (CALM 2005b). Its western boundary is the seaward limit of Western Australian coastal waters. Its northern boundary is the northern point of Dynamite Bay at Green Head (30° 4' 7.9" South), and its southern boundary is located just south of Wedge (30° 50' 20" South) and is contiguous with the southern boundary of the Wanagarren Nature Reserve.

Jurien Bay Marine Park is considered to be broadly representative of the Central West Coast limestone reef system, which is a major marine ecosystem within this bioregion. The marine biota of the area consists of an unusual mix of tropical and temperate species as well as many endemic species (Larkum & Hartog, 1989). The Marine Park is dominated by five major marine habitat types: seagrass meadows; bare or sparsely vegetated mobile sand; shoreline and offshore intertidal reef platforms; subtidal limestone reefs; and reef pavement (CALM 2005b). Marine wildlife includes 14 species of cetaceans, a variety of sea and shorebirds which nest on the islands and the Australian sea lion (North Fisherman Island to the north of Jurien Bay is one of the main breeding sites for sea lions in the Central West Coast region and it is believed this breeding population is genetically distinct from the southern coast population – Gales et al. 1992). Commercial fishing for western rock lobster as well commercial wetlining, abalone, shark netting, beach seining for mullet and collecting of specimen shells and aquarium fish are carried out within the marine park.

11.1.2. Ningaloo Marine Park

The Ningaloo Marine Park was declared in May 1987 under the National Parks and Wildlife Conservation Act 1975 (Commonwealth). The Ningaloo Coast, incorporating both key marine and terrestrial values was later granted World Heritage Status in June 2011. In November 2012, the Ningaloo Marine Park (Commonwealth Waters) was renamed to be incorporated in the North-west Commonwealth Marine Reserves Network. The park covers an area of 263,343 km^2, including both State and Commonwealth waters, extending 25 km offshore.

The park protects a large portion of Ningaloo Reef, which stretches over 300 km from North West Cape south to Red Bluff. It is the largest fringing coral reef in Australia, forming a discontinuous barrier that encloses a lagoon that varies in width from 200 m to 7 km. Gaps that regularly intercept the main reef line provide channels for water exchange with deeper, cooler waters (CALM 2005). The Ningaloo Marine Park forms the backbone of the nature-based tourism industry, and recreational activities in the Exmouth region. Seasonal aggregations of whale sharks, manta rays, sea turtles and whales, as well as the annual mass spawning of coral attract large numbers of visitors to Ningaloo each year (CALM 2005).

The reef is composed of partially dissected basement platform of Pleistocene marine or Aeolian sediments or tertiary limestone, covered by a thin layer of living or dead coral or macroalgae. Key features that characterise the Ningaloo Reef include (CALM 2005):

- Over 217 species of coral (representing 54 genera)
- Over 600 species of mollusc (clams, oysters, octopus, cuttlefish, snails)
- Over 460 species of fish
- Ninety-seven species of echinoderms (sea stars, sea urchins, sea cucumbers)
- Habitat for numerous threatened species, including whales, dugong, whale sharks and turtles
- Habitat for over 25 species of migratory wading birds listed in CAMBA and JAMBA.

11.1.3. Muiron Islands Marine Management Area

The Ningaloo Marine Park Management Plan (CALM 2005) created a marine management area (MMA) for the Muiron Islands, immediately adjacent to the northern end of the Park. This is managed as an integrated area together with the Ningaloo Marine Park, but its status as an MMA means that some activities, including oil and gas exploration, are still permitted under a strict environmental assessment process involving DMIRS.

The Muiron Islands located 15 km north-east of the North West Cape, comprise the North and South Muiron Islands and cover an area of 1,400 ha (AHC 2006). They are low limestone islands (maximum height of 18 m above sea level (ASL)) with some areas of sandy beaches, macroalgae and seagrass beds in the shallow waters (particularly on the eastern sides) and coral reef up to depths of 5 m, which surrounds both sides of South Muiron Island and the eastern side of North Muiron Island. The Muiron Islands MMA was WA's first MMA, gazetted in November 2004. It covers an area of 28,616 ha and occurs entirely within state waters (CALM 2005).

11.1.4. 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.

11.1.5. 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.

11.1.6. 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.

11.1.7. Rowley Shoals Marine Park

The Rowley Shoals (including the Commonwealth-managed Mermaid Reef Marine National Nature Reserve) are located approximately 300 km west-northwest of Broome, lying between 17°07’S, 119°36’E and 17°35’S, 118°56’E and encompassing approximately 87,674 ha (DEC 2007b).

The Rowley Shoals is ecologically significant in that the reefs form part of a series of important ecological “stepping stones” for a range of reef biota originating in Indonesian/west Pacific waters. Their position off the north-west Australian coast, an area of few offshore reef systems, provides an important upstream source for recruitment to reefs further south (DEC 2007b). Marine wildlife includes 184 species of corals, primarily Indo-West Pacific species, indicating the strong affinity of the Rowley Shoals communities with Indonesia. In terms of other species, at least 264 species of molluscs, 82 species of echinoderms and 389 species of finfish were also identified (DEC 2007b). The faunal assemblages of the Rowley Shoals Marine Park are regionally significant as they contain large numbers of species not found in the more turbid coastal environments of tropical Western Australia (DEC 2007b). There is a relatively low level of recreational and commercial activity, mostly attributed to the remoteness of the Shoals with access difficult from both Indonesia and mainland Australia (DEC 2007b).

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Santos

12. Australian Marine Parks

12.1. 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 15 and Figure 16**). 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 South-east network 10-year Management Plan came into effect on 1 July 2013. The remaining networks 10-year Management Plans were approved and came into effect on 1 July 2018. The Indian Ocean Marine Territories draft management plans were open for public consultation from 6 July to 17 August 2023 after Christmas Island Marine Park and Cocos (Keeling) Islands Marine Park were declared in March 2022.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:

- South-West Marine Parks Network
- North-West Marine Parks Network

The South-West Marine Parks Network comprises 14 marine parksTwo of these occur in West Australian waters in the EMBA, including:

- Abrolhos Commonwealth Marine Park (wholly within the EMBA)
- Jurien Marine Park (wholly within the EMBA)

The North-West Marine Parks Network comprises 13 marine parks, 11 of which occur in the EMBA:

- Carnarvon Canyon Marine Park (wholly within the EMBA)
- Shark Bay Marine Park (wholly within the EMBA)
- Gascoyne Marine Park (wholly within the EMBA)
- Ningaloo Marine Park (wholly within the EMBA)
- Montebello Marine Park (wholly within the EMBA)
- Dampier Marine Park (wholly within the EMBA)
- Eighty Mile Beach Marine Park (wholly within the EMBA)
- Argo-Rowley Terrace Marine Park (wholly within the EMBA)
- Mermaid Reef Marine Park (wholly within the EMBA)
- Kimberley Marine Park (wholly within the EMBA)
- Cartier Island Marine Park (wholly within the EMBA).

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).

The South-west Marine Parks Network includes six different types of zoning:

- National Park Zone (IUCN Category II)
- Habitat Protection Zone (IUCN Category IV)
- Multiple Use Zone (IUCN Category VI)
- Special Purpose Zone (Mining Exclusion) (IUCN Category VI)
- Special Purpose Zone (IUCN Category VI)
- Special Purpose Zone (Trawl) (IUCN Category VI).

A summary of the AMPS within the EMBA is provided below.

12.2. South-West Marine Parks Network

The South-West Commonwealth Marine Parks Network is aligned to the South-West Marine Region. The network covers 508,371 km^2 and includes 14 marine parks (Director of National Parks, 2018a). Broad values of the South-west Australian Marine Parks include:

- Natural values
- Cultural values
- Heritage values
- Socio-economic values.

Further detail on each of the relevant marine parks those that fall (wholly or partially) within the EMBA is provided below.

12.2.1. Abrolhos Marine Park

The Abrolhos Marine Park (including zones within the EMBA: Marine National Park Zone – IUCN Category II-2,548 km^2; Habitat Protection Zone – IUCN Category VI-23,239 km^2; Multiple Use Zone – IUCN Category VI-56,545 km^2; Special Purpose Zone – IUCN Category VI-5,729 km^2) covers an area of approximately 88,060 km^2 and protects the following conservation values (Director of National Parks, 2018a):

- Important foraging areas for the:
  - Threatened Australian lesser noddy.
  - Northernmost breeding colony of the threatened Australian sea lion
  - Great white sharks
  - Migratory common noddy, wedge-tailed shearwater, bridled tern, Caspian tern and roseate tern.
- Important migration habitat for the protected humpback whale and pygmy blue whales
- The second largest canyon on the west coast, the Houtman Canyon
- Examples of the northernmost ecosystems of the Central Western Province and South-west Shelf Transition (including the Central West Coast meso-scale bioregion)
- Examples of the deeper ecosystems of the Abrolhos Islands meso-scale bioregion
- Examples of the shallower, southernmost ecosystems of the Central Western Shelf Province provincial bioregion including the Zuytdorp meso-scale bioregion

- Examples of the deeper ecosystems of the Central Western Transition provincial bioregion
- Examples of diversity of sea floor features including southern most banks and shoals of the North-west region; deep holes and valleys; slope habitats; terrace and shelf environments
- Seven KEFs.

The Abrolhos Marine Park is adjacent to the Shark Bay World Heritage Property. The marine park does not contain any Commonwealth or National Heritage listings (Director of National Parks 2018a). The marine park contains 11 known shipwrecks listed under the *Underwater Culture Heritage Act 2018*. Commercial tourism, fishing, recreation (e.g., fishing, snorkelling, diving and boating) and mining are important supported socio-economic activities in the park (Director of National Parks 2018a).

12.2.2. Jurien Marine Park

The Jurien Marine Park (including zones within the EMBA): Marine National Park Zone -IUCN Category II – 31 km^2 Special Purpose Zone -IUCN Category VI – 1,820 km^2) covers an area of approximately 1,851 km^2 and protects the following conservation values (Director of National Parks 2018a):

- Important foraging areas for the:
  - Threatened soft-plumaged petrel.
  - Threatened Australian Sea lion.
  - Threatened white shark.
  - Migratory roseate tern, bridled tern, wedge-tailed shearwater, and common noddy.
- Important migration habitat for the protected humpback whale
- Examples of the ecosystems of two provincial bioregions: the central part of the South-west Shelf Transition (which includes the Central West Coast meso-scale bioregion) and small parts of the Central Western Province
- Three KEFs
- Heritage values represented by the SS Cambewarra and Oleander historic shipwreck.

The Jurien Marine Park does not contain any international, Commonwealth or National Heritage listings (Director of National Parks 2018a). Commercial tourism, fishing, recreation (e.g., fishing, snorkelling, diving and boating) and mining are important supported socio-economic activities in the park (Director of National Parks 2018a).

12.3. 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 12.1** for extent of marine parks (wholly or partially) within the EMBA.

12.3.1. Carnarvon Canyon Marine Park

The Carnarvon Canyon Marine Park (Habitat Protection Zone – IUCN Category IV) covers an area of approximately 6,177 km^2 and protects the following conservation values (Director of National Parks 2018b):

- The Carnarvon Canyon a single channel canyon with seabed features that include slope, continental rise and deep holes and valleys.

- The Carnarvon Canyon ranges in depth from 1500 m to over 5,000 m, thereby providing habitat diversity for benthic and demersal species.
- Central Western Transition provincial bioregion ecosystem examples are found here, which are characteristic of the biogeographic faunal transition between tropical and temperate species.
- There is limited information about species' use of this Marine Park (Director of National Parks 2018b). The marine park does not contain any international, Commonwealth or National Heritage listings (Director of National Parks 2018b). Commercial fishing, tourism, shipping and mining are important supported socio-economic activities in the marine park.

12.3.2. Shark Bay Marine Park

The Shark Bay Marine Park (Multiple Use Zone – IUCN Category VI) covers an area of approximately 7,443 km^2 and protects the following conservation values (Director of National Parks 2018b):

- Foraging areas adjacent to important breeding areas for several species of migratory seabirds
- Part of the migratory pathway of protected humpback whales
- Internesting habitat for marine turtles
- Waters that are adjacent to the largest nesting area for loggerhead turtles in Australia
- Marine Park and adjacent coastal areas important for shallow-water snapper
- Protection to shelf and slope habitats as well as a terrace feature
- Examples of the shallower ecosystems of the Central Western Shelf Province and Central Western Transition provincial bioregions including the Zuytdorp meso-scale bioregion
- Connectivity between the inshore waters of the Shark Bay World Heritage Area and the deeper waters of the area.

Whilst no listed international, Commonwealth or National Heritage places are within the marine park, the park is adjacent to Shark Bay World Heritage Area (Director of National Parks 2018b). Commercial tourism, fishing, mining and recreation (e.g., fishing) are important socio-economic values of the park (Director of National Parks 2018b).

12.3.3. Gascoyne Marine Park

The Gascoyne Marine Park (Multiple Use Zone – IUCN Category VI-33,652 km^2; Habitat Protection Zone – IUCN Category IV-38,982 km^2; Marine National Park Zone – IUCN Category II-9,132 km^2) covers an area of approximately 81,766 km^2 and protects the following conservation values (Director of National Parks 2018a):

- Important foraging areas for: migratory seabirds threatened and migratory hawksbills and flatback turtles; and vulnerable and migratory whale shark.
- A continuous connectivity corridor from shallow depths around 15 m out to deep offshore waters on the abyssal plain at over 5,000 m in depth
- Sea floor features including canyon, terrace, ridge, knolls, deep hole/valley and continental rise. It also provides protection for sponge gardens in the south of the reserve adjacent to Western Australian coastal waters.
- Ecosystems examples from the Central Western Shelf Transition, the Central Western Transition and the Northwest province provincial bioregions as well as the Ningaloo meso-scale bioregion
- Four KEFs for the region:
  - Canyons on the slope between the Cuvier Abyssal Plain and the Cape Range Peninsula (enhanced productivity, aggregations of marine life and unique sea-floor feature)
  - Exmouth Plateau (unique sea-floor feature associated with internal wave generation)

- Continental slope demersal fish communities (high species diversity and endemism – the most diverse slope bioregion in Australia with over 500 species found with over 64 of those species occurring nowhere else)
- Commonwealth waters adjacent to Ningaloo Reef.

- The canyons in this reserve are believed to be associated with the movement of nutrients from deep water over the Cuvier Abyssal Plain onto the slope where mixing with overlying water layers occurs at the canyon heads. These canyon heads, including that of Cloates Canyon, are sites of species aggregation and are thought to play a significant role in maintaining the ecosystems and biodiversity associated with the adjacent Ningaloo Reef
- The reserve therefore provides connectivity between the inshore waters of the existing Ningaloo Commonwealth marine park and the deeper waters of the area.

The park is also adjacent to World Heritage listings associated with the Ningaloo Coast. Commercial tourism, commercial fishing, mining and recreation are important socio-economic values of the park (Director of National Parks 2018b).

12.3.4. Ningaloo Marine Park

Ningaloo Marine Park stretches approximately 300 km along the west coast of the Cape Range Peninsula and is adjacent to the Western Australian Ningaloo Marine Park and Gascoyne Marine Park (Director of National Parks, 2018b). Ningaloo Reef is the longest fringing barrier reef in Australia forming a discontinuous barrier that encloses a lagoon that varies in width from 200 m to 7 km. Gaps that regularly intercept the main reef line provide channels for water exchange with deeper, cooler waters (CALM 2005). It is the only example in the world of extensive fringing coral reef on the west coast of a continent.

The Ningaloo Marine Park (Recreational Use Zone – IUCN Category II) covers an area of approximately 2,435 km^2 and protects the following conservation values (Director of National Parks 2018a):

- Important habitat (foraging areas) for vulnerable and migratory whale sharks
- Areas used for foraging by marine turtles adjacent to important internesting sites
- Part of the migratory pathway of the protected humpback whale
- Foraging and migratory pathway for pygmy blue whales
- Breeding, calving, foraging and nursing habitat for dugong
- Shallow shelf environments which provides protection for shelf and slope habitats, as well as pinnacle and terrace sea floor features
- Sea floor habitats and communities of the Central Western Shelf Transition
- Three KEFs
- The Ningaloo Coast World Heritage Property, the Ningaloo Coast National Heritage listing and Ningaloo Marine Area Commonwealth Heritage Listing.

Commercial tourism and recreation (e.g. fishing) are important socio-economic values of the marine park (Director of National Parks 2018b).

12.3.5. 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.

12.3.6. 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.

12.3.7. Eighty Mile Beach Marine Park

The Eighty Mile Beach Marine Park (Multiple Use Zone – IUCN Category VI) is adjacent to the Western Australia Eighty Mile Beach Marine Park, 74 km north-east of Port Hedland and covers an area of approximately 10,785 km^2 and protects the following conservation values (Director of National Parks 2018b):

- Breeding, foraging and resting habitat for seabirds (one of the world's most important feeding grounds for migratory shorebirds and waders and is listed under the Ramsar Convention)
- Internesting and nesting habitat for marine turtles (it supports a significant nesting population of flatback turtles, which are endemic to northern Australia)
- Foraging, nursing and pupping habitat for sawfish
- Migratory pathway for humpback whales
- Coastal waters provide critical habitat for several shark and ray species at varying life stages.
- Three known shipwrecks listed under the *Underwater Cultural Heritage Act 2018*: *Lorna Doone* (wrecked in 1923), *Nellie* (wrecked in 1908), and *Tifera* (wrecked in 1923).
- Tourism, commercial fishing, pearling, and recreation are important activities in the Marine Park (Director of National Parks 2018b).

12.3.8. Argo-Rowley Terrace Marine Park

The Argo-Rowley Marine Park is located approximately 270 km north-west of Broome, Western Australia, and extends to the limit of Australia's exclusive economic zone. The Marine Park (Multiple Use Zone – IUCN Category VI-108,812 km^2; Marine National Park Zone – IUCN Category II-36,050 km^2; Special Purpose Zone – IUCN Category VI-1,141 km^2) covers an area of approximately 146,003 km^2 and protects the following conservation values (Director of National Parks 2018b):

- Foraging areas that are important for migratory seabirds as well as the endangered loggerhead turtle
- Important habitat and foraging for sharks.
- Migratory pathway for pygmy blue whales (Director of National Parks 2018b)

- Protection for communities and habitats of the deeper offshore waters (220 m to over 5,000 m) of the region
- Sea floor features including aprons and fans, canyons, continental rise, knolls/abyssal hills and the terrace and continental slope
- Communities and sea floor habitats of the Northwest Transition and Timor Province provincial bioregions
- Connectivity between the existing Mermaid Reef Marine National Nature Reserve and reefs of the Western Australian Rowley Shoals Marine Park and the deeper waters of the region
- Two KEFs in the reserve include:
  - The canyons linking the Argo Abyssal Plain with the Scott Plateau (unique sea floor feature with enhanced productivity and feeding aggregations of species)
  - Mermaid Reef and the Commonwealth waters surrounding Rowley Shoals (an area of high biodiversity with enhanced productivity and feeding and breeding aggregations).

No heritage listings apply to this marine park (Director of National Parks 2018b). Commercial fishing and mining are important socio-economic values for the park.

12.3.9. Mermaid Reef Marine Park

The Mermaid Reef Marine Park (Multiple Use Zone – IUCN Category VI) lays approximately 280 km north-west of Broome, Western Australia, adjacent to the Argo–Rowley Terrace Marine Park and approximately 13 km from the Western Australian Rowley Shoals Marine Park. It covers an area of 540 km ^{2} and protects the following conservation values (Director of National Parks 2018b):

- Mermaid Reef and Commonwealth waters surrounding Rowley Shoals are valued for its high productivity, aggregations of marine life and high species richness
- Mermaid Reef, Clerke Reef and Imperieuse Reef are biodiversity hotspot and key topographic feature of the Argo Abyssal Plain
- Rowley Shoals present some of the best geological examples of shelf atolls in Australian waters, and are ecologically significant in that they are considered ecological steppingstones for reef species originating in Indonesian/Western Pacific waters, are one of a few offshore reef systems on the north-west shelf, and may also provide an upstream source for recruitment to reefs further south
- Breeding habitat for seabirds
- Migratory pathway for the pygmy blue whale
- One known shipwreck listed under the *Underwater Cultural Heritage Act 2018*: Lively (wrecked in 1810).
- Tourism, recreation, and scientific research are important activities in the Marine Park (Director of National Parks 2018b).

12.3.10. Kimberley Marine Park

The Kimberley Marine Park (Multiple Use Zone – IUCN Category VI) is located approximately 100 km north of Broome, Western Australia, and extends from the Western Australian state water boundary north from the Lacepede Islands to the Holothuria Banks offshore from Cape Bougainville. It is adjacent to the Western Australian Lalanggarram / Camden Sound Marine Park and the North Kimberley Marine Park. It covers an area of 74,469 km^2, and protects the following conservation values (Director of National Parks 2018b):

- Northwest Shelf Province
  - Diverse benthic and pelagic fish communities
  - Ancient coastline thought to be an important sea floor feature
  - Migratory pathway for humpback whales
- Northwest Shelf Transition
  - High levels of species diversity
  - Endemism occur among demersal fish communities on the continental slope

- Timor Province
  - Reefs and islands of the bioregion are regarded as biodiversity hotspots
  - Endemism in demersal fish communities of the continental slope is high (two distinct communities have been identified on the upper and mid slopes)
  - Ancient coastline at the 125 m depth contour where rocky escarpments are thought to provide biologically important habitats in areas otherwise dominated by soft sediments
  - Continental slope demersal fish communities characterised by high diversity of demersal fish assemblages
  - Breeding and foraging habitat for seabirds
  - Internesting and nesting habitat for marine turtles
  - Breeding, calving and foraging habitat for inshore dolphins
  - Calving, migratory pathway and nursing habitat for humpback whales
  - Migratory pathway for pygmy blue whales
  - Foraging habitat for dugong and whale sharks
  - More than 40 known shipwrecks listed under the *Underwater Cultural Heritage Act 2018*.

Tourism, commercial fishing, mining, recreation, (e.g. fishing), and traditional use are important activities in the Marine Park (Director of National Parks 2018b).

12.3.11. Cartier Island Marine Park

The Cartier Island Marine Park (Sanctuary Zone – IUCN Category Ia) is located approximately 45 km south-east of Ashmore Reef Marine Park and 610 km north of Broome, Western Australia. Both Marine Parks are in Australia's External Territory of Ashmore and Cartier Islands and are also within an area subject to a Memorandum of Understanding (MoU) between Indonesia and Australia, known as the MoU Box. The Marine Park covers an area of 172 km² and protects the following conservation values (Director of National Parks 2018b):

+ Ashmore Reef and Cartier Island and surrounding Commonwealth waters
+ Areas of enhanced productivity in an otherwise low-nutrient environment
+ Regional importance for feeding and breeding aggregations of birds and marine life
+ Continental slope demersal fish communities
+ Area of high diversity in demersal fish assemblages
+ Area of high diversity and abundance of hard and soft corals, gorgonians (sea fans), sponges and a range of encrusting organisms
+ Breeding and foraging habitat for seabirds
+ Internesting, nesting and foraging habitat for marine turtles
+ Foraging habitat for whale sharks
+ Internationally significant for its abundance and diversity of sea snakes
+ One known shipwreck listed under the *Underwater Cultural Heritage Act 2018*: the Ann Millicent (wrecked in 1888).

- Scientific research is an important activity in the Marine Park (Director of National Parks 2018b).

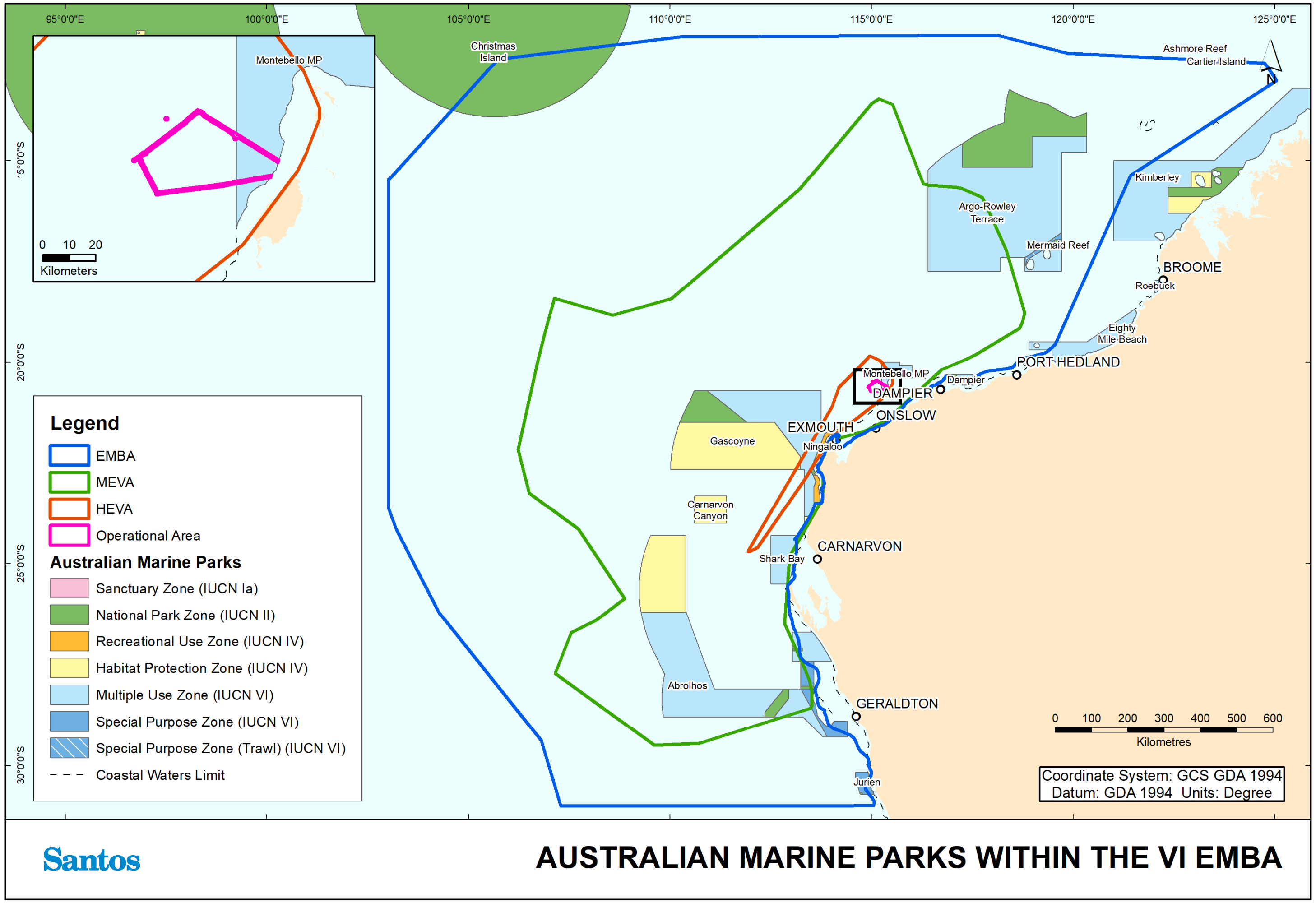

Figure 15: Australian Marine Parks in and near the EMBA and Operational Area

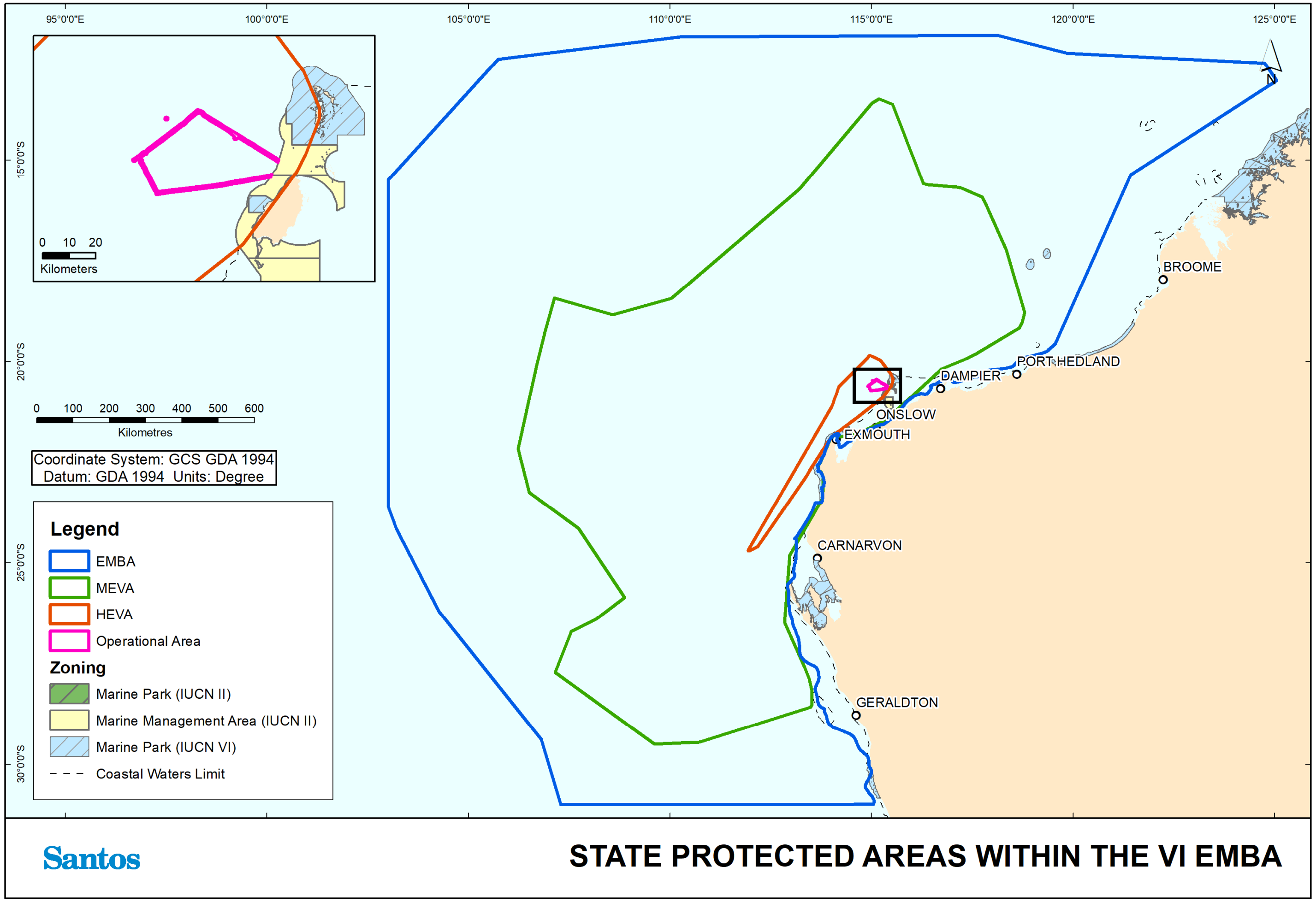

Figure 16: Sate protected areas in and near the EMBA and Operational Area

Table 18: Summary of marine network values, pressures, management programs and actions applicable to the EMBA

Marine network	Values	Pressures	Management programs and actions
South-west	• Nine bioregions • Key ecological features • EPBC listed species • Biologically important areas • Sea country indigenous values • Historic shipwrecks • Adjacent to Shark Bay World Heritage Area • Shipping and port activities • Commercial fishing • Marine tourism	• Climate change • Hydrological changes from coastal development and agriculture (increase sediment loads and pollutants) • Illegal/unregulated/ unreported fishing • Bycatch of non-target species • Habitat modification from mining • Human presence • Invasive species • Marine pollution	• Communication, education, and awareness programs • Promote suitable tourism experience. • Facilitate partnerships between tourism operators and Indigenous operators. • Indigenous engagement program • Marine monitoring programs • Park management via assessments / authorisation program for marine park activities • Marine Park management and development of suitable infrastructure • Compliance planning and surveillance
North-west	• Eight bioregions • Key ecological features • EPBC listed species • Biologically important areas • Sea country indigenous values • Native title determinations • Traditional Indonesian fishers • World Heritage Properties (Ningaloo Coast, Shark Bay) • Ashmore Reef Marine Park and Eighty-Mile Beach Ramsar sites • Shipping and port activities • Commercial fishing, pearling, aquaculture • Marine tourism • Scientific research	• Climate change • Hydrological changes from coastal development and agriculture (increase sediment loads and pollutants) • Illegal/unregulated/ unreported fishing • Bycatch of non-target species • Habitat modification from mining • Human presence • Invasive species • Marine pollution	• Communication, education and awareness programs • Promote suitable tourism experience • Facilitate partnerships between tourism operators and Indigenous operators • Indigenous engagement program • Marine monitoring programs • Park management via assessments / authorisation program for marine park activities • Marine Park management and development of suitable infrastructure • Compliance planning and surveillance

13. 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.

13.1. 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.

13.2. 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).

Relevant conservation advice, recovery plans and management plans for marine fauna ae detailed in Section 3.2.4.1 of the EP.

14. Social and Economic Features

14.1. 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 several exploration and production permits and leases throughout WA and Commonwealth waters in the EMBA. Existing petroleum infrastructure, permits and licences are shown in **Figure 17.**

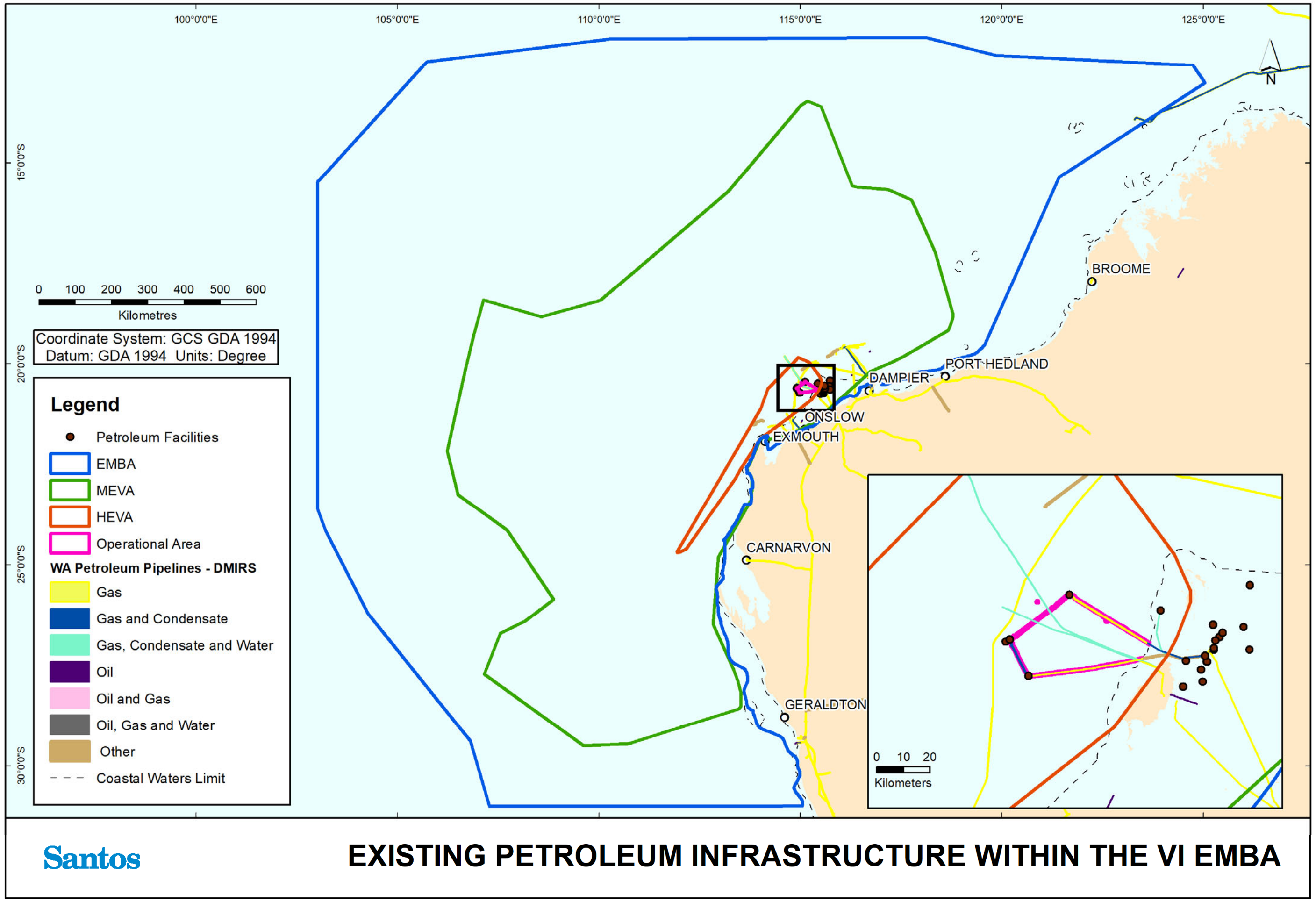

Figure 17: Existing Petroleum Infrastructure, Permits and Licences in the EMBA and Operational Area

14.2. 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 14.1**). 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 18.**

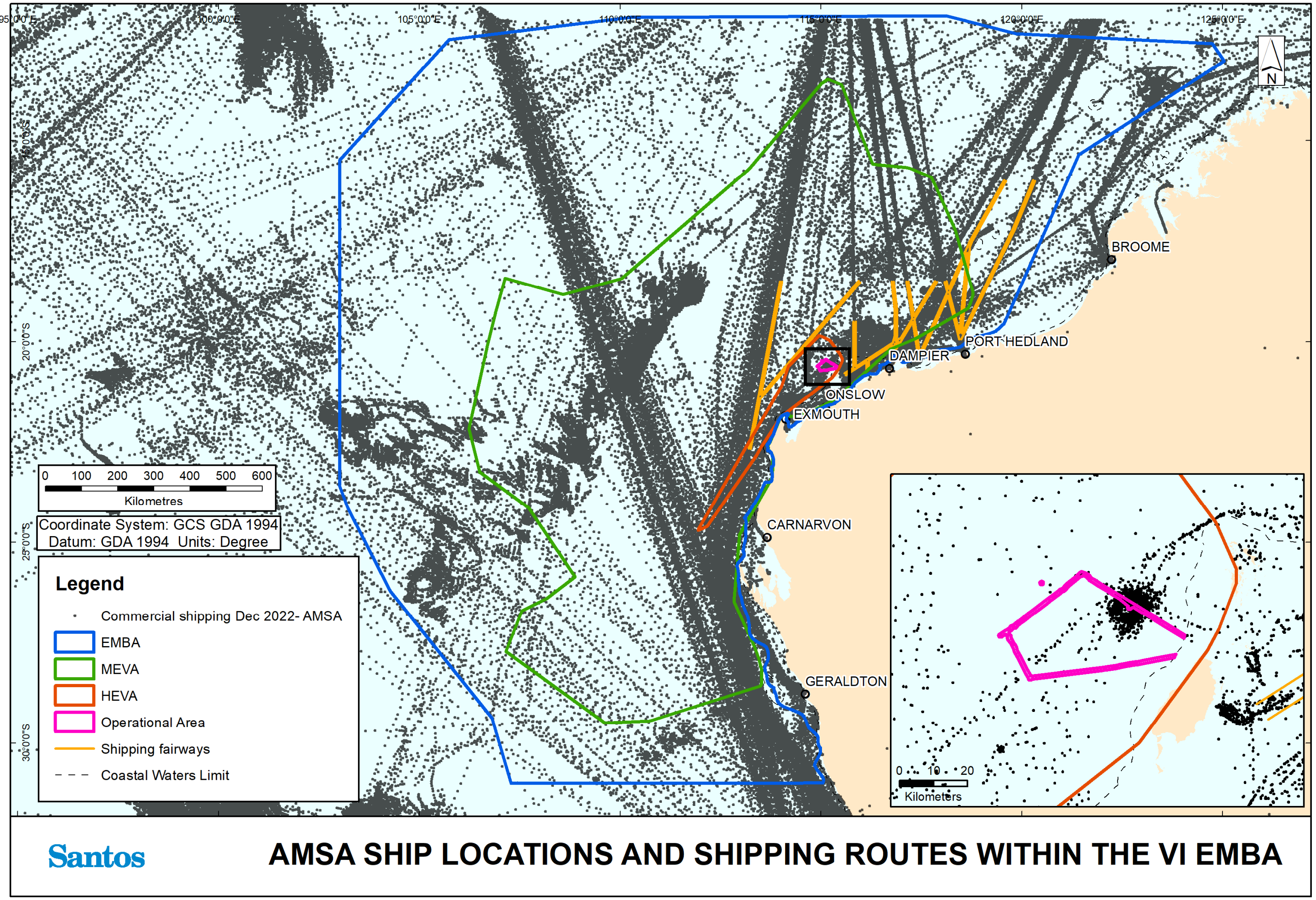

Figure 18: AMSA Ship Locations and Shipping Routes in and in Close Proximity to the EMBA and Operational Area

14.3. Tourism

The Kimberley, Pilbara and Gascoyne regions are popular visitor destination for Australian and international tourists. Tourism is concentrated in the vicinity of population centres including Broome, Dampier, Exmouth, Coral Bay and Shark Bay.

Seasonal nature-based tourism such as humpback whale watching, whale shark encounters and tours of turtle hatching mainly occurring around Ningaloo Reef, Cape Range National Park, Broome and Perth (Tourism Western Australia 2014). Seasonal aggregations of whale sharks, manta rays, sea turtles and whales, as well as the annual mass spawning of coral attract large numbers of visitors to Ningaloo each year (CALM 2005).

Given the water depths of the operational area and the lack of notable seabed features, there are unlikely to be any tourism-based activities in the surrounding waters of the operational area. The nearest area where recreation is likely to occur is the Montebello Islands, which are located approximately 20 km from the operational area.

14.4. 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. No known sites of underwater heritage have been identified within the operational area. The closest known site to the operational area is the Parks Lugger shipwreck, approximately 20 km northeast of the operational area at the Montebello Islands.

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*.

14.5. Commercial Fisheries

A valuable and diverse commercial fishing industry is supported by both the offshore and coastal waters in the North Coast, Gascoyne, West Coast and South Coast Bioregions between the WA and NT and South Australian borders. 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).

Commonwealth and State fisheries overlapping with the operational area and the EMBA are illustrated in **Figure 19, Figure 20** and **Figure 21** respectively. A summary of all commercial fisheries wholly or partially operating in the EMBA is also provided in **Table 19.**

14.5.1. 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.

North Coast Bioregion

- Onslow Prawn Managed Fishery (OPMF)
- Nickol Bay Prawn Managed Fishery (NBPMF) – referred to as Nickol Bay Prawn Limited Entry Fishery
- Broome Prawn Managed Fishery (BPMF)
- Kimberley Prawn Managed Fishery (KPMF)
- Northern Demersal Scalefish Managed Fishery (NDSF)
- Pilbara Developing Crab Fishery
- Pilbara Fish Trawl (Interim) Managed Fishery (PFTIMF)
- Western Australian Sea Cucumber Fishery
- Mackerel Managed Fishery (Area 1 – Kimberley and Area 2 – Pilbara)
- Western Australian Pearl Oyster Fishery – referred to as Pearl Oyster Managed Fishery.

Gascoyne Bioregion

- Exmouth Gulf Prawn Managed Fishery
- Gascoyne Demersal Scalefish Managed Fishery
- Shark Bay Scallop Managed Fishery – referred to as Shark Bay Scallop Limited Entry Fishery.
- Shark Bay Prawn Managed Fishery – referred to as Shark Bay Prawn Limited Entry Fishery.

West Coast Bioregion

- Abrolhos Islands and Mid-West Trawl Managed Fishery (AIMWRMF) (Closed) – referred to as Abrolhos Islands and Mid-West Trawl Limited Entry Fishery.
- West Coast Demersal Scalefish Interim Managed Fishery (WCDSIMF)
- West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery (West Coast Bioregion)
- West Coast Deep Sea Crab (Interim) Managed Fishery – referred to as West Coast Deep Sea Crustacean Managed Fishery.
- Octopus Interim Managed Fishery

- West Coast Rock Lobster Managed Fishery

Whole of State Fisheries

- Marine Aquarium Fish Managed Fishery (MAFMF)
- Specimen Shell Managed Fishery
- Hermit Crab Fishery (HCF)

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).

14.5.2. 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 as shown in **Figure 19.**

- North West Slope Trawl (NWST)
- Southern Bluefin Tuna Fishery (SBFTF)
- Western Tuna and Billfish Fishery (WTBF) (including Southern Tuna and Billfish Fishery)
- Small Pelagic Fishery (SPF)
- Skipjack Tuna Fishery (STF) (referred to as Western Skipjack Tuna Fishery
- Western Deepwater Trawl (WDTF) (referred to as Western Deepwater Trawl Fishery

Table 19: Commercial fisheries with permits to operate within the EMBA

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
State Managed Fisheries				
Abrolhos Islands and Mid-West Trawl Managed Fishery (AIMWTMF)	Saucer scallops (*Ylistrum balloti)*, with a small component targeting the western king prawn (*Penaeus latisulcatus*)	2017/2018: 651 tonnes 2022/2023: Commercial: closed Recreational: NA Environmentally limited	Operates using low opening otter trawl systems.	All the waters of the Indian Ocean adjacent to Western Australia between 27°51´ south latitude and 29°03´ south latitude on the landward side of the 200 m isobath'. Wholly within the EMBA
Aquarium Fishery	Multi-species catch including; invertebrates (hermit crabs, various snails, whelks and hard and soft corals) and finfish (rainbowfish, catfishes and scats).	Unknown	Dive-based method of collection, using barrier, cast, scoop, drag and skimmer nets, hand pumps, freshwater	The Aquarium fishery is a small-scale, multi-species fishery that prospects freshwater, estuarine and marine habitats to the outer boundary of the AFZ. Most of the harvest occurs within 100 km of Darwin, though one licence holder does collect from two offshore locations; Evans Shoal and Lynedoch Bank.

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
			pumps and handheld instruments.	Fishing activities may occur year-round. Wholly within the EMBA
Barramundi Fishery	Barramundi King threadfin	The fishery is restricted to 14 licences all of which are currently allocated to fishers.	Gill nets	The annual commercial barramundi fishing season in the NT is from 1 February to 30 September. Fishing is allowed from the high-water mark to three nautical miles seaward of the low water mark. The area is restricted to waters seaward from the coast, river mouths and legislated closed lines Wholly within the EMBA
Broome Prawn Managed Fishery (BPMF)	Western king prawns (*Penaeus latisulcatus*) and coral prawns (a combined category of small penaeid species).	Extremely low fishing effort occurred as only a single boat undertook trial fishing to investigate whether catch rates were sufficient for commercial fishing. This resulted in negligible landings of western king prawns with no byproduct recorded. Consistently low catch in 2022/2023	Otter trawl	The BPMF operates in a designated trawl zone off Broome. The boundaries of the BPMF are 'all Western Australian waters of the Indian Ocean lying east of 120° east longitude and west of 123°45' east longitude on the landward side of the 200 m isobath'. The actual trawl area is contained within a delineated small area north west of Broome. Wholly within the EMBA
Coastal Line Fishery	Black jewfish Golden snapper	Fishery is restricted to 52 licences, with approximately one third of these being active in 2015.	Lines, nets and traps	Fishing occurs along the NT coast between high water marks and 15 nm from low water mark. Majority of activity is concentrated around rocky reefs along the coastline within 100 km from Darwin. Fishing activities occur year-round. Wholly within the EMBA
Coastal Net Fishery	Mullet	This fishery is restricted to five licences, all of which are allocated.	Nets	The fishery extends from the high-water mark to three nautical miles out from the low water mark. The fishery is divided into regions including:

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
				Darwin – from Cape Hotham to Native Point and Cape Ford to Cape Dooley Gove – between Cape Arnhem and Cape Wilberforce Borroloola – from Bing Bong Creek and Pelican Spit. Wholly within the EMBA
Cockburn Sound Mussel Managed Fishery	Blue mussels (Mytilus edulis)	2015: Unspecified	Agriculture	Main mussel farming occurs in southern Cockburn Sound. Wholly within the EMBA
Cockburn Sound Crab Managed Fishery	Blue Swimmer (*Portunus armatus*) Blue swimmer crab (*Portunus armartus*)	2017/2018: 5: closed to commercial and recreational fishing since April 2014 2022/2023: remains closed	Drop nets, scoop nets, diving	Encompasses the inner waters of Cockburn Sound, from South Mole at Fremantle to Stragglers Rocks, through Mewstone to Carnac Island and Garden Island, along the eastern shore of Garden Island and back to John Point on the mainland. Wholly within the EMBA
Cockburn Sound Line and Pot Managed Fishery	Southern garfish (*Hyporhamphus melanochir*), Australian herring (*Arripis geogianus*)	2017/2018: 257 tonnes 2022/2023: insufficient information	Line (fish) Shelter and trigger pots (octopus)	Encompasses the inner waters of Cockburn Sound, from South Mole at Fremantle to Stragglers Rocks, through Mewstone to Carnac Island and Garden Island, along the eastern shore of Garden Island and back to John Point on the mainland. Wholly within the EMBA
Demersal Fishery	Red snappers Goldband snappers	There are currently 19 licences issued for the fishery, with around 9 active.	Handline Dropline Fish traps Although essentially trap-based since 2002	This fishery extends from waters 15nm from the coastal waters mark to the outer limit of the AFZ, excluding the area of the Timor Reef Fishery. Wholly within the EMBA
Exmouth Gulf Prawn Managed Fishery	Western king prawns (*Penaeus latisulcatus*), brown tiger prawns (*Penaeus esculentus*), endeavour prawns (*Metapenaeus* spp.) and banana prawns (*Penaeus merguiensis*).	2017/2018: 713 tonnes 2022/2023: Commercial: 898t	Low opening otter trawls.	Sheltered waters of Exmouth Gulf Essentially the western half of the Exmouth Gulf (eastern part is a nursery ground). The Muiron Islands and Point Murat provide the western boundary; Serrurier Island provides the northern limit Wholly within the EMBA
Gascoyne Demersal Scalefish Managed	Targets pink snapper (*Pagrus auratus*) and	2017/2018: Snapper: 133 tonnes	Mechanised handlines	The GDSF operates in the waters of the Indian Ocean and Shark Bay between latitudes 23°07’30”S and 26°30’S.

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
Fishery (GDSMF)	goldband snapper (*Pristipomoides multidens*). Other demersal species caught include the rosy snapper (*P. filamentosus*), ruby snapper *(Etelis carbunculus*), red emperor (*Lutjanus sebae*), emperors (*Lethrinidae*, including spangled emperor, *Lethrinus nebulosus*, and redthroat emperor, *L. miniatus*), cods (*Epinephelidae*, including Rankin cod, *Epinephelus multinotatus* and goldspotted rockcod, *E. coioides*), pearl perch (*Glaucosoma burgeri)*, mulloway (*Argyrosomus japonicas*), amberjack (*Seriola dumerili)* and trevallies (*Carangidae*).	Other demersals: 144 tonnes 2022/2023: Commercial: 166.3t Recreational: 79-117t		Vessels are not permitted to fish in inner Shark Bay. Wholly within the EMBA
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 apparatus) or SCUBA using an abalone ‘iron’ to prise the shellfish off rocks – both commercial and recreational divers employ this method.	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. Partially within the 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	Land based hand collection typically using four-wheel drives	Operates in Western Australian waters north of the Exmouth Gulf (22°30’S) Wholly within the EMBA

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
		58,643-118,203). 2022 insufficient information	to access remote beaches	
Kimberley Developing Mud Crab Managed Fishery	Mud crab (*Scylla serrata*)	2017/2018: 60 tonnes (also includes catch data from Pilbara Developmental crab fishery) 2022/23: insufficient information	Mud Crab traps	This fishery operates between Broome and Cambridge Gulf. Three commercial operators are permitted to fish from King Sound to the Northern Territory border, with closed areas around communities and fishing camps. One Aboriginal Corporation is permitted to fish in King Sound, with the other Aboriginal Corporation permitted to fish in a small area on the western side of the Dampier peninsula, north of Broome. Notices issued under the Fish Resources Management Act 1994 prohibit all commercial fishing for mud crabs in Roebuck Bay and an area of King Sound near Derby. Wholly within the EMBA
Kimberley Gillnet and Barramundi Managed Fishery (KGBF)	Barramundi (*Lates calcarifer*), King threadfin (*Polydactylus macrochir*), Blue threadfin (*Eleutheronema tetradactylum*)	2017/2018: 79.9 tonnes 2022/2023: Commercial: 112t Recreational: 12-23t	Gill net in inshore waters	Nearshore and estuarine zones of the North Coast Bioregion from the WA/NT border (129ºE) to the top end of Eighty Mile Beach, south of Broome (19ºS). The waters of the KGBF are defined as 'all Western Australian waters north of 19° south latitude and west of 129° east longitude and within three nautical miles of the high-water mark of the mainland of Western Australia and the waters of King Sound south of 16°21.47´ south latitude. Wholly within the EMBA
Kimberley Prawn Managed Fishery (KPMF)	Banana prawns (*Penaeus merguiensis*) Tiger prawns (*Penaeus esculentus*) Endeavour prawns (*Metapenaeus endeavouri*) Western king prawns (*Penaeus latisulcatus*)	2017/2018: 269 tonnes 2022/2023: Commercial: 239t	Otter trawl	The KPMF operates off the north of the state between Koolan Island and Cape Londonderry. The boundaries of the KPMF are 'all Western Australian waters of the Indian Ocean lying east of 123°45´ east longitude and west of 126°58´ east longitude'. It abuts the western boundary of the Commonwealth Northern Prawn Fishery (NPF).

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
				Wholly within the EMBA
Mandurah to Bunbury Developing Crab Fishery	Blue swimmer crab (*Portunus armartus*)	2017/2018: 5.2 tonnes 2022/2023: Closed in September 2022	Drop nets, scoop nets, diving	Fishery extends from south of the Shoalwater Islands Marine Park (32°22'40''S) to Point McKenna near Bunbury (33°16'S) and offshore to 115°30'E. The fishery is divided into two zones with crab fishing historically being permitted within Area 1, Comet Bay between 32°22''40''S and 32°30'S, and Area 2, Cape Bouvard to the southern boundary of the fishery. In 2015 crab fishing within Area 2 ceased. Wholly within the EMBA
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

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
				managed fish grounds (State of the Fisheries 2014-15). Wholly within the EMBA
North Coast Trochus Fishery	Trochus (*Tectus niloticus*)	2022/2023: Unspecified	Harvested by with handheld levers or chisels	Indigenous fishery operating within King Sound Wholly within the EMBA
Northern Demersal Scalefish Managed Fishery (NDSF)	Red emperor (*Lutjanus sebae*) Goldband snapper (*Pristipomoides multidens*)	2017/2018:1317 t (total) Goldband snapper (not including other jobfish): 473 tonnes. Red emperor: 34 – 47 t 2022/2023: Commercial: 1458 t Recreational:41-63 t	The permitted means of operation within the fishery include handline, dropline and fish traps, but since 2002 it has essentially been a trap-based fishery which uses gear time access and spatial zones as the primary management measures (State of the Fisheries 2014-15).	The Northern Demersal Scalefish Managed Fishery (NDSF) operates off the northwest coast of Western Australia in the waters east of 120° E longitude. These waters extend out to the edge of the Australian Fishing Zone (200 nautical miles). The Fishery consists of three zones; Zone A is an inshore area; Zone B comprises the area with most historical fishing activity and Zone C is an offshore deep slope developmental area. The fishery is further divided into two fishing areas: an inshore sector and an offshore sector. The inshore waters in the vicinity of Broome are closed to commercial fishing. Wholly within the EMBA
WA North Coast Shark Fisheries	Sandbar (*Carcharhinus plumbeus*), hammer head (*Sphyrnidae*), blacktip (*Carcharhinus melanopterus*) and lemon sharks (*Negaprion brevirostris*).	2022/2023: closed since 2008/2009	Gill net, longline	Comprised of the State-managed WA North Coast Shark Fishery in the Pilbara and western Kimberley, and the Joint Authority Northern Shark Fishery in the eastern Kimberley. Wholly within the EMBA
Octopus Interim Managed Fishery	Octopus cf. tetricus, with occasional bycatch of *O. ornatus* and *O. cyanea* in the northern parts of the fishery, and *O. maorum* in the southern and deeper sectors.	2017/2018: Commercial: 257 t Recreational: 1 t 2022/2023: Commercial: 744 t Recreational: 0-4 t	Line and pots Trawl and trap (land Octopus as byproduct)	Fishery in development phase. Four main categories in WA waters. Octopus are primarily caught in the Developing Octopus Interim Managed Fishery (largest fishery) are limited to the boundaries of the developmental fishery, which is an area bounded by the Kalbarri Cliffs (26°30'S) in the north and Esperance in the south.

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
				Passive and by-product harvests of octopus occur in both the Cockburn Sound (Line and Pot) Managed Fishery and the West Coast Rock Lobster Managed Fishery. Partially within the EMBA
Offshore Net and Line Fishery	Blacktip sharks Grey mackerel,	The number of licences for the fishery is restricted to 17 and only 10 boats operated in 2015. Limited effort was undertaken in the outer offshore area of the fishery during 2012.	Lines and nets	The fishery covers an area of over 522,000 km^2 and extends from the NT high water mark to the boundary of the AFZ. Majority of the fishing effort is in the coastal zone (within 12 nm of the coast) and immediately offshore in the Gulf of Carpentaria. Partially 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 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)	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

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
			Recreational fishers use drop nets or scoop nets, with diving for crabs becoming increasingly popular	
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 (*Lethrinus 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
Pilbara Line Managed Fishery	Variety of demersal scalefish including goldband snapper (*Pristipomoides multidens*), red emperor (*Lutjanus*	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

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
	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 (*Argyrops spinifer*), Ruby snapper (*Etelis carbunculus*) and eightbar grouper (*Hyporthodus octofasciatu*s)			boundary approximating the 200 m isobath and seaward of a line generally following the 30 m isobath. Wholly within the EMBA
Roe's Abalone	Western Australian Roe's abalone (*Haliotis roei)*	2017/2018: Commercial: 49 t Recreational: 23 t 2022/2023: Commercial: 28.9 t Recreational: 21-25 t (Perth metro area)	Dive and wade fishery. 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. Abalone divers operate from small fishery vessels (generally less than 9 metres in length).	Operating in shallow coastal waters along WA's western and southern coasts from Shark Bay to the SA border. Divided into 8 management areas. Commercial fishing for Roe's abalone is managed in 6 separate regions from the South Australian border to Busselton Jetty – Areas 1, 2, 5, 6, 7 and 8. Area 8 of the fishery was not fished in 2013. Partially within the EMBA
Shark Bay Crab Interim Managed Fishery	Blue swimmer crab (*Portunus armatus*)	2017/2018: 443 t total Crab: 153 t 2022/2023:	Trawl and trap	Waters of Shark Bay north of Cape Inscription, to Bernier and Dorre Islands and Quobba Point. In addition, two fishers with long-standing histories of trapping

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
		Commercial: 401 t Recreational: 1-4 t		crabs in Shark Bay are permitted to fish in the waters of Shark Bay south of Cape Inscription. Wholly within the EMBA
Shark Bay Prawn Managed Fishery	Western king prawn (*Penaeus latisulcatus*), brown tiger prawn (*Penaeus esculentus*), Variety of smaller prawn species including endeavour prawns (*Metapenaeus* spp.) and coral prawns (various species).	2017/2018: 1,608 t 2022/2023: Commercial: 831 t	Low opening otter trawls	The boundaries of the Shark Bay Prawn Managed Fishery are located in and near the waters of Shark Bay Wholly within the EMBA
Shark Bay Scallop Managed Fishery	Saucer scallop (*Ylistrum balloti*)	2017/2018: 1,632 t 2022/2023: Commercial: 177 t	Low opening otter trawls	The boundaries of the Shark Bay Scallop Managed Fishery are located in and near the waters of Shark Bay Wholly within the EMBA
Shark Bay Beach Seine and Mesh Net Managed Fishery	Yellowfin whiting (*Sillago schomburgkii*)	2022/2023: Commercial: 131 t	Seine and Mesh net	Low catch efforts. Fishery review to be undertaken in late 2023 Wholly within the EMBA
South Coast Open Access Netting Fishery	Insufficient information	2022/2023: Insufficient information	Insufficient information	Bunbury to the South Australian Border Partially 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	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

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
			depths between 60 and 300 m.	
South Coast Salmon Managed Fishery	WA salmon (*Arripis truttaceus*)	2017: 50 t 2022/2023: Commerical:137 t	Beach seine net, rod and line	Licensees operate from 18 designated beaches within the South Coast Bioregion, many of which have huts that are referred to as salmon camps. 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 EMBA
South West Coast Beach Net	Sea mullet, mulloway (*Argyrosomus hololepidotus*), Australian herring, yellowfin, whiting and southern garfish	Insufficient information	Beach net	Outside the metropolitan area under an Exemption that allows them to fish in the waters of the West Coast Demersal Scalefish (Interim) Managed Fishery . Wholly within the EMBA
South West Trawl Managed Fishery (SWTMF)	Saucer scallops (*Ylistrum balloti)*	2017/2018: 460 t meat weight (2,301 t whole weight) 2022/2023: Commercial: 65 t meat weight (326 t whole weight)	Otter trawls	Waters between 31°34’27’’S and 115°8’8’’E where it intersects with the high-water mark at Cape Leeuwin and on the landward side of the 200 m isobath. Wholly within the EMBA
Spanish Mackerel Fishery	Narrow-barred Spanish mackerel	In 2012, there were 16 fishery licences of which 12 were actively operating (DPIF 2014). The 2012 fishing effort was 719 boat-days; a decrease from 813 boat-days in 2011 but an increase from the 672 boat-days in 2010.	Near-surface trolling gear from vessels or handline.	The fishery extends from the NT waters seaward off the coast and river mouths to the outer limit of the AFZ. The majority of the fishing effort occurs coastal areas around reefs, shoals and headlands. The majority of the catch is taken in the Kimberley Area and north of Port Hedland. Wholly within the EMBA
Temperate Demersal Gillnet and Demersal Longline	Gummy shark (*Mustelus antarcticus*), dusky shark (*Carcharhinus obscurus*), whiskery shark (*Furgaleus*	2017/2018: 2016-17 Sharks and rays: 936 t Scalefish: 133 t 2022/2023:	Demersal gillnets and power-hauled reels	The Temperate Demersal Gillnet and Demersal Longline fisheries consists of Zone 1 of the Joint Authority Southern Demersal Gillnet and Demersal Longline

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
Fisheries (TDGDLF)	*macki*) and sandbar shark (*Carcharhinus plumbeus*).	Commercial: 924 t	(to target sharks) Demersal longline	Managed Fishery and the West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery. The Joint Authority Southern Demersal Gillnet and Demersal Longline Managed Fishery (JASDGDLF) spans the waters from 33° S latitude to the WA/SA border and comprises three management zones Zone 1 extends southwards from 33° S to 116° 30' E longitude off the south coast. Zone 2 extends from 116°30' E to the WA/SA border (129° E). A small number of Zone 3 units permit fishing throughout Zone 1 and eastwards to 116° 55'40" E. The West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery (WCDGDLF) technically extends northwards from 33° S latitude to 26° S longitude. However, the use of shark fishing gear has been prohibited north of 26° 30' S (Steep Point) since 1993. Demersal gillnet and longline fishing inside the 250-metre depth contour has been prohibited off the Metropolitan coast (between latitudes 31° S and 33° S) since November 2007. Wholly within the EMBA
Trepang Fishery	Sea cucumber (sandfish species)	The fishery is restricted to six licences, all of which are currently allocated.	Trepang are harvested by hand, either on foot or by diving.	Commercial fishing for sea cucumber is allowed from the high-water mark to three nautical miles seaward from the territorial sea baseline. Most sea cucumbers are collected along the Arnhem Land coast, mainly around the Cobourg Peninsula and Groote Eylandt Partially within the EMBA
Timor Reef Fishery	Goldband snapper	Consultation undertaken in 2016 confirmed there are only two active fishers currently operating in the fishery	Drop lines primarily in the 100 m–200 m depth range	Operates in remote offshore waters in the Timor Sea in a defined area approximately 370 km north-west of Darwin. Wholly within the EMBA

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
Warnbro Sound Crab Managed Fishery	Blue Swimmer (*Portunus armatus*) Blue swimmer crab (*Portunus armartus*)	2017/2018: closed to commercial and recreational fishing Fishery closed in May 2023	Drop nets, scoop nets, diving	Includes Warnbro sound and adjacent water, extending from Becher Point to John Point. 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 EMBA
West Coast Demersal Scalefish (Interim) Managed Fishery	West Coast Inshore Demersals: West Australian Dhufish (*Glaucosoma hebraicum*), Pink snapper (*Pagrus auratus*) with other species captured including Redthroat Emperor (*Lethrinus miniatus*), Bight Redfish (*Centroberyx gerrardi)* and Baldchin Groper *(Choerodon rubescens*). West Coast Offshore Demersals: Eightbar Grouper *Hyporthodus octofasciatus, Hapuku Polyprion oxygeneios*, Blue-eye Trevalla *Hyperoglyphe antarctica* and Ruby Snapper *Etelis carbunculus*.	2017/2018: 248 t 2022/2023 Commercial: 294 t Recreational: 342 t	Handline and drop line	The WCDSIMF encompasses the waters of the Indian Ocean just south of Shark Bay (at 26°30'S) to just east of Augusta (at 115°30'E) and extends seaward to the 200 nm boundary of the Australian Fishing Zone (AFZ). The commercial fishery is divided into five management areas comprising four inshore areas and one offshore area. The inshore areas, i.e. Kalbarri, Mid-West, Metropolitan and South-West, extend outwards to the 250 m depth contour, while the Offshore Area extends the entire length of the fishery from the 250 m depth contour to the boundary of the AFZ. Wholly within the EMBA
West Coast Estuarine Managed Fishery	Blue swimmer crab (*Portunus armartus*)	2017/2018: 353 t (blue swimmer crab) commercial and 58-77 t recreational 2022/2023: Commercial: 58 t Recreational: 22-38 t	Drop nets, scoop nets, diving (crabs)	Includes the waters of the Swan and Canning Rivers (Area 1), the waters of the Peel Inlet and Harvey Estuary, together with the Murray Serpentine, Harvey and Dandalup rivers (Area 2) and waters of the Hardy Inlet (Area 3). Of these areas only Areas 1-2 are permitted for crab fishing. Wholly within the EMBA

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
West Coast Nearshore and Estuarine Finfish Fisheries	Nearshore: whitebait (*Hyperlophus vittatus*), western Australian salmon (*Arripis truttaceus*), Australian herring (*Arripis georgianus*), southern school whiting (*Sillago bassensis)*, yellowfin whiting (*Sillago schomburgkii*), yelloweye mullet (*Aldrichetta forsteri*), tailor (*Pomatomus saltarix)*, southern garfish (*Hyporhamphus melanochir)*, silver trevally (*Pseudocaranx georgianus*) and King George whiting (*Sillaginodes punctate*). Estuarine: sea mullet (*Mugil cephalus*), estuary cobbler (*Cnidoglanis macrocephalus*) and black bream (*Acanthopagrus butcheri)*.	2017/2018: 353 t 2022/2023: Commercial: 90 t	Haul, beach seine and gill netting (commercial). Line fishing (recreational)	Five commercial fisheries target nearshore and/or estuarine finfish in the West Coast Bioregion. Nearshore: Cockburn Sound Fish Net Managed Fishery operating within in Cockburn sound, South West Coast Salmon Managed Fishery operating on various beaches south of the Perth Metropolitan area, West Coast Beach Bait Managed Fishery operating on beaches spanning from Moore River to Tim's Thicket and the South West Beach Seine Fishery operating on various beaches from Tim's Thicket southwards to Port Geographe Bay Marina. Estuarine: West Coast Estuarine Managed Fishery operating in the Swan/Canning and Peel Harvey estuaries, and in the Hardy Inlet Wholly within the EMBA
West Coast Nearshore Net Managed Fishery	Southern garfish (*Hyporhamphus melanochir)*, Australian herring (*Arripis georgianus*),	2022/2023: Commercial: 23 t Recreational: 62-94 t	Insufficient information	Cockburn Sound Fish Net Managed Fishery, South West Beach Seine, West Coast Nearshore Open Access Net Fishery, South West Coast Salmon Managed Fishery, West Coast Beach Bait Fisheries target nearshore scalefish and invertebrates Wholly within the EMBA
West Coast Purse Seine Fishery	Scaly mackerel (*Sardinella lemuru*), pilchard (*S. sagax*), Australian anchovy (*Engraulis australis*), yellowtail scad (*Trachurus novaezelandiae*) and maray (*Etrumeus teres*).	2017/2018: 1,095 t 2022/2023: Commercial: 259 t Recreational: <1 t	Purse seine gear	Waters between Ningaloo and Cape Leeuwin including three separate zones: Northern Development (22°00'S to 31°00'S), Perth Metropolitan (31°00'S to 33°00'S) and Southern Development Zone (33°00'S to Cape Leeuwin). Wholly within the EMBA
West Coast Rock Lobster Managed Fishery (WCRLMF)	Western rock lobster (*Panulirus cygnus*)	2016: 272 – 400 tonnes (346-481 t based on updated average weight) 2022/2023:	Baited traps (pots). Pots and diving (recreational catch)	The fishery is situated along the west coast of Australia between Latitudes 21°44´ to 34°24´ S. The fishery is managed in three zones: Zone A – Abrolhos Islands, north of latitude 30° S excluding the Abrolhos Islands

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
		Commercial: 862 t (12 month) Recreational: 401-476 t Charter: 17 t		(Zone B) and south of latitude 30° S (Zone C). Wholly within the EMBA
West Coast Demersal Gillnet and Demersal Longline (WCDGDLF)*	Gummy shark (*Mustelus antarcticus*), dusky shark (*Carcharhinus obscurus*), whiskery shark (*Furgaleus macki*) and sandbar shark (*C. plumbeus*)	2016/2018: 936 t of sharks and rays 2021/2022: 924 t sharks and rays	Demersal gillnets and demersal longline (not widely used)	Operates between 26° and 33° S. Wholly within the 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
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	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.

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
			outrigger booms on a vessel and towed slowly over the pearl oyster beds, harvesting legalised oysters by hand as they are seen.	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
South Coast Crustacean Managed Fishery	Western Rock Lobster (*Panulrius cygnus*), Crystal crab (*Chaceon albus*), southern rock lobster (*Jasus edwardsii*),	2022/2023: Commercial: 8.6 t	Pot based fishing	Catch has been constrained through the transition of the fishery to quota management. Recent reduced catches have been market driven. A harvest strategy is in development South coast of Western Australia (south of 34° 24' S, between 116° 00' E and 129° 00' E), Western Australia, Australia Partially within the EMBA
Commonwealth Managed Fisheries				
North West Slope Trawl	Scampi (crayfish): velvet scampi (*Metanephrops velutinus*) and boschmai scampi *(Metanephrops boschmai)*. Deepwater prawns (penaeid and carid): pink prawn (*Parapenaeus longirostris)*, red prawn (*Aristaeomorpha foliacea*), striped prawn (*Aristeus virilis)*, giant scarlet prawn (*Aristaeopsis*	2017-18: 79.7 t (total) 2021/2022: 85.8 t	Demersal crustacean trawl seaward of the 200 m isobath.	Extends from 114° E to approximately 125° E off the WA coast between the 200 m isobath and the outer limit of the Australian Fishing Zone (AFZ). Wholly within the EMBA

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
	edwardsiana), red carid prawn (*Heterocarpus woodmasoni*) and white carid prawn (*Heterocarpus sibogae*). Snapper.			
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
Small Pelagic Fishery	Australian sardine (*Sardinops sagax*), blue mackerel (*Scomber australasicus*), jack mackerel (*Trachurus declivis)* and redbait (*Emmelichthys nitidus*).	2018-19: 9,424 t 2022/2023 Commercial 259 t (WA)	Purse-seine and midwater trawling	Extends from Queensland to southern Western Australia. Partially within the EMBA
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 EMBA
Western Deepwater	A diverse range of species are caught, ranging from	2017-18: 101.9 t	Demersal fish trawl	Its northernmost point is from the boundary of the AFZ to

Fishery	Target Species	Catch[1]	Fishing Method	Area Description
Trawl Fishery	tropical and ruby snappers on the shelf edge to orange roughy *(Hoplostethus atlanticus*), oreo dories and bugs (*Ibacus* spp.) in the deeper temperate waters.	2021/2022: 12 t	seaward of the 200 m isobath.	longitude 114° E, and its southernmost point is from the boundary of the AFZ to longitude 115°08' E. Deep water off WA, from the 200 m isobath to the edge of the AFZ. Wholly within the 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

14.6. Recreational Fisheries

14.6.1. West Coast Bioregion

The marine environment of the West Coast Bioregion which lies between Kalbarri and Augusta is predominantly a temperate oceanic zone, but it is heavily influenced by the Leeuwin current, which transports warm tropical water southward along the edge of the continental shelf. This region contains the state's major population centres and is the most heavily used bioregion for recreational fishing (Fletcher and Santoro 2015). The range of recreational fishing opportunities includes estuarine fishing, beach fishing and boat fishing either in embayments or offshore for demersal and pelagic game species often around the islands and out to the continental shelf (WAFIC 2016).

14.6.2. Gascoyne Coast Bioregion

The Gascoyne Coast Bioregion extends from just north of Kalbarri to the Ashburton River, south of Onslow. The marine environment of this region represents a transition between the fully tropical waters of the north-west shelf of the north coast region and the temperate waters of the west coast region. This region has been identified as one of the 18 world 'hotspots' in terms of tropical reef endemism and the second most divers marine environment in the world in terms of tropical reef species. This region is a focal point for winter recreational fishing and is a key component of many tourist visits. Angling activities include beach and cliff fishing (e.g. Steep Point and Quobba), embayment and shallow-water boat angling (e.g. Shark Bay, Exmouth Gulf and Ningaloo lagoons), and offshore boat angling for demersal and larger pelagic species (e.g. off Ningaloo). The predominant target species include the tropical species such as emperors, tropical snappers, groupers, mackerels, trevallies and other game fish. Temperate species at the northern end of their ranges such as pink snapper, tailor and whiting also provide significant catches, particularly in Shark Bay (WAFIC 2016).

14.6.3. North Coast Bioregion

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).

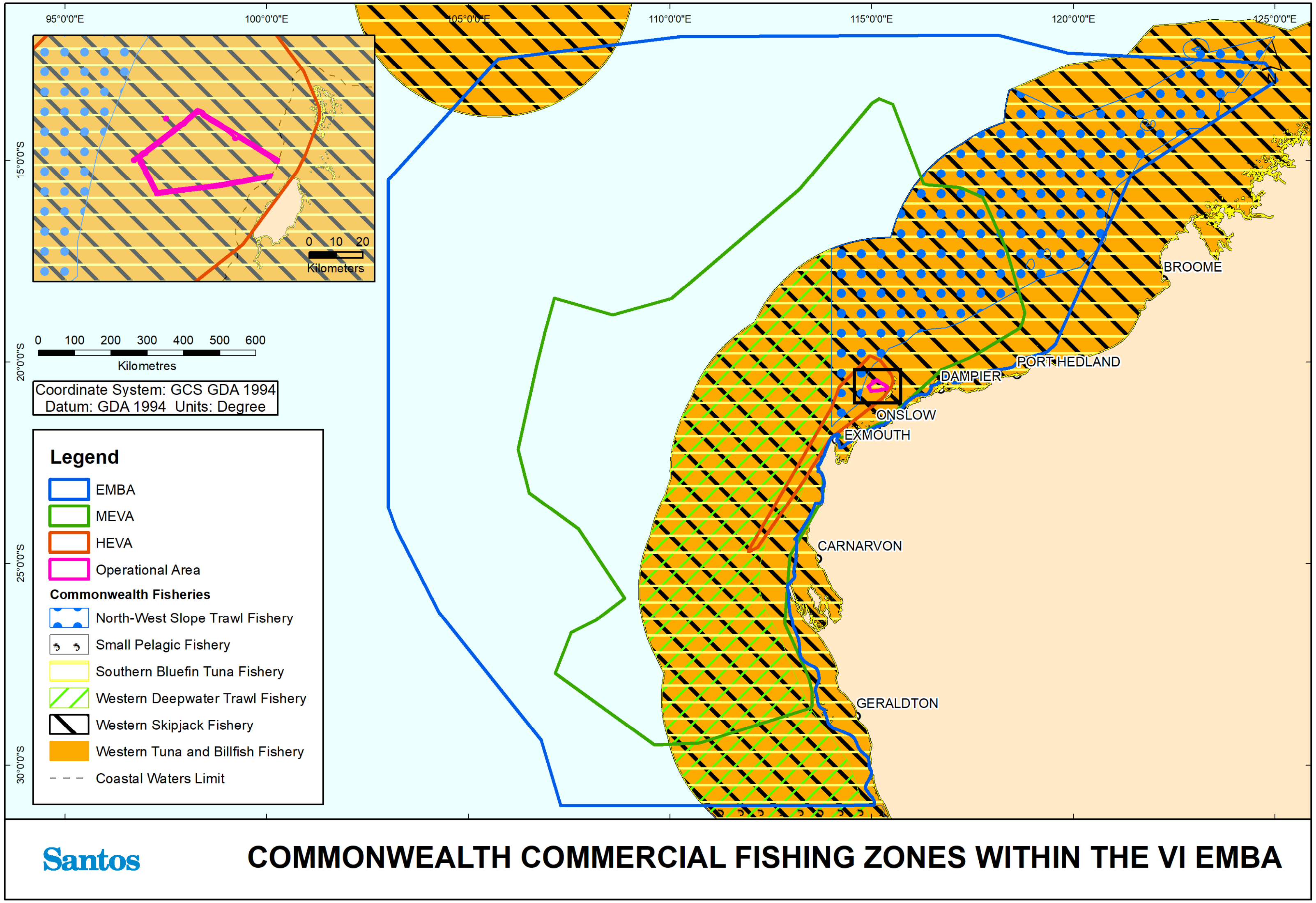

Figure 19: Commonwealth Commercial Fishing Zones in the EMBA and Operational Area

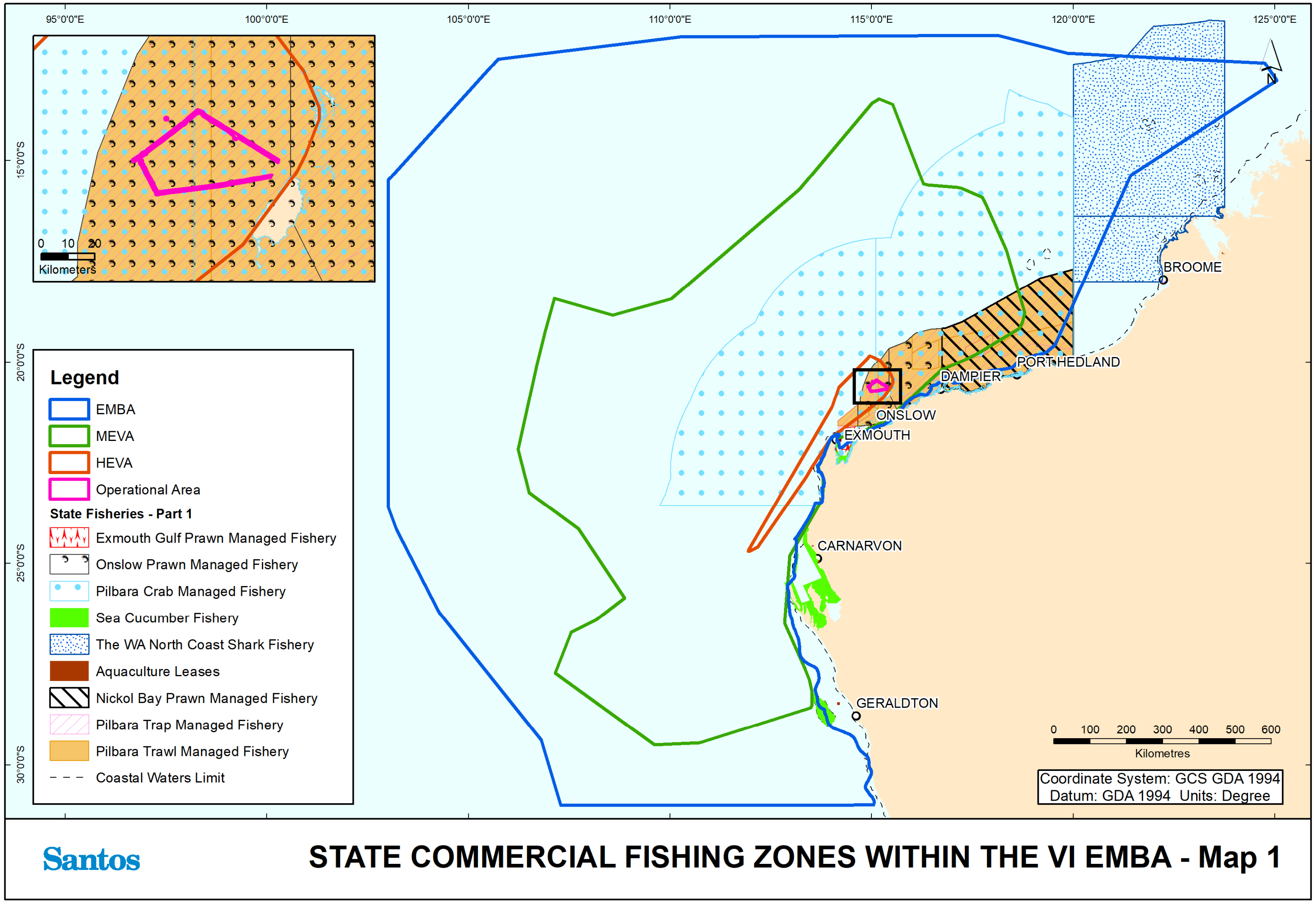

Figure 20: State Commercial Fishing Zones in the EMBA and Operational Area

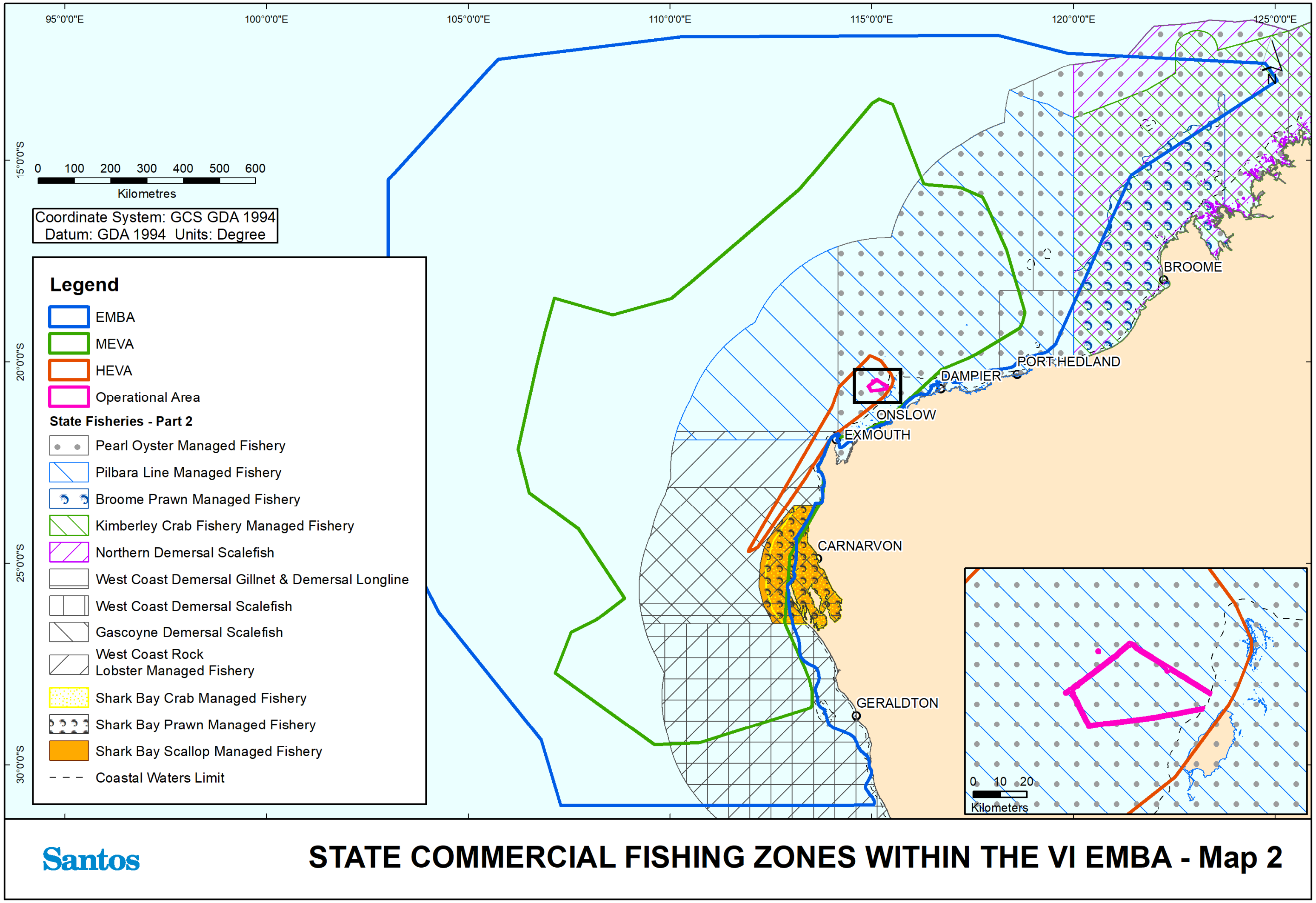

Figure 21: State Commercial Fishing Zones in the EMBA and Operational Area

15. Document Review

This document is to be reviewed annually at a minimum. The review and revision will consider any changes to the spatial scope of the document, i.e. the Environment that May be Affected (EMBA), as well as any changes to EPBC Act Matters of National Environmental Significance (MNES) from one review year to the next, regardless of any changes to the spatial extent of the EMBA. A review of changes to MNES shall consider at a minimum any changes to EPBC Act species lists, species management/recovery plans and MNES spatial layers.

Santos

16. References

16.1. Physical Environment

Baker C, Potter A, Tran M, Heap AD (2008) Geomorphology and sedimentology of the North-west Marine Region of Australia. Record 2008/07, Geoscience Australia, Canberra

BHPB 2005. Pyrenees Development. Draft EIS. BHP Billiton Petroleum. Perth

Blaber SJM and Young JW and Dunning, MC 1985. Community structure and zoogeographic affinities of the coastal fishes of the Dampier region of north-western Australia. *Australian Journal of Marine and Freshwater* Research 36(2): 247–266

Brewer, D.T., Potter, A., Skewes, T.D, Lyne, V., Andersen, J., Davies, C., Taranto, T.,Heap, A. D., Murphy, N. E., Rochester, W. A., Fuller, M., Donovan, A. (2009).Conservation values in Commonwealth waters of the Christmas and Cocos (Keeling)Islands remote Australian Territories. Report to Department of Environment and Water Resources. CSIRO, Cleveland. 216 pp.

BoM (Bureau of Meteorology) 2013. Climatology of Tropical Cyclones in Western Australia. Bureau of Meteorology, Canberra, ACT. Available at http://www.bom.gov.au/cyclone/climatology/wa.shtml [Accessed 31 July 2013]

BoM (Bureau of Meteorology) 2024a. Monthly climate statistics. Barrow Island Airport. http://www.bom.gov.au/climate/averages/tables/cw_005094.shtml

BoM (Bureau of Meteorology) 2024b. Tropical cyclone climatology. http://www.bom.gov.au/cyclone/tropical-cyclone-knowledge-centre/history/climatology/

Condie, S, Andrewartha, J, Mansbridge, J and Waring, J 2006. Modelling circulation and connectivity on Australia's North West Shelf. North West Shelf Joint Environmental Management Study: Technical Report No. 6. CSIRO Marine and Atmospheric Research, Hobart, Tasmania

Commonwealth of Australia (2022). State of the climate 2022. Bureau of Meteorology and CSIRO. https://www.csiro.au/en/research/environmental-impacts/climate-change/State-of-the-Climate

DEH (2005a). PB23 – Christmas Island Province factsheet.

Department of Sustainability, Environment, Water, Population and Communities. (2012a). Marine bioregional plan for the North-west Marine Region. Marine Bioregional Plan.

Department of Sustainability, Environment, Water, Population and Communities. (2012b). Marine bioregional plan for the South-west Marine Region. Marine Bioregional Plan.

Department of Sustainability, Environment, Water, Population and Communities. (2012). Marine bioregional plan for the North Marine Region. Marine Bioregional Plan.

DEWHA 2008a. The North-west Marine Bioregional Plan: Bioregional profile: A Description of the Ecosystems, Conservation Values and Uses of the North-West Marine Region. Department of the Environment Water, Heritage and the Arts, Canberra, Australian Capital Territory

DEWHA 2008b. The South-west Marine Bioregional Plan: Bioregional profile: A Description of the Ecosystems, Conservation Values and Uses of the South-West Marine Region. Department of the Environment Water, Heritage and the Arts, Canberra, Australian Capital Territory

Fugro, 2015. Barossa Field Meteorological, Current Profile, Wave and CTD Measurements – Final Report. Reporting Period: 8 July 2014 to 16 July 2015. Report prepared for ConocoPhillips Australia Pty Ltd., Perth, Western Australia

McKinnon, AD, Meekan, MG, Carleton, JH, Furnas, MJ, Duggan, S and Skiring, W 2003 Rapid changes in shelf water and pelagic communities on the southern Northwest Shelf, Australia, following a tropical cyclone. *Continental Shelf Research* 23: 93–111

NSR 1995. Wandoo full field development. Public Environmental Report for Ampolex Ltd, NSR Environmental Consultants Pty Ltd. November 1995

O'Hara, TD. 2023. An assessment of the offshore marine natural values of Australia's Indian Ocean Territories. Museums Victoria.

Pearce, A and Pattiaratchi, C. 1999. The Capes Current: a summer countercurrent flowing past Cape Leeuwin and Cape Naturaliste, Western Australia. *Continental Shelf Research* 19: 401-420

Przeslawski, R., Daniell, J., Anderson, T., Barrie, J.V., Battershill, C., Heap, A., Hughes, M., Li, J., Potter, A., Radke, R., Siwabessy, J., Tran, M, Whiteway, T., Nichol, S., 2011. Seabed Habitats and Hazards of the Joesph Bonaparte Gulf and Timor Sea, Northern Australia. Geoscience Australia, record 2011/40. Geoscience Australia, Canberra, Australian Capital Territory.

RPS (2023). Santos Spar Halyard Oil Spill Modelling. Report produced for Santos Limited.

SSE 1991. Normal and extreme environmental design criteria. Campbell and Sinbad locations, and Varanus Island to Mainland Pipeline. Volume 1. Prepared for Hadson Energy Limited by Steedman Science and Engineering. Report E486. March 1991

WNI 1995. Preliminary report on ambient and non-cyclonic design criteria for the Stag location. WNI Science & Engineering. December 1995

Woodside 2005. The Vincent Development. Draft EIS. EPBC Referral 2005/2110. Woodside Energy, Perth

16.2. Benthic and Pelagic Habitats

Adam, A.A.S. et al. 2022. Population connectivity and genetic offset in the spawning coral *Acropora digitifera* in Western Australia, *Molecular Ecology*, 31(13): 3533–3547

AIMS 2014. Benthic habitat characterisation of Montgomery Reef, Kimberley region, Western Australia. Available at http://data.aims.gov.au/metadataviewer/uuid/b4175af1-e213-4ac7-a7e8-baa121f709b2 [Accessed April 2014]

Amalfi C 2006. Flowers of the Ocean: WA's Expansive Seagrass Meadows; Western Fisheries Nov 2006, pg. 6-9

Bancroft KP & JA Davidson 2000. Bibliography of marine scientific research relevant to the conservation of Ningaloo Marine Park and adjacent waters. Marine Conservation Branch, Department of Conservation and Land Management, Perth, Western Australia

BHPBIO 2011. Proposed Outer Harbour Development, Port Hedland Public Environmental Review/Draft Environmental Impact Statement. BHP Billiton Iron Ore, Perth, Western Australia

Blakeway D & Radford BTM 2004. Scleractinian corals of the Dampier Port and inner Mermaid Sound: species list, community composition and distributional data. Corals of the Dampier Harbour: Their survival and reproduction during the dredging programs of 2004, 1–8

Brewer DT, Lyne V, Skewes TD and Rothlisberg P 2007. Trophic Systems of the North West Marine Region Prepared for the Department of the Environment, Water, Heritage and the Arts by CSIRO Marine and Atmospheric Research, Cleveland, Queensland

CALM, NPNCA 1996. Shark Bay Marine Reserves Management Plan 1996–2006. Management Plan No. 34. Department of Conservation and Land Management and National Parks and Nature Conservation Authority, Perth, Western Australia

CALM, MPRA 2005a. Management Plan for the Ningaloo Marine Park and Muiron Islands Marine Management Area 2005–2015. Management Plan No. 52. Department of Conservation and Land Management and Marine Parks and Reserves Authority, Perth, Western Australia

Ceccarelli DM, Richards ZT, Pratchett MS, and Cvitanovic C (2011) Rapid increase in coral cover on an isolated coral reef, the Ashmore Reef National Nature Reserve, north-western Australia. Marine and Freshwater Research 62(10): 1214

Chevron 2010. Draft Environmental Impact Statement/Environmental Review and Management Programme for the Proposed Wheatstone Project Volume 1 (Chapters 1 to 6), 6.0 Overview of Existing Environment. Chevron Australia Pty Ltd, Perth, Western Australia

ConocoPhillips 2018. Barossa Area Development Offshore Project Proposal. ConocoPhillips, Perth, Western Australia

DEC 2008. Preliminary reconnaissance survey of benthic habitats in the Anjo Peninsula area, Kimberley Bioregion, Western Australia. Prepared for Northern Development Taskforce, Department of Industry and Resources by Department of Environment and Conservation, Perth, Western Australia, October 2008

DEC 2013. Ngari Capes Marine Park management plan 2013. Department of Environment and Conservation, Perth

DEWHA 2008a. The North-west Marine Bioregional Plan Bioregional profile: A Description of the Ecosystems, Conservation Values and Uses of the North-west Marine Region. Department of the Environment, Water, Heritage and the Arts, Canberra, Australian Capital Territory

DEWHA 2008b. The South-west Marine Bioregional Plan: Bioregional profile: A Description of the Ecosystems, Conservation Values and Uses of the South-West Marine Region. Department of the Environment Water, Heritage and the Arts, Canberra, Australian Capital Territory

Director of National Parks 2012. Christmas Island National Park – Draft management Plan 2012-2022 Department of Sustainability, Environment, Water, Population and Communities, Canberra, Australian Capital Territory

DoF 2007. Plan of Management for the Kalbarri Blue Holes Fish Habitat Protection Area. Department of Fisheries, Fisheries Management Paper No. 188, Perth, Western Australia

DoF 2012. Exploring the Houtman Abrolhos Islands. Published by Department of Fisheries, Perth, Western Australia. Publication No. 105, June 2012.

Done TJ Williams D Mc B, Speare P, Turak E, Davidson J, DeVantier LM, Newman SJ & Hutchins JB 1994. Surveys of Coral and Fish Communities at Scott Reef and Rowley Shoals. Australian Institute of Marine Science, Townsville, Queensland

[DoNP] Director of National Parks. (2012). Christmas Island National Park Management Plan 2014 – 2024.

[DoNP] Director of National Parks. (2015). Pulu Keeling National Park Management Plan 2015 – 2025.DPAW 2009. Shark Bay World Heritage Area. Department of Parks and Wildlife, Perth, Western Australia. Available at http://www.sharkbay.org/Stromatolitesfactsheet.aspx [Accessed April 2014]

DPAW 2013. Lalang-garram/ Camden Sound Marine Park Management Plan 73 2013–2023. Department of Parks and Wildlife, Perth, Western Australia

EA 2000. Mermaid Reef Marine National Nature Reserve Plan of Management 2000-2007. Environment Australia, Canberra, Australian Capital Territory

Fry G, Heyward A, Wassenberg T, Taranto T, Stiegliz T and Colquhoun J 2008. Benthic habitat surveys of potential LNG hub locations in the Kimberley region. A CSIRO and AIMS Joint Preliminary Report for the Western Australian Marine Science Institution, Perth, Western Australia, 18 July 2008

Gilmour, J, Smith, L, Cook, K and Pincock, S 2013. Discovering Scott Reef: 20 years of exploration and research. Australian Institute of Marine Science, Perth, Western Australia.

Gilmour, J.P. et al. 2016. Biannual Spawning and Temporal Reproductive Isolation in Acropora Corals, *PLOS ONE*. Edited by N. Johnson, 11(3), p. e0150916. Available at: https://doi.org/10.1371/journal.pone.0150916

Griffith JK 1997. The Corals Collected During September/October at Ashmore Reef, Timor Sea. Parks Australia

Griffith JK 2004. Scleractinian corals collected during 1998 from the Dampier Archipelago, Western Australia. Records of the Western Australian Museum Supplement No. 66: 101–120

Hale J, Butcher R 2013. Ashmore Reef Commonwealth Marine Reserve Ramsar Site Ecological Character Description. A report to the Department of the Environment, Canberra, Australian Capital Territory

Heyward, A.J., Pincerato, E.J., and Smith, L. (eds). 1997. Big Bank Shoals of the Timor Sea: An Environmental Resource Atlas. BHP Petroleum, Melbourne, Victoria

Heyward, A., Radford, B., Burns, K., Colquhoun, J., Moore, C. 2010. Montara Surveys: Final report on Benthic Surveys at Ashmore, Cartier and Seringapatam Reefs. Australian Institute of Marine Science, Crawley Western Australia

Heyward, A., Jones, R., Travers, M., Burns, K., Suosaari, G., Colquhoun, J., Case, M., Redford, B., Meekan, M., Markey, K., Schenk, T., O'Leary, R.A., Brooks, K., Tinkler, P., Cooper, T., Emslie, M. 2012. Montara: 2011 shallow reef surveys at Ashmore, Cartier and Seringapatam reefs (Monitoring Study No. S6B Coral Reefs). Australian Institute of Marine Science, Townsville

Heyward, A., Radford, B., Cappo, M., Wakeford, M., Fisher, R., Colquhoun, J., Case, M., Stowar, M. and Miller K. 2017. Barossa Environmental Baseline Study, Regional Shoals and Shelf Assessment 2015 Final Report. A report for ConocoPhillips Australia Exploration Pty Ltd by the Australian Institute of Marine Science, Perth 2017

Hooper J, Ekins M 2004. Collation and Validation of Museum Collection Databases related to the Distribution of Marine Sponges in Northern Australia. (Contract National Oceans Office C2004/020), Unpublished Report to the National Oceans Office, Brisbane: Queensland Museum

Huisman JM, Leliaert F, Verbruggen H, Townsend RA 2009. Marine Benthic Plants of Western Australia's Shelf Edge Atolls. Records of the Western Australian Museum Supplement No. 77: 50–87

IRCE 2002. Victoria, Little Sandy and Pedrika wells environmental monitoring programme. Prepared for Apache Energy Ltd by IRC Environment, Perth, Western Australia

IRCE (2003) Environmental monitoring of drilling discharges in shallow water habitats. Prepared for Apache Energy Ltd by IRC Environment, Perth, Western Australia

IRCE (2004) Biannual Coral Monitoring Survey 2004. Prepared for Apache Energy Ltd by IRC Environment, Perth, Western Australia

IRCE (2006) Biannual Macroalgae Monitoring Survey 2005. Prepared for Apache Energy Ltd by IRC Environment, Perth, Western Australia

IRCE 2007. Annual Marine Monitoring 2007: Lowendal and Montebello Islands Macroalgal Survey. Prepared for Apache Energy Ltd by IRC Environment, Perth, Western Australia

IUCN 2019. The IUCN Red List of Threatened Species. Version 2019-3. http://www.iucnredlist.org. Downloaded on 16 December 2019.

Keesing JK, Irvine TR, Alderslade P, Clapin G, Fromont J, Hosie AM, Huisman JM, Philips JC, Naughton KM, Marsh LM, Slack-Smith SM, Thomson DP, Watson JE (2011). Marine benthic flora and fauna of Gourdon Bay and the Dampier Peninsula in the Kimberley region of north-western Australia. Journal of the Royal Society of Western Australia 94, no. 2 (2011): 285-301

Kendrick GA, Huisman JM and Walker DI (1990). Benthic Macroalgae of Shark Bay, Western Australia. Botanica Marina 33: 47–54

Lanyon JM & Marsh H 1995. Temporal changes in the abundance of some tropical intertidal seagrasses in North Queensland. Aquatic Botany 49:217–237

Last P, Lyne V, Yearsley G, Gledhill D, Gomon M, Rees T & White W, (2005) Validation of National Demersal Fish Datasets for the Regionalisation of the Australian Continental Slope and Outer Shelf (>40 m depth), Department of Environment and Heritage and CSIRO Marine

LEC, Astron 1993. Griffin Gas Pipeline Development Consultative Environmental Review. Prepared for BHP Petroleum and Doral Resources by LeProvost Environmental Consultants and Astron Engineering, Perth, Western Australia

Marsh LM 1990. Hermatypic corals of Shark Bay, Western Australia. In: Research in Shark Bay – Report of the France-Australe Bicentenary Expedition Committee, eds PF Berry, SD Bradshaw, BR Wilson, Western Australian Museum, Perth, pp 115–128

Masini R, Sim C, Simpson C 2009. Protecting the Kimberley: a synthesis of scientific knowledge to support conservation management in the Kimberley region of Western Australia, Part A. Department of Environment and Conservation, Perth, Western Australia

McCook L J, Klumpp DW, McKinnon AD 1995. Seagrass communities in Exmouth Gulf, Western Australia. A preliminary survey. Journal of the Royal Society of Western Australia 78: 81–87

McKinney, D 2009. A survey of the scleractinian corals at Mermaid, Scott, and Seringapatam Reefs, Western Australia, Records of the Western Australian Museum, Supplement, 77(1): 105. Available at: https://doi.org/10.18195/issn.0313-122x.77.2009.105-143.

Mellbrand, K., Lavery, P.S., Hyndes, G. et al. 2011. Linking Land and Sea: Different Pathways for Marine Subsidies. Ecosystems 14, 732–744. https://doi.org/10.1007/s10021-011-9442-x

Orr M, Zimmer M, Jelinski DE, & Mews M 2005. Wrack deposition on different beach types: spatial and temporal variation in the pattern of subsidy. Ecology 86(6), 2005, pp. 1496–1507

Prince RIT 1986. Dugong in northern waters of Western Australia 1984. Technical Report No7, Department of Conservation and Land Management, WA

Rees M, Heyward A, Cappo M, Speare P, Smith L 2004. Ningaloo Marine Park – Initial Survey of Seabed Biodiversity in Intermediate and Deeper Waters. Prepared for Australian Government Department of the Environment and Heritage by Australian Institute of Marine Science, Townsville, Queensland

Russell BC, Hanley JR 1993. History and Development. In: Survey of the Marine Biological and Heritage Resources of Cartier and Hibernia Reefs, Timor Sea. Northern Territory Museum of Arts and Sciences, Darwin

Seagrass-Watch 2019. Kimberley Region. Available at http://www.seagrasswatch.org/WA.html [Accessed December 2019]

Skewes, T., Dennis, D., Jacobs, D., Gordon, S., Taranto, T., Haywood, M., Pitcher, C., Smith, G., Milton, D., Poiner, I., 1999a. Survey and Stock Size Estimates of the Shallow Reef (0-15 M Deep) and Shoal Area (15-50 M Deep) Marine Resources and Habitat Mapping Within the Timor Sea MOU74 Box. Volume 1: Stock Estimates and Stock Status. CSIRO Marine Research, Hobart

Skewes, T., Gordon, S., McLeod, I., Taranto, T., Dennis, D., Jacobs, D., Pitcher, C., Haywood, M., Smith, G., Poiner, I., Milton, D., Griffin, D., Hunter, C., 1999b. Survey and Stock Size Estimates of the Shallow Reef (0-15 m Deep) and Shoal Area (15-50 m Deep) Marine Resources and Habitat Mapping within the Timor Sea MOU74 Box. Volume 2: Habitat Mapping and Coral Dieback. CSIRO Marine Research, Hobart.

SKM 2009b. Browse Kimberley LNG DFS#10 – Intertidal Survey. Prepared for Woodside Energy Limited by Sinclair Knight Merz Pty Ltd, Perth, Western Australia

The Ecology Lab 1997. Macroalgal Habitats of the Lowendal/Montebello Island Region. Prepared for Apache Energy Ltd by The Ecology Lab, September 1997

Thomas, L. et al. 2017. Restricted gene flow and local adaptation highlight the vulnerability of high-latitude reefs to rapid environmental change, *Global Change Biology*, 23(6): 2197–2205

Underwood, J.N. et al. 2020. Extreme seascape drives local recruitment and genetic divergence in brooding and spawning corals in remote north-west Australia, *Evolutionary Applications*, 13(9): 2404–2421.

URS 2009. Report Annual Marine Monitoring – Macroalgae. Prepared for Apache Energy Ltd by URS Australia Pty Ltd, Perth, Western Australia, August 2009

URS 2010a. Ichthys Gas Field Development Project Studies of the Offshore Marine Environment. Prepared for INPEX Browse Ltd, Perth Western Australia, INPEX Document No. C036-AH-REP-0023

URS 2010b. Benthic Primary Producer (Seagrass and Macroalgae) Habitats of the Wheatstone Project Area. Report R1442. Prepared for Chevron Australia Pty Ltd by URS Australia Pty Ltd, Perth, Western Australia

van Keulen M, Langdon MW 2011. Ningaloo Collaboration Cluster: Biodiversity and ecology of the Ningaloo Reef lagoon. Ningaloo Collaboration Cluster Final Report No. 1c

Vergès A., Vanderklift M. Doropoulos C. and Hyndes G. 2011. Spatial Patterns in Herbivoury on a Coral Reff Are Influenced by Structural Complexity but not by Algal Traits. PloS one. 6. e17115. 10.1371/journal.pone.0017115.

Veron JEN 1986. Reef building corals. In: Berry, P.F. (ed.). Faunal surveys of the Rowley Shoals, Scott Reef and Seringapatam Reef, north-western Australia. Records of the Western Australian Museum, Supplement No. 25:25–35

Veron JEN 1993. Hermatypic corals of Ashmore Reef and Cartier Island. In: Marine Faunal Surveys of Ashmore Reef and Cartier Island, North-western Australia, ed. P.F. Berry. Western Australian Museum, Perth

Veron JEN, Marsh LM 1988. Hermatypic corals of Western Australia; Records and Annotated Species List. Records of the Western Australian Museum, Supplement No. 29. Western Australian Museum, Perth, Western Australia

Walker DI 1989. Seagrass in Shark Bay – the foundations of an ecosystem. In: Seagrasses: A Treatise on the Biology of Seagrass with Special Reference to the Australian Region, eds A W D Larkum, A J McComb, S A Shepherd, Elsevier, Amsterdam, pp.182-210

Walker DI & Prince RIT 1987. Distribution and biogeography of seagrass species on the northwest coast of Australia. Aquatic Botany 29:19–32

Waples K & Hollander E 2008. Ningaloo Research Progress Report: Discovering Ningaloo – latest findings and their implications for management. Ningaloo Research Coordinating Committee, Department of Environment and Conservation, WA

Western Australian Museum (WAM). 2009. A Marine Biological Survey of Mermaid Reef (Rowley Shoals), Scott and Seringapatam Reefs, Western Australia 2006. Edited by C Bryce. Records of the Western Australian Museum Supplement 77.

Wells FE, Walker DI & Jones DS (eds) 2003. The marine flora and fauna of Dampier, Western Australia. Western Australian Museum, Perth, Western Australia

Williams A, Dunstan P, Althaus F, Barker B, McEnnulty F, Gowlett-Holmes K & Keith G (2010) Characterising the seabed biodiversity and habitats of the deep continental shelf and upper slope off the Kimberley coast, NW Australia. Report produced for Woodside Energy Ltd. CSIRO, pp. 95

Wilson B 2013. The Biogeography of the Australian North West Shelf: Environmental Change and Life's Response. Elsevier. Western Australian Museum, Perth, Western Australia

Woodside 2011. Browse LNG Development Draft Upstream Environmental Impact Statement. EPBC Referral 2008/4111. Woodside Energy Ltd, Perth, Western Australia, November 2011

Woodside Energy Limited, Australian Institute of Marine Science, Western Australian Museum 2010. Scott Reef Status Report 2010.

16.3. Shoreline Habitats

Alongi DM 2002. Present state and future of the world's mangrove forests. Environmental Conservation 29, 331–349. doi:10.1017/S0376892902000231

Alongi DM (2009). The Energetics of Mangrove Forests. Springer.

Astron (2014) Apache OSMP - Desktop Mangrove Assessment. Prepared for Apache Energy Ltd by Astron Environmental Services, Perth, Western Australia, November 2013. Report reference 564-13-1MSR-1Rev0-140225

Ayukai T (1998) Introduction: carbon fixation and storage in mangroves and their relevance to the global climate change – a case study in Hinchinbrook Channel in North-eastern Australia. Mangroves and Salt Marshes V2 No 4, Kluwer Academic Publishers.

CALM (2005) Management Plan for the Ningaloo Marine Park and Muiron Islands Marine Management Area 2005–2015 Management Plan No. 52. Department of Conservation and Land Management, Western Australia.

DEC (2007) Management Plan for the Montebello/Barrow Islands Marine Conservation Reserves 2007-2017. Management Plan Number 55. Department of Conservation and Land Management, Western Australia.

Duke NC, Ball MC, Ellison JC (1998) Factors influencing biodiversity and distributional gradients in mangroves. Global Ecology and Biogeography Letters 7, 27–47.

EPA (2001) Guidance Statement for Protection of Tropical Arid Zone Mangroves Along the Pilbara Coastline. Guidance Statement No. 1. Environmental Protection Authority Western Australia Perth

Garnet S.T. and Crowley, G.M. (2000) The action plan for Australian birds 2000. Environment Australia, Canberra.

Kangas M, McCrea J, Fletcher W, Sporer E and Weir V (2006) Exmouth Gulf Prawn Fishery ESD Report Series No.1 Department of Fisheries Western Australia.

Kathiresan, K., Bingham, B.L., 2001. Biology of mangroves and mangrove ecosystems. Advances in marine biology 40, 81–251.

Kenyon R, Loneragan N, Manson F, Vance D, Venables W (2004). Allopatric distribution of juvenile red-legged banana prawns (*Penaeus indicus* H. Milne Edwards, 1837) and juvenile white banana prawns (*Penaeus merguiensis* De Man, 1888), and inferred extensive migration, in the Joseph Bonaparte Gulf, northwest Australia. Journal of Experimental Marine Biology and Ecology 309, 79–108.

Mangrove Watch Australia (2014) Pilbara Mangroves, MangroveWatch, Australia. Available at http://www.mangrovewatch.org.au/index.php?option=com_content&view=category&layout=blog&id=84&Itemid=300201 [Accessed February 2020]

Nagelkerken I, van der Velde G, Gorissen MW, Meijer GJ, Van't Hof T, den Hartog C, 2000. Importance of Mangroves, Seagrass Beds and the Shallow Coral Reef as a Nursery for Important Coral Reef Fishes, Using a Visual Census Technique. Estuarine, Coastal and Shelf Science 51, 31–44. doi:10.1006/ecss.2000.0617

NOAA (2010) Oil Spills in Mangroves, Planning and Response. National Oceanic and Atmospheric Administration. US Department of Commerce, Office of Response and Restoration.

Rule M, Kendrick A, Huisman J (2012) Mangroves of the Shark Bay Marine Park. Information Sheet 46/2012 Science Division. Department of Environment and Conservation.

Semeniuk V (1993) The mangrove systems of Western Australia: 1993 Presidential Address. Journal of the Royal Society of Western Australia 76:99-122.

16.4. Intertidal Habitats

CALM (1996) Shark Bay Marine Reserves. Management Plan. 1996-2006. Marine Conservation Branch, Management Plan No. 34. Department of Conservation and Land Management, Western Australia.

DEC (2012) Indicative Management Plan for the Proposed Eight Mile Beach Marine Park. Department of Environment and Conservation, Western Australia.

DSEWPaC (2013b) World Heritage Places – Shark Bay, Western Australia. Available at: https://www.environment.gov.au/heritage/places/world/shark-bay [Accessed 17 July 2013]

DoF (2012) Exploring the Houtman Abrolhos Islands. Published by Department of Fisheries, Perth, Western Australia. Publication No. 105, June 2012.

Garnet ST and Crowley GM (2000) The action plan for Australian birds 2000. Environment Australia Canberra.

Hanley JR and Morrison PF (2012) A Guide to the intertidal flora and fauna of the Point Samson Fish Reserve. Sinclair Knight Merz and Rio Tinto Australia Pty Ltd.

Jones DS (2004) Marine biodiversity of the Dampier Archipelago Western Australia 1998-2002.

Sinclair Knight Merz (2009) Baseline Intertidal Report. Cape Lambert Port B Development. Rio Tinto Australia Pty Ltd.

Sinclair Knight Merz (2010) Browse Kimberley LNG DFS10 – Intertidal Survey. James Price Point Intertidal Survey.

Sinclair Knight Merz (2011) Port Hedland Outer Harbour Development. Marine Coastal Intertidal Benthic Habitats Impact Assessment. Prepared for BHPBIO Pty Ltd.

Wildsmith MD, Potter IC, Valesini FJ, Platell ME (2005) Do the assemblages of benthic Macroinvertebrates in nearshore waters of Western Australia vary among habitat types, zones and seasons? Journal of Marine Biology 85: 217-232.

16.5. Fish and Sharks

Allen, GR. (1989). Fishes. In Survey of the Marine Fauna of Cocos (Keeling) Islands, Indian Ocean. (Ed. P.F. Berry). (Western Australian Museum: Perth, Western Australia).

BBG (1994) Dampier Port Authority, Environmental Management Plan. Report prepared by Bowman Bishaw Gorham Perth, for the Dampier Port Authority, Dampier.

Borrell A, Aguilar A, Gazo M, Kumarran RP, Cardona L 2011. Stable isotope profiles in whale shark (Rhincodon typus) suggest segregation and dissimilarities in the diet depending on sex and size. Environmental Biology of Fishes, 92: 559-567.

Bradshaw CJA, Mollet HF, Meekan MG 2007. Inferring population trends for the world's largest fish from mark-recapture estimates of survival. Journal of Animal Ecology 76: 480-489

Brewer DT, Lyne V, Skewes TD and Rothlisberg P 2007. Trophic Systems of the North West Marine Region. Prepared for the Department of the Environment, Water, Heritage and the Arts by CSIRO Marine and Atmospheric Research, Cleveland, Australia.

CALM (1996) Shark Bay Marine Reserves. Management Plan. 1996-2006. Marine Conservation Branch, Management Plan No. 34. Department of Conservation and Land Management.

CALM (2005) Management Plan for the Ningaloo Marine Park and Muiron Islands Marine Management Area 2005 – 2015 Management Plan No. 52. Department of Conservation and Land Management, Perth, Western Australia.

Cailliet, G.M. (1996). An Evaluation of Methodologies to Study the Population Biology of White Sharks. In: Klimley, A.P. & D.G. Ainley, eds. Great White Sharks The biology of Carcharodon carcharias. Page(s) 415-416. United States of America: Academic Press Limited.

Chen C-T, Liu K-M, Joung S-J (1997) Preliminary report on Taiwan's whale shark fishery. Traffic Bulletin, 17: 53-57.

Chevron 2011. Technical Appendix 06 Draft Marine Fauna Management Plan. Appendix D: Sawfish Management Summary Report. Document No. WS0-0000-HES-PLN-CVX-000-00037-000. Rev E

Chidlow J, Gaughan D and McAuley RB (2006) Identification of Western Australian Grey Nurse Shark aggregation sites. Final report to the Australian Government, Department of the Environment and Heritage. Fisheries research report No. 155. Department of Fisheries, Western Australia, 48p.

CITES (2004). Convention of International Trade in Endangered Species of Wild Fauna and Flora - Appendix II Listing of the White Shark (revision 1). Available from: https://www.environment.gov.au/system/files/resources/2a4abfb5-236c-43bf-ad9d-b6d29c507f04/files/great-white-cites-appendix2-english.pdf [accessed February 2020].

Commonwealth of Australia, 2015. Sawfish and River Sharks Multispecies Recovery Plan. Available from: http://www.environment.gov.au/system/files/resources/062794ac-ef99-4fc8-8c18-6c3cd5f6fca2/files/sawfish-river-sharks-multispecies-recovery-plan.pdf. [Accessed 24 February 2020].

Compagno, L J (2001) Sharks of the World: An Annotated and Illustrated Catalogue of Shark Species Known to Date. Vol. 2, Bullhead, Mackerel and Carpet Sharks (Heterodontiformes, Lamniformes and Orectolobiformes) (Vol. 2, No. 1). Food & Agriculture Org.

Compagno, LJV & Last, PR 1999. Order Pristiformes. Pristidae: sawfishes, in KE Carpenter & VH Niem (eds), FAO species identification guide for fishery purposes – the living marine resources of the western central Pacific, vol. 3, Batoid fishes, chimaeras and bony fishes, part 1 (*Elopidae* to *Linophyroidae*), FAO, Rome, pp. 1410–1417.

Couturier, LIE, Rohner, CA, Richardson, AJ, Pierce, SJ, Marshall, AD, Jaine, FRA, Townsend, KA, Bennett, MB, Weeks, SJ, & Nichols, PD. (2013). Unusually high levels of n-6 polyunsaturated fatty acids in whale sharks and reef manta rays. *Lipids,* 48(10):1029-1034.

de Lestang P & Jankowski A (2017). A Guide to the Common Marine Fishes of Barrow Island. Chevron. Available from: https://australia.chevron.com/-/media/australia/publications/documents/nature-book-fish.pdf [Accessed 26/02/20].

DCCEEW. (2024c). *Thunnus maccoyii* — Southern Bluefin Tuna. https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=69402

DEC (2007b) Management Plan for the Rowley Shoals Marine Park 2007–2017: Management Plan No. 56. Department of Environment and Conservation, Perth, Western Australia

DEH (2006) A Guide to the Integrated Marine and Coastal Regionalisation of Australia Version 4.0. Department of the Environment and Heritage, Canberra, Australia.

DEWHA (2008a) The north-west marine region bioregional profile: a description of the ecosystems, conservation values and uses of the north-west marine region, Australian Government Department of the Environment, Water, Heritage and the Arts (DEWHA), Canberra.

DEWHA (2009) DEWHA Fact Sheet – Three sharks listed as migratory species under the EPBC Act. Department of the Environment, Water, Heritage and the Arts, Canberra, Australia.

DoE (2014a) *Ophisternon candidum* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat. Accessed 21 Mar 2014

DoE (2014b) *Pristis clavata* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat. Accessed 18 Mar 2014

DoE (2014c) *Pristis zijsron* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat. Accessed 25 Mar 2014

DoE (2015) Approved Conservation Advice *Rhincodon typus* (whale shark). Threatened Species Scientific Committee, Department of the Environment, Canberra, Australian Capital Territory

DSEWPaC (2012) Marine Bioregional Plan for the North-west Marine Region. Prepared under the Environment Protection and Biodiversity Conservation Act 1999. Department of Sustainability, Environment, Water, Population and Communities, Canberra, Australian Capital Territory

Eckert, S.A, and Stewart, B. S. (2001) Telemetry and satellite tracking of whale sharks, *Rhincodon typus*, in the sea of Cortez, Mexico, and the north Pacific Ocean. Environmental Biology of Fishes 60: 299-308.

Fletcher, WJ. and Santoro, K. (2013). Status Reports of the Fisheries and Aquatic Resources of Western Australia 2012/13(eds). The State of the Fisheries. Department of Fisheries, Western Australia.

Fox, NJ and Beckley, LE (2005). Priority areas for conservation of Western Australian coastal fishes: A comparison of hotspot, biogeographical and complementarity approaches. Biological Conservation, 125: 399-410.

Gaughan, D.J., Molony, B. and Santoro, K. (eds). 2019. Status Reports of the Fisheries and Aquatic Resources of Western Australia 2017/18: The State of the Fisheries. Department of Primary Industries and Regional Development, Western Australia.

Gelsleichter J, Musick JA & Nichols S (1999). Food habits of the smooth dogfish, *Mustelus canis*, dusky shark, *Carcharhinus obscurus*, Atlantic sharpnose shark, *Rhizoprionodon terraenovae*, and the sand tiger, *Carcharias taurus*, from the northwest Atlantic Ocean, Environmental Biology of Fishes, vol. 54, pp. 205–217.

Humphreys B & J Blyth (1994) Subterranean Secrets. Landscope - WA's Conservation, Forests and Wildlife Magazine. 9, No. 3:22-27.

Hutchins JB (2003). Checklist of marine fishes of the Dampier Archipelago, Western Australia. Pp. 453-478. In: Wells, F.E., Walker D.I. & Jones D.S. (eds). *The Marine Flora and Fauna of Dampier, Western Australia*. Western Australian Museum, Perth.

Hutchins JB (2004) Fishes of the Dampier Archipelago, Western Australia pp. 343-398. In: Jones D.S. (ed). Report on the results of the Western Australia Museum/Woodside Energy Ltd. Partnership to explore the Marine Biodiversity of the Dampier Archipelago. Western Australia 1998-2002. Records of the Western Australian Museum Supplement No. 66: 343-398.

IUCN 2019. The IUCN Red List of Threatened Species. Version 2019-3. http://www.iucnredlist.org. Accessed 16 December 2019.

Jarman SN, Wilson SG (2004) DNA-based species identification of krill consumed by whale sharks. *Journal of Fish Biology*, 65: 586-591

Kemps, H (2010) Ningaloo: Australia’s Untamed Reef. Quinns Rocks: MIRG Australia

Last P, Lyne V, Yearsley G, Gledhill D, Gomon M, Rees T and White, W (2005) Validation of national demersal fish datasets for the regionalisation of the Australian continental slope and outer shelf (>40 m depth). Department of Environment and Heritage and CSIRO Marine Research, Australia. 99pp

Last PR & Stevens JD (2009) Sharks and rays of Australia, 2nd edn, CSIRO Publishing, Collingwood.

Mackie M, Nardi A, Lewis P and Newman S (2007) Small Pelagic Fishes of the North-west Marine Region, Prepared for the Department of the Environment and Water Resources by Department of Fisheries, Perth, Western Australia.

Marcus, L., Virtue, P, Pethybridge, HR,. Meekan, MG, Thums, M & Nichols, PD. (2016).Intraspecific Variability in Diet and Implied Foraging Ranges of Whale Sharks at Ningaloo Reef, Western Australia, from Signature Fatty Acid Analysis. Marine Ecology Progress Series554: 115–28

McAuley, R. 2004. Western Australian Grey Nurse Shark Pop Up Archival Tag Project. Final Report to Department of Environment and Heritage. Page(s) 55.

Meekan MG, Bradshaw CJA, Press M, McLean C, Richards A, Quasnichka S, Taylor JA (2006) Population size and structure of whale sharks (*Rhincodon typus*) at Ningaloo Reef, Western Australia. Marine Ecology Progress Series 319: 275-285

Meekan MG, Jarman SN, McLean C, Schultz MB (2009) DNA evidence of whale sharks (*Rhincodon typus*) feeding on red crab (*Gecarcoidea natalis*) larvae at Christmas Island, Australia. Marine and Freshwater Research 60: 607-609

Newman, S.J., Wise, B.S., Santoro, K.G. and Gaughan, D.J. (eds). 2023. Status Reports of the Fisheries and Aquatic Resources of Western Australia 2021/22: The State of the Fisheries. Department of Primary Industries and Regional Development, Western Australia.

Peverell SC (2005) Distribution of sawfishes (Pristidae) in the Queensland Gulf of Carpentaria, Australia, with notes on sawfish ecology, Environmental Biology of Fishes, vol. 73, pp. 391–402.

Pierce, SJ., Pardo, SA., Rohner, CA., Matsumoto, R., Murakumo, K., Nozu, R. & Meekan, M.G. (2021). Whale Shark Reproduction, Growth, and Demography. Whale Sharks: Biology, Ecology, and Conservation.

Pogonoski JJ, DA Pollard & JR Paxton (2002) Conservation Overview and Action Plan for Australian Threatened and Potentially Threatened Marine and Estuarine Fishes. [Online]. Canberra, ACT: Environment Australia. Available from: https://www.environment.gov.au/system/files/resources/ca415225-5626-461c-a929-84744e80ee36/files/marine-fish.pdf [Accessed February 2020].

Pollard, DA MP Lincoln-Smith & A.K. Smith (1996) The biology and conservation of the grey nurse shark (*Carcharias taurus* Rafinesque 1810) in New South Wales, Australia. Aquatic Conservation: Marine and Freshwater Ecosystems. 6.

Rowat, D & KS Brooks. (2012). A Review of the Biology, Fisheries and Conservation of the Whale Shark Rhincodon Typus. *Journal of fish biology*, 80(5).

Sainsbury KJ, Campbell RA and Whitlaw AW (1992) Effects of trawling on the marine habitat on the North West Shelf of Australia and implications for sustainable fisheries management. In: Hancock D. A. (Editor). *Sustainable Fisheries through Sustaining Fish Habitat*. Canberra Australia. Australian Government Publishing Service, 1993, 137–145. Aust Soc. for Fish. Biol. Workshop, Victor Harbour, SA, 12–13 August 1992.

Smale MJ (2005) The diet of the ragged-tooth shark *Carcharias taurus* Rafinesque 1810 in the Eastern Cape, South Africa, African Journal of Marine Science, vol. 27, pp. 331–335.

Stevens JD, Pillans, RD and Salini J (2005) Conservation Assessment of *Glyphis sp.* A (Speartooth Shark), *Glyphis sp.* C (Northern River Shark), *Pristis microdon* (Freshwater Sawfish) and *Pristis zijsron* (Green Sawfish). [Online]. Hobart, Tasmania: CSIRO Marine Research. Available from: https://www.environment.gov.au/system/files/resources/d1696b5b-6a2e-4920-a3e2-16e5a272349a/files/assessment-glyphis.pdf [Accessed February 2020].

Thorburn DC, DL Morgan, AJ Rowland & HS Gill (2007) Freshwater sawfish *Pristis microdon* Latham, 1794 (Chondrichthyes: Pristidae) in the Kimberley region of Western Australia. *Zootaxa*. 1471:27-41.

Thorburn, DC, Morgan, DL, Rowland, AJ, Gill, HS & Paling, E (2008) Life history notes of the critically endangered dwarf sawfish, *Pristis clavata*, Garman 1906 from the Kimberley region of Western Australia', Environmental Biology of Fishes, vol. 83, pp. 139–145

Tyminski, John P et al. (2015). Vertical Movements and Patterns in Diving Behavior of Whale Sharks as Revealed by Pop-Up Satellite Tags in the Eastern Gulf of Mexico: *PloS one*, 10(11).

Whisson, G & Hoshke, A (2013). *In situ* video monitoring of finfish diversity at Ningaloo Reef, Western Australia. Galaxea, Journal of Coral Reef Studies. The Japanese Coral Reef Society. Vol. 15, pp 72-28

Womersley, Freya C et al. (2022) Global Collision-Risk Hotspots of Marine Traffic and the World's Largest Fish, the Whale Shark. Proceedings of the National Academy of Sciences, 119(20).

16.6. Marine Reptiles

AIMS (Australian Institute of Marine Science). (2021). Hawksbill and green turtle distribution and important areas. As part of the Northwest Shores to Shoals Research Program, supported by Santos. Available at: https://northwestatlas.org/nwa/nws2s-megafauna#green_bia

Astron Environmental Services (2014) Exmouth Islands Turtle Monitoring Program – January 2014 Field Survey. Rev A, 11 February 2014, unpublished report for Apache Energy Ltd, Perth.

BHPB (2005) Pyrenees Development: Draft Environmental Impact Statement. BHP Billiton, Perth, Western Australia.

Brewer, D.T., Potter, A., Skewes, T.D, Lyne, V., Andersen, J., Davies, C., Taranto, T.,Heap, A. D., Murphy, N. E., Rochester, W. A., Fuller, M., Donovan, A. (2009).Conservation values in Commonwealth waters of the Christmas and Cocos (Keeling)Islands remote Australian Territories. Report to Department of Environment and Water Resources. CSIRO, Cleveland. 216 pp.

CALM (2005a) Management Plan for the Ningaloo Marine Park and Muiron Islands Marine Management Area 2005 – 2015 Management Plan No. 52. Department of Conservation and Land Management, Perth, Western Australia.

Chaloupka M and Prince RIT (2012) Estimating demographic parameters for a critically endangered marine species with frequent reproductive omission: Hawksbill turtles nesting at Varanus Island, Western Australia. Marine Biology 159(2): 355-363.

Chevron (2005) Environmental Impact Statement/Environmental Review and Management Programme for the proposed Gorgon Development. Chevron Australia Pty Ltd, Perth, Western Australia.

Chevron (2008) Gorgon Gas Development Revised and Expanded Proposal Public Environmental Review Operated by Chevron Australia in joint venture with Gorgon Project. EPBC Referral 2008/4178Assessment No. 1727. Chevron Australia Pty Ltd, Perth, Western Australia, September 2008.

Cogger HG (2000) Reptiles and Amphibians of Australia - 6th edition. Sydney, NSW: Reed New Holland

Commonwealth of Australia (2017a), Recovery Plan for Marine Turtles in Australia 2017 – 2027.

DSEWPaC (2012a) *Eretmochelys imbricata* – Hawksbill Turtle. Available from: http://www.environment.gov.au/cgibin/sprat/public/publicspecies.pl?taxon_id=1766. Department of Sustainability, Environment, Water, Population and Communities.

DSEWPaC (2012b) Marine bioregional plans. Department of Sustainability, Environment, Water, Population and Communities, Canberra, ACT. Available at http://www.environment.gov.au/marine/marine-bioregional-plans/about

DSEWPaC (2012c) *Natator depressus* – Flatback Turtle. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59257. Department of Sustainability, Environment, Water, Population and Communities.

DSEWPaC (2012d) Species Group Report Card – Reptiles. Supporting the draft marine bioregional plan for the North-west Marine Region. Department of Sustainability, Environment, Water, Populations and Communities, Canberra, Australia.

DoE (2014) *Aipysurus foliosquama* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1118. Accessed 23 July 2014

DoEE (2019) Species Profile and Threats Database [Online] Department of Environment and Energy Canberra, Commonwealth of Australia Available from: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

Ferreira, Luciana, C & Thums, Michele & Fossette, Sabrina & Wilson, Phillipa & Shimada, Takahiro & Tucker, Anton & Pendoley, Kellie & Waayers, Dave & Guinea, Michael & Loewenthal, Graham & King, Joanne & Speirs, Marissa & Rob, Dani & Whiting, Scott. (2020). Multiple satellite tracking datasets inform green turtle conservation at a regional scale. Diversity and Distributions. 27. 249-266. 10.1111/ddi.13197.

Fossette, S, Ferreira, LC, Whiting, SD, Pendoley, JKK, Shimada, T, Speirs, M, Tucker, AD, Wilson, P & Thums, M. (2021). Movements and distribution of hawksbill turtles in the Eastern Indian Ocean. *Global Ecology and Conservation,* 29. e01713.

Hamann, M, Jessop, T. Limpus, C. and Whittier, J.M. (2002). Interactions among endocrinology, seasonal reproductive cycles and the nesting biology of the female green sea turtle. Marine Biology. 140. 823-830. 10.1007/s00227-001-0755-8.

Keesing, J.K. (Ed.) 2019. Benthic habitats and biodiversity of the Dampier and Montebello Australian Marine Parks. Report for the Director of National Parks. CSIRO, Australia.

Limpus CJ (2007) A biological review of Australian marine turtle species. 5. Flatback turtle*, Natator depressus* (Garman). The State of Queensland. Environmental Protection Agency, Brisbane, Queensland.

Limpus CJ (2008a) A biological review of Australian marine turtle species. 2. Green turtle*, Chelonia mydas* (Linneaus). The State of Queensland. Environmental Protection Agency, Brisbane, Queensland.

Limpus CJ (2008b) A biological review of Australian marine turtle species. 1. Loggerhead turtle*, Caretta caretta* (Linneaus). The State of Queensland. Environmental Protection Agency, Brisbane, Queensland.

Limpus CJ 2009a. A biological review of Australian marine turtle species.3. Hawksbill turtle, *Eretmochelys imbricata* (Linneaus). The State of Queensland. Environmental Protection Agency, Brisbane, Queensland.

Limpus CJ (2009c) A biological review of Australian marine turtle species. 6. Leatherback turtle, *(Dermochelys coriacea*). The State of Queensland. Environmental Protection Agency, Brisbane, Queensland.

Limpus C.J and McLachlin N (1994) The conservation status of the Leatherback Turtle, *Dermochelys coriacea*, in Australia. In: James R (ed.) Proceedings of the Australian Marine Turtle Conservation Workshop, Gold Coast 14-17 November 1990. pp. 63-67. Queensland Department of Environment and Heritage. Canberra: ANCA.

McMahon, CR, Bradshaw, JA & Hays, GC. (2007). Satellite tracking reveals unusual diving characteristics for a marine reptile, the olive ridley turtle *Lepidochelys olivacea*. Marine Ecology Progress Series. 329:239-252.

Minton SA & Heatwole H (1975) Sea snakes from three reefs of the Sahul Shelf. In: Dunson, W. A., ed. The Biology of Sea Snakes. Page(s) 141-144. Baltimore: University Park Press.

Northern Territory Government (n.d.) Threatened Species of the Northern Territory Green Turtle Chelonia mydas. The Northern Territory Government, Northern Territory.

Oliver GA (1990) Interim Guidelines for Operations – Serrurier Island Nature Reserve. Department of Conservation and Land Management, Perth, Western Australia.

Pendoley KL (2005) Sea Turtles and the Environmental Management of Industrial Activities in North West Western Australia, PhD Thesis, Murdoch University, Australia. 310pp.

Pendoley Environmental (2009) Marine Turtle Beach Survey: Forty Mile Beach Area, North East and South West Regnard Island. Report to Apache Energy Ltd.

Pendoley Environmental (2011) Varanus Island Marine Turtle Tagging Programme 2009 - 2010. Report to Apache Energy Ltd.

Pendoley Environmental (2013) Varanus Island Marine Turtle Tagging Program 2012 – 2013 Season. Report to Apache Energy Ltd.

Pendoley, KL, Schofield, G., Whittock, P. A., Ierodiaconou, D., & Hays, G. C. (2014a). Protected species use of a coastal marine migratory corridor connecting marine protected areas. Marine Biology, 1-12.

Prince RIT (1994) Status of the Western Australian Marine Turtle Populations: The Western Australian Marine Turtle Project 1986–1990. Report prepared for the Queensland Department of Environment and Heritage and Australian Nature Conservation Agency.

Waayers D (2010) A Holistic Approach to Planning for Wildlife Tourism: A Case Study of Marine Turtle Tourism and Conservation in the Ningaloo Region, Western Australia. PhD Thesis, Murdoch University, Perth.

Woodside (2002) WA-271-P Field Development: Environmental Impact Statement. Woodside Energy Ltd., Perth.

Guinea ML & SD Whiting (2005) Insights into the distribution and abundance of sea snakes at Ashmore Reef. The Beagle (Supplement 1). Page(s) 199-206

McCosker JE (1975). Feeding behaviour of Indo-Australian Hydrophiidae. In: Dunson W A (eds.) The Biology of Sea Snakes. Page(s) 217-232. Baltimore: University Park Press

16.7. Marine Mammals

Bannister, J.L., C.M. Kemper & R.M. Warneke (1996). *The Action Plan for Australian Cetaceans*. Canberra: Australian Nature Conservation Agency. Available from: http://www.environment.gov.au/resource/action-plan-australian-cetaceans.

Bejder M, Johnston D.W., Smith J, Friedlaender A, Bejder L (2016) Embracing conservation success of recovering humpback whale populations: Evaluating the case for downlisting their conservation status in Australia. Marine Policy 66 (2016) 137–141.

Branch TA, Stafford KM, Palacios DM, Allison C, Bannister JL, Burton CLK, Cabrera E, Carlson CA, Galletti vernazzani B, Gill PC, Hucke-gaete R, Jenner KC, Jenner M-N, Matsuoka K, Mikhalev YA, Miyashita MG, Morrice S, Nishiwaki VJ, Sturrock D, Tormosov RC, Anderson AN, Baker PB, Best P, Borsa T, Brownell Jr. RL, Childerhouse SK, Findlay P, Gerrodette, T, Ilangakoon, AD, Joergensen, M, Kahn, B, Ljungblad, DK, Maughan, B, Mccauley, RD, Mckay, S, Norris, TF, Oman whale and Dolphin research group, Rankin, S, Samaran, F, Thiele, D, Van Waerebeek K & Warneke RM (2007) Past and present distribution, densities and movements of blue whales *Balaenoptera musculus* in the Southern Hemisphere and Northern Indian Ocean. Mammal Rev. 37(2):116–175

Cerchio, S. et al. (2020). A new blue whale song-type described for the Arabian sea and western Indian Ocean. Endanger. Species Res. 43, 495–515

ConocoPhillips 2018. Barossa Area Development Offshore Project Proposal. ConocoPhillips, Perth, Western Australia

DAWE (2020) National Conservation Values Atlas [Online] Department of Environment and Energy Canberra, Commonwealth of Australia Available from: http://www.environment.gov.au/webgis-framework/apps/ncva/ncva.jsf

DEWHA (Department of the Environment, Water, Heritage and the Arts) (2008) The South-West Marine Bioregional Plan: Bioregional Profile: A Description of the Ecosystems, Conservation Values and Uses of the South-West Marine Region. [Online] Canberra: DEWHA Available from: https://parksaustralia.gov.au/marine/pub/scientific-publications/archive/south-west-marine-bioregional-plan.pdf

DEWR (Department of Environment and Water Resources) (2007) Whales and dolphins identification guide. Department of Environment and Water Resources, Canberra. http://www.environment.gov.au/system/files/resources/9c058c02-afd1-4e5d-abff-11cac2ebc486/files/blue-whale-conservation-management-plan.pdf.

Department of the Environment (DoE) (2015) Conservation Management Plan for the Blue Whale. A Recovery Plan under the *Environment Protection and Biodiversity Conservation Act 1999*. Department of the Environment. Canberra.

DoEE (2016b). *Tursiops aduncus* — Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin. Species Profile and Threats Database. Available at: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=68418 [Accessed on 3 August 2016]

DoEE (2016c) *Orcaella heinsohni* — Australian Snubfin Dolphin. Species Profile and Threats Database. Available at: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=81322 [Accessed on 3 August 2016]

Department of Agriculture, Water and the Environment (DAWE) (2020a) Species Profile and Threats Database [Online]. Department of Agriculture, Water and the Environment. Canberra, Commonwealth of Australia. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

Department of Agriculture, Water and the Environment (DAWE) (2020b) National Conservation Values Atlas [Online]. Department of Agriculture, Water and the Environment. Canberra, Commonwealth of Australia. Available from: http://www.environment.gov.au/webgis-framework/apps/ncva/ncva.jsf

Department of State Development (DSD) 2010. Browse Liquified Natural Gas Precinct – Strategic Assessment Report. Part 3 – Environmental Assessment - Marine Impacts. December 2010

Double MC, Andrews-Goff V, Jenner KCS, Jenner M-N, Laverick SM, Branch TA & Gales N (2014) Migratory movements of pygmy blue whales (*Balaenoptera musculus brevicauda*) between Australia and Indonesia as revealed by satellite telemetry. PLOS one, April 2014 9(4)

Double, M.C. et al. (2014) Migratory Movements of Pygmy Blue Whales (Balaenoptera musculus brevicauda) between Australia and Indonesia as Revealed by Satellite Telemetry, PLOS one, 9(4)

Double MC, Gales N, Jenner KCS & Jenner M-N (2010) Satellite tracking of south-bound female humpback whales in the Kimberley region of Western Australia. Final report to the Australian Marine Mammal Centre, Tasmania, September 2010

Double MC, Jenner KCS, Jenner M-N, Ball I, Laverick S, Gales N (2012a) Satellite tracking of northbound humpback whales (*Megaptera novaeangliae*) off Western Australia. Final report to the Australian Marine Mammal Centre, Tasmania May 2012.

Double MC, Jenner KCS, Jenner M-N, Ball I, Laverick S, Gales N (2012b) Satellite tracking of pygmy blue whales (*Balaenoptera musculus brevicauda*) off Western Australia. Final report to the Australian Marine Mammal Centre, Tasmania, May 2012

DSEWPaC (Department of Sustainability, Environment, Water, Population and Communities) (2012) Conservation Management Plan for the Southern Right Whale. [Online] Department of Sustainability, Environment, Water, Population and Communities Canberra, Commonwealth of Australia Available from: http://www.environment.gov.au/biodiversity/threatened/recovery-plans

DSEWPaC (2013c) Recovery Plan for the Australian Sea Lion (*Neophoca cinerea*). [Online] Department of Sustainability, Environment, Water, Population and Communities Canberra, Commonwealth of Australia Available from: http://www.environment.gov.au/system/files/resources/1eb9233c-8474-40bb-8566-0ea02bbaa5b3/files/neophoca-cinerea-recovery-plan.pdf

Gedamke J, Gales N, Hildebrand J & Wiggins S (2007) Seasonal occurrence of low frequency whale vocalisations across eastern Antarctic and southern Australian waters, February 2004 to February 2007. IWC SC/59/SH5

Gill PC (2002) A blue whale (*Balaenoptera musculus*) feeding ground in a southern Australian coastal upwelling zone. J. Cetacean Res. Manage. 4(2):179—184

Hale, P.T., Barreto, A.S., Ross, G.J.B. (2000) Comparative morphology and distribution of the *aduncus* and *truncatus* forms of bottlenose dolphin Tursiops in the Indian and Western Pacific Oceans. Aquatic Mammals 26, 101–110.

Hamer, DJ, Ward, TM, Shaughnessy, PD & Clark, SR 2001 Assessing the effectiveness of the Great Australian Bight Marine Park in protecting the endangered Australian sea lion *Neophoca cinerea* from bycatch mortality in shark gillnets. End. Species Res. 14: 203—216

Hedley, SL, Bannister, JL & Dunlop, RA 2011 Abundance estimates of Southern Hemisphere Breeding Stock 'D' Humpback Whales from aerial and land-based surveys off Shark Bay, Western Australia, 2008. J. Cetacean Res. Manage. (special issue 3): 209—221

INPEX Browse. 2010. Icthys Gas Field Development Project: draft environmental impact statement. INPEX Browse, Perth.

Irvine, L. and Kent, C.S. (2018) The distribution and relative abundance of marine mega-fauna, with a focus on humpback whales (Megaptera novaeangliae), in Exmouth Gulf, Western Australia

Irvine, L.G., Thums, M., Hanson, C.E., McMahon, C.R. & Hindell, M.A. (2018) Evidence for a widely expanded humpback whale calving range along the West Australian coast. Marine Mammal Science, 34(2): 294-310.

JASCO Applied Sciences, 2016. Underwater Acoustics: Boise and the Effects on Marine Mammals. Compiled by Christine Erbe, Perth, Western Australia.

Jenner, KCS, Jenner, M-N & McCabe, KA, 2001 Geographical and temporal movements of humpback whales in Western Australian waters. APPEA Journal Vol 41(2001), pp 749—765

Kato, H. (2002). Bryde's Whales *Balaenoptera edeni* and *B. brydei*. **In:** Perrin W.F., B. Wrsig & H.G.M. Thewissen, eds. *Encyclopedia of Marine Mammals*. Page(s) 171-177. Academic Press.

Kemper, C.A. (2002). Distribution of the pygmy right whale, *Caperea marginata*, in the Australasian region. *Marine Mammal Science*. 18(1):99-111.

Leaper, R, Bannister, J. L., Branch, T. A., Clapham, P. J., Donovan, G. P., Matsuoka, K., Reilly, S., and Zerbini, A. N. (2008). A review of abundance, trends and foraging parameters of baleen whales in the Southern Hemisphere, CCAMLR-IWC-WS-08/04 presented to IWC/CCAMLR workshop, Hobart, 2008.

Marsh, H, Eros, C, Penrose, H & Hugues, J 2002, Dugong - Status Report and Action Plans for countries and territories, UNEP Early Warning and Assessment Report Series 1.

McCauley RD (2011) Woodside Kimberley sea noise logger program, Sept-2006 to June-2009: Whales, fish and man-made noise. Report prepared for Woodside Energy Ltd., Perth, Western Australia.

McCauley RD & Jenner C (2010) Migratory patterns and estimated population size of pygmy blue whales (*Balaenoptera musculus brevicauda*) traversing the Western Australian coast based on passive acoustics. SC/62/SH26 in Proceedings of the 62nd IWC Annual Meeting, Agadir, Morocco (June 21–25). Available as SC-62-SH26.pdf in archive at https://iwc.int/document_1453 (Accessed February 2020).

McPherson, C, Kowarski, K, Delarue, Whitt, C, MacDonnell, Martin, B. (2015). Passive Acoustic Monitoring of Ambient Noise and Marine Mammals – Barossa Field: Juley 2014 to July 2015 (No. JASCO Document 00997, Version 1.0). Technical report by JASCO Applied Sciences (Australia) Pty Ltd. For Jacobs.

Möller, L.M. et al. (2020) Movements and behaviour of blue whales satellite tagged in an Australian upwelling system, *Scientific Reports*, 10(1): 21165f

Perrin, W.F. & R.L. Brownell, Jr (2002). Minke Whales *Balaenoptera acutorostrata* and *B. bonaerensis*. **In:** Perrin W.F., Würsig B. & H.G.M. Thewissen, eds. *Encyclopedia of Marine Mammals*. Page(s) 750-754. Academic Press.

Rennie, S, Hanson, C.E, McCauley, R.D, Pattiaratchi, C, Burton, C, Bannister, J, Jenner, C, Jenner, M.N, (2009). Physical properties and processes in the Perth Canyon, Western Australia: links to water column production and seasonal pygmy blue whale abundance. In: J. Mar. Syst., 77, pp. 21–44.

RPS 2010a. Technical Appendix – Marine Mammals. Wheatstone Project EIS/ERMP. Unpublished report for Chevron Australia Pty Ltd, March 2010

RPS. 2010b. Marine Megafauna Report Browse MMFS 2009. Prepared for Woodside Energy Ltd.

Salgado Kent, C, Jenner, C, Jenner, M, Bouchet, P & Rexstad, E. 2012 Southern Hemisphere Breeding Stock D humpback whale population estimates from North West Cape, Western Australia. J. Cetacean Res. Manage. 12(1): 29—38

Thums, M, Ferreira, L.C, Jenner, C, Jenner, M, Harris, D, Davenport, A, Andrews-Goff, V, Double, M, Moller, L, Attard, C.R.M, Bilgmann, K, Thomson, P.G, McCauley, R. (2022) Pygmy blue whale movement, distribution and important areas in the Eastern Indian Ocean. Global Ecology and Conservation 35, e02054.

Whiting, A.U., Thomson, A., Chaloupka, M., Limpus, C. J., 2009. Seasonality, abundance and breeding biology of one of the largest populations of nesting flatback turtles, *Nataor depressus*: Cape Domett, Western Australia. Australian Journal of Zoology 56, 297-303.

Woodside (2012) Rosebud 3D Marine Seismic Survey Environment Plan Summary. Available online at: https://docs.nopsema.gov.au/A251121

Woodside Energy (2014) Browse FLNG Development Draft Environmental Impact Statement, EPBC Referral 2013/7079, November 2014.

Woodside 2020. WA-49-L Gemtree Anchor Hold Testing. NOPSEMA Reference 5049. Accessed at https://info.nopsema.gov.au/activities/406/show_public.

16.8. Birds

Astron (2017a), Quadrant Environmental Monitoring Program Varanus and Airlie Islands Shearwater Monitoring Annual Report 2016/17, Prepared for Quadrant Energy Australia Ltd by Astron Environmental Services, Perth, Western Australia, June 2017. Report reference EA-60-RI-10174

Astron (2017b), Quadrant Environmental Monitoring Program Varanus and Airlie Islands Seabird Monitoring Annual Report 2016/17, Prepared for Quadrant Energy Australia Ltd by Astron Environmental Services, Perth, Western Australia, September 2017. Report reference EA-60-RI-10184

Bamford M, Watkins D, Bancroft W, Tischler G & Wahl J (2008) Migratory Shorebirds of the East Asian - Australasian Flyway; Population Estimates and Internationally Important Sites. Wetlands International – Oceania, Canberra, Australia

Bennelongia (2008) Report on shorebird numbers and shorebird values at Cape Preston. Prepared for Citic Pacific Mining by Bennelongia Environmental Consultants, Report 2008/52

Bennelongia (2011) Port Hedland Migratory shorebird survey report and impact assessment. Prepared for BHP Billiton Iron Ore by Bennelongia Environmental Consultants, Report 2011/124

Brooke, M. (2004). Albatrosses and Petrels Across The World. Oxford University Press, Oxford, UK.

Burbidge AA, Blyth JD, Fuller PJ, Kendrick PG, Stanley FJ & Smith LA (2000) The Terrestrial Vertebrate Fauna of the Montebello Islands, Western Australia. CALMScience 3: 95-107

CALM & MPRA (2005a) Management Plan for the Ningaloo Marine Park and Muiron Islands Marine Management Area 2005–2015. Management Plan No. 52. Department of Conservation and Land Management and Marine Parks and Reserves Authority. Perth, WA

Chatto, R. (2001). The distribution and status of colonial breeding seabirds in the Northern Territory. Parks & Wildlife Commission of the NT Technical Report. 70pp.

Chevron (2010) A Guide to the Birds of Barrow Island. Available from: https://australia.chevron.com/-/media/australia/publications/documents/nature-book-birds.pdf

Commonwealth of Australia (2017b) EPBC Act Policy Statement 3.21—Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species. Commonwealth of Australia.

Dinara Pty Ltd. (1991) Report on results of shearwater monitoring on Varanus Island, Western Australia for the inclusion in the Hadson Energy Triennial report 1991.

DoE (2014d) *Fregata andrewsi* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1011. Accessed 23 July 2014

DoE (2014e) *Macronectes halli* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=1061. Accessed 23 July 2014

DoE (2014g) *Papasula abbotti* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59297. Accessed 23 July 2014

DoF 2012. Exploring the Houtman Abrolhos Islands. Published by Department of Fisheries, Perth, Western Australia. Publication No. 105, June 2012.

DSEWPaC (2012b) Species group report card- seabirds. Supporting the marine bioregional plan for the South-west Marine Region. Commonwealth of Australia, 2012

DSEWPaC (2011) National recovery plan for threatened albatrosses and giant petrels 2011-2016. Commonwealth of Australia, Hobart

The East Asian-Australasian Flyway Partnership [EAAFP], 2018. Home - Eaaflyway. [Accessed 8 April 2024]

Garnet ST, Szabo JK, Dutson G (2011) The Action Plan for Australian Birds 2010. CSIRO Publishing, Melbourne

Hansen, B.D., Fuller, R.A., Watkins, D., Rogers, D.I., Clemens, R.S., Newman, M., Woehler, E.J. and Weller, D.R. (2016) Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species. Unpublished report for the Department of the Environment. BirdLife Australia, Melbourne.

Higgins PJ & Davies SJJF eds (1996) Handbook of Australian, New Zealand and Antarctic Birds. Volume Three - Snipe to Pigeons. Melbourne, Victoria: Oxford University Press

Hill R, Bamford M, Rounsevell D & Vincent J (1988) Little Terns and Fairy Terns in Australia - an RAOU Conservation Statement. RAOU Report Series. 53:1-12

Lindsey TR (1986) The Seabirds of Australia. North Ryde, NSW: Angus and Robertson

Marchant S & Higgins PJ eds. (1990) Handbook of Australian, New Zealand and Antarctic Birds. Volume One - Ratites to Ducks. Melbourne, Victoria: Oxford University Press

Marchant S & Higgins PJ (Eds) (1993) Handbook of Australian, New Zealand and Antarctic Birds. Volume Two - Raptors to Lapwings. Oxford University Press, Melbourne

Moore, J.L. (1985). Norfolk Island notes. Notornis. 32:311-318

Rogers, D. 1999. What determines shorebird feeding distribution in Roebuck Bay? Chapter 9, 145-174. In Pepping, M., Piersma, T., Pearson, G. and Lavaleye, M. (eds) 1999. Intertidal sediments and benthic animals of Roebuck Bay, Western Australia. Netherlands Institute for Sea Research Report 3, Texel, Netherlands, 1-214

Stokes, T. 1988. A review of the birds of Christmas Island, Indian Ocean. Australian National Parks & Wildlife Service Occasional Paper 16.

Stokes T & Hinchey M (1990) Which small Noddies breed at Ashmore Reef in Eastern Indian Ocean? Emu. 90:269-271

Storr GM, Johnstone RE & Griffin P (1986). Birds of the Houtman Abrolhos, Western Australia. Records of the Western Australian Museum Supplement. 24

Surman CA (2003) Second Field Survey of the Avifauna of the Barrow Island-Double Island Area, December 2003. Prepared for Apache Energy Ltd

Surman CA (2013) Scientific monitoring program 07 seabirds and shorebirds. Unpublished report to Apache Energy Ltd

Surman CA & Nicholson LW (2006) 'Seabirds,' in S McClatchie, J Middleton, C Pattiaratchi, D Currie & G Kendrick (eds), The South-west Marine Region: ecosystems and key species groups, Australian Government Department of the Environment and Water Resources, Hobart

Surman CA & Nicholson LW (2012) Monitoring of annual variation in seabird breeding colonies throughout the Lowendal Group of islands: 2012 Annual Report. Unpublished report prepared for Apache Energy Ltd. by Halfmoon Biosciences. 42pp.

Surman CA & Nicholson LW (2013) Monitoring of annual variation in seabird breeding colonies throughout the Lowendal Group of islands: 2013 Annual Report. Lowendal Island Seabird Monitoring Program (LISMP). Unpublished report prepared for Apache Energy Ltd. by Halfmoon Biosciences. 59pp.

Threatened Species Scientific Committee (2020a). Conservation Advice for the Christmas Island Frigatebird *Fregeta andrewsii.* Canberra: Department of Agriculture, Water and the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/1011-conservation-advice-19102020.pdf. In effect under the EPBC Act from 19-Oct-2020.

Threatened Species Scientific Committee (2020b). Conservation Advice the Abbott's booby *Papasula abbotti*. Canberra: Department of the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/59297-conservation-advice-19102020.pdf. In effect under the EPBC Act from 19-Oct-2020.

16.9. Protected Areas

DEWHA (2008) Shark Bay World Heritage Property Strategic Plan 2008-2020. Department of the Environment, Water, Heritage and the Arts, Canberra, Australia

DEWHA (2010b) Ningaloo Coast World Heritage Nomination. Department of the Environment, Water, Heritage and the Arts, Canberra, Australia. Available at < http://www.environment.gov.au/node/19787> [Accessed April 2014]

DoE (Department of Environment) (2014a) World Heritage Places - The Ningaloo Coast Western Australia. Available at: http://www.environment.gov.au/node/19787 [Accessed April 2014]

DoE (2014b) Shark Bay, Western Australia, Work Heritage Values. Available at: http://www.environment.gov.au/heritage/places/world/shark-bay [Accessed April 2014]

DoE (2014d) Australian Heritage Database. Available at http://www.environment.gov.au/cgi-bin/ahdb/search.pl [Accessed April 2014]

UNESCO (2020) Shark Bay, Western Australia. Available at: https://whc.unesco.org/en/list/578 [Accessed February 2020]

16.10. Key Ecological Features

Brewer DT, Lyne V, Skewes TD, Rothlisberg, P (2007) Trophic systems of the North West Marine Region. Report to the Australian Government Department of the Environment and Water Resources, CSIRO, Cleveland

Currey-Randall, M, Galaiduk, R, Stowar, M, Vaughan, B.I and K. J. Miller (2021) Mesophotic fish communities of the ancient coastline in Western Australia. PLoS ONE 16(4): e0250427. https://doi.org/10.1371/journal.pone.0250427Dambacher, JM, Rochester, W & Dutra, L, (2009). Addendum to ecological indicators for the exclusive economic zone waters of the South-west Marine Region., report for the Australian Government Department of the Environment, Water, Heritage and the Arts, Canberra.

DEWHA (2008b). The South-West Marine Bioregional Plan: Bioregional Profile: A Description of the Ecosystems, Conservation Values and Uses of the South-West Marine Region. Canberra: DEWHA.

DEWHA (2008c) A characterisation of the marine environment of the North-west Marine Region: Perth workshop report. A summary of an expert workshop convened in Perth, Western Australia. 5-6 September 2007, DEWHA, Hobart

DEWHA (2008d) The North-west Marine bioregional plan: bioregional profile. A description of the ecosystems, conservation values and uses of the North-west Marine Bioregion. DEWHA, Canberra

DEWHA, (2010). Recovery Plan for the Australian Sea Lion (*Neophoca cinerea*), Technical Issues Paper., Australian Government, Canberra.

Donovan A, Brewer D, van der Velde T, Skewes T (2008) Scientific descriptions of four selected key ecological features in the North-west Bioregion: final report. Report to the Australian Government Department of Environment, Water, Heritage and the Arts, CSIRO Marine and Atmospheric Research, Cleveland

DSEWPaC (Department of Sustainability, Environment, Water, Population and Communities) (2012) Commonwealth marine environment report card. Commonwealth of Australia

DSEWPaC (Department of Sustainability, Environment, Water, Population and Communities) (2012c) Commonwealth marine environment report card: supporting the marine bioregional plan for the South-west Marine Region

Falkner I, Whiteway T, Przeslawski R, Heap AD (2009) Review of ten key ecological features in the Northwest Marine Region. Record 2009/13, Geoscience Australia, Canberra

Fletcher WJ, Santoro K (eds) (2009) State of the fisheries report 2008/09. Department of Fisheries, Western Australia, Perth

Gilmour, J, Cheal, A, Smith, L, Underwood, J, Meekan, M, Fitzgibbon, B & Rees, M, (2007). Data compilation and analysis for Rowley Shoals: Mermaid, Imperieuse and Clerke reefs., Report to the Department of Environment and Water Resources, Australian Institute of Marine Science, Perth.

Guinea, M, (2006). Sea turtles, sea snakes and dugongs of Scott Reef, Seringapatam Reef and Browse Island with notes on West Lacepede Island., Report submitted to the Australian Government Department of the Environment, Water, Heritage and the Arts, Canberra.

Heap AD, Harris PT (2008) Geomorphology of the Australian margin and adjacent sea floor. Australian Journal of Earth Sciences 55:555–585

Jenner C, Jenner M, Pirzl R (2008) A study of cetacean distribution and oceanography in the Scott Reef/Browse Basin development areas during the austral winter of 2008. Centre for Whale Research (WA), Perth

Lyne V, Fuller M, Last P, Butler A, Martin M, Scott R (2006) Ecosystem characterisation of Australia's North West Shelf. North West Shelf Joint Environmental Management Study Technical Report 12, CSIRO Marine and Atmospheric Research, Hobart

McClatchie, S, Middleton, J, Pattiaratchi, C, Currie, D & Kendrick, G, (Eds), (2006). The South-west Marine Region: ecosystems and key species groups., Australian Government Department of the Environment and Water Resources, Canberra.

McLoughlin RJ, Young PC (1985) Sedimentary provinces of the fishing grounds of the North West Shelf of Australia: grain-size frequency analysis of surficial sediments. Australian Journal of Marine and Freshwater Research 36: 671–81

Milton DA (2005) Birds of Ashmore Reef National Nature Reserve: an assessment of its importance for seabirds and waders. The Beagle, Records of the Museums and Art Gallery of the Northern Territory, suppl. 1: 133–141

Sleeman JC, Meekan MG, Wilson SG, Jenner CKS, Jenner MN, Boggs GS, Steinberg CC, Bradshaw CJA (2007) 'Biophysical correlates of relative abundances of marine megafauna at Ningaloo Reef, Western Australia', Marine and Freshwater Research, vol. 58, pp. 608–623

16.11. State Marine Parks

AHC (2006) Cape Range National Park and Surrounds, Exmouth, WA. A WWW publication accessed December 2006 at http://www.environment.gov.au/. Australian Heritage Commission, Canberra.

CALM (1996) Shark Bay Marine Reserves. Management Plan. 1996-2006. Marine Conservation Branch, Management Plan No. 34. Department of Conservation and Land Management.

CALM (2005) Management Plan for the Ningaloo Marine Park and Muiron Islands Marine Management Area 2005 – 2015 Management Plan No. 52. Department of Conservation and Land Management, Perth, Western Australia.

DEC (2007a) Management Plan for the Montebello/Barrow Islands Marine Conservation Reserves 2007–2017: Management Plan No. 55. Department of Environment and Conservation, Perth, Western Australia.

DEC (2007b) Management Plan for the Rowley Shoals Marine Park 2007–2017: Management Plan No. 56. Department of Environment and Conservation, Perth, Western Australia.

16.12. Australian Marine Parks

Director of National Parks (2018a), South-west Marine Parks Network Management Plan 2018, Director of National Parks, Canberra.

Director of National Parks (2018b), North-west Marine Parks Network Management Plan 2018, Director of National Parks, Canberra.

16.13. Conservation Management Plans

DCCEEW, 2024. DCCEEW Recovery Plans Website. Accessible at: https://www.dcceew.gov.au/environment/biodiversity/threatened/recovery-plans#:~:text=listed%20under%20the%20Commonwealth%20Environment,species%20or%20threatened%20ecological%20communities. [accessed on 17 April 2024]

16.14. Commercial and Recreational Fisheries

Department of Agriculture (2019) Fishery Status Reports 2019. Department of Agriculture, Canberra, Australian Capital Territory.

DPIRD (2018) Department of Primary Industries and Regional Development. Annual Report 2018. Government of Western Australia.

Gaughan, D.J., Molony, B. and Santoro, K. (eds). 2019. Status Reports of the Fisheries and Aquatic Resources of Western Australia 2017/18: The State of the Fisheries. Department of Primary Industries and Regional Development, Western Australia.

Gaughan, D.J. and Santoro, K. (eds). 2020. Status Reports of the Fisheries and Aquatic Resources of Western Australia 2018/19: The State of the Fisheries. Department of Primary Industries and Regional Development, Western Australia.

Newman, S.J., Santoro, K.G. and Gaughan, D.J. (eds). 2023. Status Reports of the Fisheries and Aquatic Resources of Western Australia 2022/23: The State of the Fisheries. Department of Primary Industries and Regional Development, Western Australia.

WAFIC 2016. Western Australia Fishing Industry Council Incorporated. Available at: http://www.wafic.org.au/region/west-coast/ [Accessed August 2016]

16.15. Social and Economic Features

AMSA (Australian Marine Safety Authority) (2012) Marine Notice 15/2012, Shipping Fairways off the north-west coast of Australia. Australian Maritime Safety Authority, Australian Government

AMSA (2013) North West Shipping Management. Australian Maritime Safety Authority. Canberra.

Tourism Western Australia (2014) Visitor Fact Sheets – Tourism Regional Level. Available at http://www.tourism.wa.gov.au/Research_and_Reports/Regional_Fact_Sheets/Pages/Regional_Fact_Sheets.aspx [Accessed April 2014]

Appendix D Environment Protection and Biodiversity Conservation Protected Matters Search Tool Reports

Australian Government

Department of Climate Change, Energy, the Environment and Water

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.

Operational Area

Report created: 08-Nov-2024

Summary

Matters of National Environment Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	25
Listed Migratory Species:	42

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:	68
Whales and Other Cetaceans:	28
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	1
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:	1
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	21
Key Ecological Features (Marine):	2
Biologically Important Areas:	11
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
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 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
Phaethon rubricauda westralis Red-tailed Tropicbird (Indian Ocean), Indian Ocean Red-tailed Tropicbird [91824]	Endangered	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding known to 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
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	Congregation or aggregation known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Congregation or aggregation known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Congregation or aggregation known to occur within area

Scientific Name	Threatened Category	Presence Text
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Congregation or aggregation 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 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
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 likely 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]		Foraging, feeding or related behaviour likely 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 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

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	Congregation or aggregation known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Congregation or aggregation known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Congregation or aggregation known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
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	Congregation or aggregation known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
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]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Tursiops aduncus (Arafura/Timor Sea populations)		
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus		
Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Anous stolidus		
Common Noddy [825]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to 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 may occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely 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 may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Phaethon lepturus fulvus		
Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Sterna dougallii		
Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area
Thalasseus bengalensis as Sterna bengalensis		
Lesser Crested Tern [66546]		Breeding known to occur within 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
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

Scientific Name	Threatened Category	Presence Text
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
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

Scientific Name	Threatened Category	Presence Text
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
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammal		
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Reptile		
Aipysurus 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
Caretta caretta Loggerhead Turtle [1763]	Endangered	Congregation or aggregation known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Congregation or aggregation known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
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	Congregation or aggregation known to 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 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

Scientific Name	Threatened Category	Presence Text
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation 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
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
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

Current Scientific Name	Status	Type of Presence
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
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
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]		Species or species habitat likely to occur within area

Current Scientific Name	Status	Type of Presence
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
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
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
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
Montebello	Multiple Use Zone (IUCN VI)

Habitat Critical to the Survival of Marine Turtles [Resource Information]

Scientific Name	Behaviour	Presence
Aug - Sep		
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur
Dec - Jan		

Scientific Name	Behaviour	Presence
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur
Nov - May		
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Known to occur

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State
Barrow Island	Marine Management Area	WA

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Gorgon Gas Development	2003/1294		Post-Approval
Controlled action			
Construct and operate LNG & domestic gas plant including onshore and offshore facilities - Wheatston	2008/4469	Controlled Action	Post-Approval
Gorgon Gas Development 4th Train Proposal	2011/5942	Controlled Action	Post-Approval
Pluto Gas Project	2005/2258	Controlled Action	Completed
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
Not controlled action (particular manner)			
"Leanne" offshore 3D seismic exploration, WA-356-P	2005/1938	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

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Aperio 3D Marine Seismic Survey, WA	2012/6648	Not Controlled Action (Particular Manner)	Post-Approval
CGGVERITAS 2010 2D Seismic Survey	2010/5714	Not Controlled Action (Particular Manner)	Post-Approval
Deep Water Northwest Shelf 2D Seismic Survey	2007/3260	Not Controlled Action (Particular Manner)	Post-Approval
Harmony 3D Marine Seismic Survey	2012/6699	Not Controlled Action (Particular Manner)	Post-Approval
Huzzas MC3D Marine Seismic Survey (HZ-13) Carnarvon Basin, offshore WA	2013/7003	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
Munmorah 2D seismic survey within permits WA-308/9-P	2003/970	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
Triton 3D Marine Seismic Survey, WA-2-R and WA-3-R	2006/2609	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	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

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
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 pacifica Wedge-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

Scientific Name	Behaviour	Presence
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.

EMBA

Report created: 08-Nov-2024

Summary

Matters of National Environment Significance

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

World Heritage Properties:	2
National Heritage Places:	7
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	13
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	100
Listed Migratory Species:	90

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:	55
Commonwealth Heritage Places:	5
Listed Marine Species:	170
Whales and Other Cetaceans:	40
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	33
Habitat Critical to the Survival of Marine Turtles:	4

Extra Information

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

State and Territory Reserves:	66
Regional Forest Agreements:	None
Nationally Important Wetlands:	4
EPBC Act Referrals:	341
Key Ecological Features (Marine):	18
Biologically Important Areas:	71
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

World Heritage Properties [Resource Information]

Name	State	Legal Status
Shark Bay, Western Australia	WA	Declared property
The Ningaloo Coast	WA	Declared property

National Heritage Places [Resource Information]

Name	State	Legal Status
Historic		
HMAS Sydney II and HSK Kormoran Shipwreck Sites	EXT	Listed place
Batavia Shipwreck Site and Survivor Camps Area 1629 - Houtman Abrolhos	WA	Listed place
Dirk Hartog Landing Site 1616 - Cape Inscription Area	WA	Listed place
Indigenous		
Dampier Archipelago (including Burrup Peninsula)	WA	Listed place
Natural		
Lesueur National Park	WA	Listed place
Shark Bay, Western Australia	WA	Listed place
The Ningaloo Coast	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)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)

Feature Name
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
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Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community may occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community may occur within area

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Anous tenuirostris melanops		
Australian Lesser Noddy [26000]	Vulnerable	Breeding known to occur within area
Aphelocephala leucopsis		
Southern Whiteface [529]	Vulnerable	Species or species habitat may occur within area
Arenaria interpres		
Ruddy Turnstone [872]	Vulnerable	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

Scientific Name	Threatened Category	Presence Text
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Vulnerable	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
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely 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 known to occur within area
Fregata andrewsi Christmas Island Frigatebird, Andrew's Frigatebird [1011]	Endangered	Foraging, feeding or related behaviour known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely 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
Limosa limosa Black-tailed Godwit [845]	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
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to 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
Malurus leucopterus leucopterus White-winged Fairy-wren (Dirk Hartog Island), Dirk Hartog Black-and-White Fairy-wren [26004]	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
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat may occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
[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	Foraging, feeding or related behaviour likely to occur within area
[Phaethon rubricauda westralis] Red-tailed Tropicbird (Indian Ocean), Indian Ocean Red-tailed Tropicbird [91824]	Endangered	Breeding known to occur within area
[Phoebetria fusca] Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
[Pluvialis squatarola] Grey Plover [865]	Vulnerable	Species or species habitat known to occur within area
[Pterodroma mollis] Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
[Rostratula australis] Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
[Sternula nereis nereis] Australian Fairy Tern [82950]	Vulnerable	Breeding known to occur within area
[Thalassarche carteri] Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
[Thalassarche cauta] Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
[Thalassarche impavida] Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area
Turnix varius scintillans Painted Button-quail (Houtman Abrolhos) [82451]	Endangered	Species or species habitat likely to occur within area
Xenus cinereus Terek Sandpiper [59300]	Vulnerable	Species or species habitat known to occur within area
Zanda latirostris listed as Calyptorhynchus latirostris Carnaby's Black Cockatoo, Short-billed Black-cockatoo [87737]	Endangered	Species or species habitat likely to occur within area
CRUSTACEAN		
Kumonga exleyi Cape Range Remipede [86875]	Vulnerable	Species or species habitat likely to occur within area
FISH		
Milyeringa veritas Cape Range Cave Gudgeon, Blind Gudgeon [66676]	Vulnerable	Species or species habitat known to occur within area
Ophisternon candidum Blind Cave Eel [66678]	Vulnerable	Species or species habitat known to occur within area
MAMMAL		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour 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
Bettongia lesueur lesueur Burrowing Bettong (Shark Bay), Boodie [66659]	Vulnerable	Species or species habitat known to occur within area
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat likely to occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat may occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely 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 bernieri Rufous Hare-wallaby (Bernier Island) [66662]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Lagorchestes hirsutus Central Australian subspecies		
Mala, Rufous Hare-Wallaby (Central Australia) [88019]	Endangered	Translocated population known to occur within area
Lagorchestes hirsutus dorreae		
Rufous Hare-wallaby (Dorre Island) [66663]	Vulnerable	Species or species habitat known to occur within area
Lagostrophus fasciatus fasciatus		
Banded Hare-wallaby, Merrnine, Marnine, Munning [66664]	Vulnerable	Species or species habitat known to occur within area
Macroderma gigas		
Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Neophoca cinerea		
Australian Sea-lion, Australian Sea Lion [22]	Endangered	Breeding known to occur within area
Osphranter robustus isabellinus		
Barrow Island Wallaroo, Barrow Island Euro [89262]	Vulnerable	Species or species habitat likely to occur within area
Parantechinus apicalis		
Dibbler [313]	Endangered	Species or species habitat known to occur within area
Perameles bougainville		
Shark Bay Bandicoot [278]	Endangered	Species or species habitat known 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
Pseudomys fieldi		
Shark Bay Mouse, Djoongari, Alice Springs Mouse [113]	Vulnerable	Species or species habitat likely to occur within area
Rhinonicteris aurantia (Pilbara form)		
Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area
PLANT		

Scientific Name	Threatened Category	Presence Text
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat likely to occur within area
Caleana dixonii listed as Paracaleana dixonii Sandplain Duck Orchid [87944]	Endangered	Species or species habitat may occur within area
Eucalyptus argutifolia Yanchep Mallee, Wabling Hill Mallee [24263]	Vulnerable	Species or species habitat may occur within area
Grevillea batrachioides Mt Lesueur Grevillea [21735]	Endangered	Species or species habitat may occur within area
Grevillea humifusa Spreading Grevillea [61182]	Endangered	Species or species habitat may occur within area
Hemiandra gardneri Red Snakebush [7945]	Endangered	Species or species habitat likely to occur within area
Leucopogon obtectus Hidden Beard-heath [19614]	Endangered	Species or species habitat may occur within area
Minuria tridens Minnie Daisy [13753]	Vulnerable	Species or species habitat may 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
Aipysurus fuscus Dusky Sea Snake [1119]	Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
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 lancelini Lancelin Island Skink [1482]	Vulnerable	Translocated population 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	Foraging, feeding or related behaviour known to occur within area
Egernia stokesii badia Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink [64483]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Liasis olivaceus barroni Pilbara Olive Python [66699]	Vulnerable	Species or species habitat known to occur within area
Liopholis pulchra longicauda Jurien Bay Skink, Jurien Bay Rock-skink [83162]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
SHARK		

Scientific Name	Threatened Category	Presence Text
Carcharias taurus (west coast population)		
Grey Nurse Shark (west coast population) [68752]	Vulnerable	Congregation or aggregation known to occur within area
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Centrophorus uyato		
Little Gulper Shark [68446]	Conservation Dependent	Species or species habitat likely to occur within area
Glyphis garricki		
Northern River Shark, New Guinea River Shark [82454]	Endangered	Species or species habitat may occur within area
Pristis clavata		
Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis		
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sphyrna lewini		
Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat known to occur within area

Listed Migratory Species

[Resource Information]

Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Anous stolidus		
Common Noddy [825]		Foraging, feeding or related behaviour known to occur within area

Scientific Name	Threatened Category	Presence Text
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour 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 known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Fregata andrewsi Christmas Island Frigatebird, Andrew's Frigatebird [1011]	Endangered	Foraging, feeding or related behaviour known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Breeding known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Foraging, feeding or related behaviour likely to occur within area
Hydroprogne caspia Caspian Tern [808]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Onychoprion anaethetus Bridled Tern [82845]		Breeding known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Breeding known to occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons Little Tern [82849]		Breeding known to occur within area
Sula dactylatra Masked Booby [1021]		Breeding known to occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Sula sula Red-footed Booby [1023]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour 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	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area
Carcharias taurus Grey Nurse Shark [64469]		Congregation or aggregation known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour 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
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	Foraging, feeding or related behaviour known to occur within area
Dugong dugon Dugong [28]		Breeding 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 likely to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour 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 known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
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 known to occur within area

Scientific Name	Threatened Category	Presence Text
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]		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		
Cecropis daurica Red-rumped Swallow [80610]		Species or species habitat may occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat 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
Arenaria interpres Ruddy Turnstone [872]	Vulnerable	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

Scientific Name	Threatened Category	Presence Text
Calidris alba Sanderling [875]		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 likely to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Vulnerable	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius 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
Limosa limosa Black-tailed Godwit [845]	Endangered	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis squatarola Grey Plover [865]	Vulnerable	Species or species habitat known to occur within area
Thalasseus bergii Greater Crested Tern [83000]		Breeding known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Species or species habitat known to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]	Vulnerable	Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

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

Commonwealth Land Name	State
Defence	
Defence - EXMOUTH ADMIN & HF TRANSMITTING [50127]	WA
Defence - EXMOUTH ADMIN & HF TRANSMITTING [50125]	WA
Defence - EXMOUTH ADMIN & HF TRANSMITTING [50129]	WA
Defence - EXMOUTH ADMIN & HF TRANSMITTING [50128]	WA
Defence - EXMOUTH ADMIN & HF TRANSMITTING [50124]	WA
Defence - EXMOUTH ADMIN & HF TRANSMITTING [50126]	WA
Defence - EXMOUTH VLF TRANSMITTER STATION [50123]	WA
Defence - EXMOUTH VLF TRANSMITTER STATION [50122]	WA
Defence - LEARMONTH - AIR WEAPONS RANGE [50193]	WA
Defence - LEARMONTH RADAR SITE - TWIN TANKS EXMOUTH [50002]	WA
Defence - LEARMONTH RADAR SITE - VLAMING HEAD EXMOUTH [50001]	WA
Unknown	
Commonwealth Land - [51449]	WA
Commonwealth Land - [51448]	WA
Commonwealth Land - [51475]	WA
Commonwealth Land - [51442]	WA
Commonwealth Land - [52236]	WA
Commonwealth Land - [52201]	WA
Commonwealth Land - [51455]	WA
Commonwealth Land - [51454]	WA
Commonwealth Land - [51457]	WA
Commonwealth Land - [51456]	WA

Commonwealth Land Name	State
Commonwealth Land - [51445]	WA
Commonwealth Land - [51444]	WA
Commonwealth Land - [51447]	WA
Commonwealth Land - [51446]	WA
Commonwealth Land - [51443]	WA
Commonwealth Land - [51466]	WA
Commonwealth Land - [51465]	WA
Commonwealth Land - [51472]	WA
Commonwealth Land - [51458]	WA
Commonwealth Land - [51464]	WA
Commonwealth Land - [51468]	WA
Commonwealth Land - [51453]	WA
Commonwealth Land - [51451]	WA
Commonwealth Land - [51459]	WA
Commonwealth Land - [51452]	WA
Commonwealth Land - [51450]	WA
Commonwealth Land - [51884]	WA
Commonwealth Land - [51463]	WA
Commonwealth Land - [51467]	WA
Commonwealth Land - [51462]	WA
Commonwealth Land - [51461]	WA
Commonwealth Land - [51460]	WA
Commonwealth Land - [51469]	WA
Commonwealth Land - [51476]	WA
Commonwealth Land - [51477]	WA
Commonwealth Land - [50385]	WA
Commonwealth Land - [51104]	WA

Commonwealth Land Name	State
Commonwealth Land - [51470]	WA
Commonwealth Land - [51473]	WA
Commonwealth Land - [51471]	WA
Commonwealth Land - [51474]	WA
Commonwealth Land - [52214]	WA
Commonwealth Land - [52111]	WA
Commonwealth Land - [51887]	WA

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Historic		
HMAS Sydney II and HSK Kormoran Shipwreck Sites	EXT	Listed place
Natural		
Learmonth Air Weapons Range Facility	WA	Listed place
Mermaid Reef - Rowley Shoals	WA	Listed place
Ningaloo Marine Area - Commonwealth Waters	WA	Listed place
Scott Reef and Surrounds - Commonwealth Area	EXT	Listed place

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]		Foraging, feeding or related behaviour known to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Breeding known to 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
Ardenna carneipes as Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna pacifica as Puffinus pacificus Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Arenaria interpres Ruddy Turnstone [872]	Vulnerable	Species or species habitat 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 known to occur within area
Calidris alba Sanderling [875]		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 likely to occur within area overfly marine area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Calidris tenuirostris		
Great Knot [862]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Calonectris leucomelas		
Streaked Shearwater [1077]		Species or species habitat known to occur within area
Cecropis daurica as Hirundo daurica		
Red-rumped Swallow [80610]		Species or species habitat may occur within area overfly marine area
Chalcites osculans as Chrysococcyx osculans		
Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area
Charadrius leschenaultii		
Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius ruficapillus		
Red-capped Plover [881]		Species or species habitat known to occur within area overfly marine 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
Diomedea amsterdamensis		
Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora		
Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Fregata andrewsi Christmas Island Frigatebird, Andrew's Frigatebird [1011]	Endangered	Foraging, feeding or related behaviour known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Breeding known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Foraging, feeding or related behaviour likely 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
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Species or species habitat known to occur within area overfly marine area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area overfly marine area
Hydroprogne caspia as Sterna caspia Caspian Tern [808]		Breeding known to occur within area
Larus pacificus Pacific Gull [811]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]	Endangered	Species or species habitat known to occur within area overfly marine area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to 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
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
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
Pachyptila turtur		
Fairy Prion [1066]		Species or species habitat may occur within area
Pandion haliaetus		
Osprey [952]		Breeding known to occur within area
Papasula abbotti		
Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Pelagodroma marina		
White-faced Storm-Petrel [1016]		Breeding known to occur within area
Phaethon lepturus		
White-tailed Tropicbird [1014]		Breeding known to occur within area
Phaethon lepturus fulvus		
Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Phaethon rubricauda		
Red-tailed Tropicbird [994]		Breeding known to occur within area
Phalacrocorax fuscescens		
Black-faced Cormorant [59660]		Breeding likely to occur within area
Phoebetria fusca		
Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pluvialis squatarola		
Grey Plover [865]	Vulnerable	Species or species habitat known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Pterodroma macroptera Great-winged Petrel [1035]		Foraging, feeding or related behaviour known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Puffinus assimilis Little Shearwater [59363]		Breeding known to occur within area
Puffinus huttoni Hutton's Shearwater [1025]		Foraging, feeding or related behaviour known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area overfly marine area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area
Stercorarius antarcticus as Catharacta skua Brown Skua [85039]		Species or species habitat may occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons as Sterna albifrons Little Tern [82849]		Breeding known to occur within area
Sternula nereis as Sterna nereis Fairy Tern [82949]		Breeding known to occur within area
Sula dactylatra Masked Booby [1021]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Sula sula Red-footed Booby [1023]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area
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
Thinornis cucullatus as Thinornis rubricollis Hooded Plover, Hooded Dotterel [87735]		Species or species habitat known to occur within area overfly marine area
Tringa brevipes as Heteroscelus brevipes Grey-tailed Tattler [851]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area overfly marine area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area overfly marine area
Xenus cinereus Terek Sandpiper [59300]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Fish		
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		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 galei Gale's Pipefish [66191]		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

Scientific Name	Threatened Category	Presence Text
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 amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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 dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus 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

Scientific Name	Threatened Category	Presence Text
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		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 subelongatus West Australian Seahorse [66722]		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
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Mitotichthys meraculus Western Crested Pipefish [66259]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		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
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		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

Scientific Name	Threatened Category	Presence Text
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
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Mammal		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Dugong dugon Dugong [28]		Breeding known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Endangered	Breeding 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 fuscus Dusky Sea Snake [1119]	Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
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 pooleorum Shark Bay Sea Snake [66061]		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	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	Foraging, feeding or related behaviour known to occur within area
Emydocephalus annulatus Eastern Turtle-headed Sea Snake [1125]		Species or species habitat may occur within area
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 coggeri Cogger's Sea Snake [25925]		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 hardwickii as Lapemis hardwickii Spine-bellied Sea Snake [93516]		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

Scientific Name	Threatened Category	Presence Text
Hydrophis zweiffei as Enhydrina schistosa Australian Beaked Sea Snake [93514]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour likely to 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 bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour 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	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		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
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to 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
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Hyperoodon planifrons Southern Bottlenose Whale [71]		Species or species habitat may occur within area
Indopacetus pacificus Longman's Beaked Whale [72]		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

Current Scientific Name	Status	Type of Presence
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon ginkgodens Gingko-toothed Beaked Whale, Gingko-toothed Whale, Gingko Beaked Whale [59564]		Species or species habitat may occur within area
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
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]		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
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

Park Name	Zone & IUCN Categories
Abrolhos	Habitat Protection Zone (IUCN IV)
Carnarvon Canyon	Habitat Protection Zone (IUCN IV)
Dampier	Habitat Protection Zone (IUCN IV)
Gascoyne	Habitat Protection Zone (IUCN IV)
Gascoyne	Habitat Protection Zone (IUCN IV)
Abrolhos	Multiple Use Zone (IUCN VI)
Abrolhos	Multiple Use Zone (IUCN VI)
Abrolhos	Multiple Use Zone (IUCN VI)
Argo-Rowley Terrace	Multiple Use Zone (IUCN VI)
Argo-Rowley Terrace	Multiple Use Zone (IUCN VI)
Dampier	Multiple Use Zone (IUCN VI)
Eighty Mile Beach	Multiple Use Zone (IUCN VI)
Gascoyne	Multiple Use Zone (IUCN VI)
Kimberley	Multiple Use Zone (IUCN VI)
Montebello	Multiple Use Zone (IUCN VI)
Shark Bay	Multiple Use Zone (IUCN VI)
Abrolhos	National Park Zone (IUCN II)
Abrolhos	National Park Zone (IUCN II)
Abrolhos	National Park Zone (IUCN II)
Argo-Rowley Terrace	National Park Zone (IUCN II)
Christmas Island	National Park Zone (IUCN II)
Dampier	National Park Zone (IUCN II)
Gascoyne	National Park Zone (IUCN II)
Jurien	National Park Zone (IUCN II)

Park Name	Zone & IUCN Categories
Mermaid Reef	National Park Zone (IUCN II)
Ningaloo	National Park Zone (IUCN II)
Ningaloo	Recreational Use Zone (IUCN IV)
Ningaloo	Recreational Use Zone (IUCN IV)
Cartier Island	Sanctuary Zone (IUCN Ia)
Abrolhos	Special Purpose Zone (IUCN VI)
Abrolhos	Special Purpose Zone (IUCN VI)
Jurien	Special Purpose Zone (IUCN VI)
Argo-Rowley Terrace	Special Purpose Zone (Trawl) (IUCN VI)

Habitat Critical to the Survival of Marine Turtles [Resource Information]

Scientific Name	Behaviour	Presence
Aug - Sep		
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur
Dec - Jan		
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur
Nov-Feb		
Caretta caretta Loggerhead Turtle [1763]	Nesting	Known to occur
Nov - May		
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Known to occur

Extra Information

State and Territory Reserves		[Resource Information]
Protected Area Name	Reserve Type	State
Abrolhos Islands	Fish Habitat Protection Area	WA
Airlie Island	Nature Reserve	WA
Barrow Island	Nature Reserve	WA
Barrow Island	Marine Management Area	WA
Barrow Island	Marine Park	WA
Beagle Islands	Nature Reserve	WA
Bedout Island	Nature Reserve	WA
Beekeepers	Nature Reserve	WA
Bernier And Dorre Islands	Nature Reserve	WA
Bessieres Island	Nature Reserve	WA
Boodie, Double Middle Islands	Nature Reserve	WA
Boullanger, Whitlock, Favourite, Tern And Osprey Islands	Nature Reserve	WA
Bundegi Coastal Park	5(1)(h) Reserve	WA
Cape Range	National Park	WA
Cape Range (South)	National Park	WA
Dirk Hartog Island	National Park	WA
Fisherman Islands	Nature Reserve	WA
Gnandaroo Island	Nature Reserve	WA
Great Sandy Island	Nature Reserve	WA
Houtman Abrolhos Islands	National Park	WA
Jurabi Coastal Park	5(1)(h) Reserve	WA
Jurien Bay	Marine Park	WA
Koks Island	Nature Reserve	WA
Lesueur	National Park	WA

Protected Area Name	Reserve Type	State
Lipfert, Milligan, Etc Islands	Nature Reserve	WA
Little Rocky Island	Nature Reserve	WA
Locker Island	Nature Reserve	WA
Lowendal Islands	Nature Reserve	WA
Montebello Islands	Conservation Park	WA
Montebello Islands	Conservation Park	WA
Montebello Islands	Marine Park	WA
Muiron Islands	Nature Reserve	WA
Muiron Islands	Marine Management Area	WA
Murujuga	National Park	WA
Ningaloo	Marine Park	WA
North Sandy Island	Nature Reserve	WA
North Turtle Island	Nature Reserve	WA
Nyingguulu (Ningaloo) Coastal Reserve	5(1)(h) Reserve	WA
Rocky Island	Nature Reserve	WA
Round Island	Nature Reserve	WA
Rowley Shoals	Marine Park	WA
Sandland Island	Nature Reserve	WA
Scott Reef	Nature Reserve	WA
Serrurier Island	Nature Reserve	WA
Shark Bay	Marine Park	WA
Tent Island	Nature Reserve	WA
Thevenard Island	Nature Reserve	WA
Unnamed WA11883	5(1)(h) Reserve	WA
Unnamed WA36907	5(1)(h) Reserve	WA
Unnamed WA36909	5(1)(h) Reserve	WA

Protected Area Name	Reserve Type	State
Unnamed WA36910	5(1)(h) Reserve	WA
Unnamed WA36913	Nature Reserve	WA
Unnamed WA36915	Nature Reserve	WA
Unnamed WA37338	5(1)(h) Reserve	WA
Unnamed WA37383	5(1)(h) Reserve	WA
Unnamed WA37500	5(1)(g) Reserve	WA
Unnamed WA40322	5(1)(h) Reserve	WA
Unnamed WA40828	5(1)(h) Reserve	WA
Unnamed WA40877	5(1)(h) Reserve	WA
Unnamed WA41080	5(1)(h) Reserve	WA
Unnamed WA44665	5(1)(h) Reserve	WA
Unnamed WA44667	5(1)(h) Reserve	WA
Unnamed WA44672	5(1)(h) Reserve	WA
Victor Island	Nature Reserve	WA
Weld Island	Nature Reserve	WA
Y Island	Nature Reserve	WA

Nationally Important Wetlands

[Resource Information]

Wetland Name	State
Cape Range Subterranean Waterways	WA
Exmouth Gulf East	WA
Mermaid Reef	EXT
Shark Bay East	WA

EPBC Act Referrals

[Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Browse to North West Shelf Development, Indian Ocean, WA	2018/8319		Approval
Gorgon Gas Development	2003/1294		Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Marine Route Survey for Subsea Fibre Optic Data Cable System - Australia West	2024/09826		Completed
Midwest Offshore Wind Farm	2022/09264		Assessment
Ningaloo Lighthouse Development, 17km north west Exmouth, Western Australia	2020/8693		Post-Approval
North West Shelf Project Extension, Carnarvon Basin, WA	2018/8335		Approval
Optimised Mardie Solar Salt Project	2022/9169		Post-Approval
Project Crux Cable Lay and Operation	2022/09441		Completed
Project Highclere Cable Lay and Operation	2022/09203		Completed
Action clearly unacceptable			
Highlands 3D Marine Seismic Survey	2012/6680	Action Clearly Unacceptable	Completed
Controlled action			
'Van Gogh' Petroleum Field Development	2007/3213	Controlled Action	Post-Approval
2-D seismic survey Scott Reef	2000/125	Controlled Action	Post-Approval
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
Boating Facility	2002/830	Controlled Action	Completed
Browse FLNG Development, Commonwealth Waters	2013/7079	Controlled Action	Post-Approval
Conduct an exploration drilling campaign	2010/5718	Controlled Action	Completed
Construct and operate LNG & domestic gas plant including onshore and offshore facilities - Wheatston	2008/4469	Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Construction and operation of a Solar Salt Project, SW Onslow, WA	2016/7793	Controlled Action	Assessment Approach
Develop Ichthys gas-condensate field permit area W	2006/2767	Controlled Action	Completed
Develop Jansz-Io deepwater gas field in Permit Areas WA-18-R, WA-25-R and WA-26-	2005/2184	Controlled Action	Post-Approval
Development of Angel gas and condensate field, North West Shelf	2004/1805	Controlled Action	Post-Approval
Development of Browse Basin Gas Fields (Upstream)	2008/4111	Controlled Action	Completed
Development of Coniston/Novara fields within the Exmouth Sub-basin	2011/5995	Controlled Action	Post-Approval
Development of Stybarrow petroleum field incl drilling and facility installation	2004/1469	Controlled Action	Post-Approval
Echo-Yodel Production Wells	2000/11	Controlled Action	Post-Approval
Enfield full field development	2001/257	Controlled Action	Post-Approval
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 Enfield (Vincent) Development	2005/2110	Controlled Action	Post-Approval
Greater Gorgon Development - Optical Fibre Cable, Mainland to Barrow Island	2005/2141	Controlled Action	Completed
Ichthys Gas Field, Offshore and onshore processing facilities and subsea pipeline	2008/4208	Controlled Action	Post-Approval
Light Crude Oil Production	2001/365	Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Mardie Project, 80 km south west of Karratha, WA	2018/8236	Controlled Action	Post-Approval
Mauds Landing Marina	2000/98	Controlled Action	Completed
Montara 4, 5, and 6 Oil Production Wells, and Montara 3 Gas Re-Injection Well	2002/755	Controlled Action	Post-Approval
Nava-1 Cable System	2001/510	Controlled Action	Completed
Pluto Gas Project	2005/2258	Controlled Action	Completed
Pluto Gas Project Including Site B	2006/2968	Controlled Action	Post-Approval
Port Hedland Outer Harbour Development and associated marine and terrestrial in	2008/4159	Controlled Action	Post-Approval
Prelude Floating Liquefied Natural Gas Facility and Gas Field Development	2008/4146	Controlled Action	Post-Approval
Proposed West Pilbara Iron Ore Project	2009/4706	Controlled Action	Post-Approval
PTTEP AA Floating LNG Facility	2011/6025	Controlled Action	Completed
Pyrenees Oil Fields Development	2005/2034	Controlled Action	Post-Approval
Simpson Development	2000/59	Controlled Action	Completed
Simpson Oil Field Development	2001/227	Controlled Action	Post-Approval
The Scarborough Project - FLNG & assoc subsea infrastructure, Carnarvon Basin	2013/6811	Controlled Action	Post-Approval
Torosa South Initial Appraisal Drilling	2007/3500	Controlled Action	Completed
Vincent Appraisal Well	2000/22	Controlled Action	Post-Approval
Yardie Creek Road Realignment Project	2021/8967	Controlled Action	Assessment Approach
Not controlled action			

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
'Goodwyn A' Low Pressure Train Project	2003/914	Not Controlled Action	Completed
'Van Gogh' Oil Appraisal Drilling Program, Exploration Permit Area WA-155-P(1)	2006/3148	Not Controlled Action	Completed
3D marine seismic survey in WA 314P and WA 315P	2004/1927	Not Controlled Action	Completed
Adele Trend TQ3D Seismic Survey	2001/252	Not Controlled Action	Completed
Airlie Island soil and groundwater investigations, Exmouth Gulf, offshore Pilbara coast	2014/7250	Not Controlled Action	Completed
APX-West Fibre-optic telecommunications cable system, WA to Singapore	2013/7102	Not Controlled Action	Completed
archaeological surveys & excavation at historic sites, Cape Inscription	2006/3027	Not Controlled Action	Completed
Baniyas-1 Exploration Well, EP-424, near Onslow	2007/3282	Not Controlled Action	Completed
Barrow Island 2D Seismic survey	2006/2667	Not Controlled Action	Completed
Boating Facility	2002/832	Not Controlled Action	Completed
Bollinger 2D Seismic Survey 200km North of North West Cape WA	2004/1868	Not Controlled Action	Completed
Bultaco-2, Laverda-2, Laverda-3 and Montesa-2 Appraisal Wells	2000/103	Not Controlled Action	Completed
Carnarvon 3D Marine Seismic Survey	2004/1890	Not Controlled Action	Completed
Cazadores 2D seismic survey	2004/1720	Not Controlled Action	Completed
Construct 110km buried natural gas pipeline from Onslow, connecting to Dampier/Bunbury natural gas p	2013/7039	Not Controlled Action	Completed
Construction and operation of an unmanned sea platform and connecting pipeline to Varanus Island for	2004/1703	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Controlled Source Electromagnetic Survey	2007/3262	Not Controlled Action	Completed
Crux-A and Crux-B appraisal wells, Petroleum Permit Area AC/P23	2006/2748	Not Controlled Action	Completed
Crux gas-liquids development in permit AC/P23	2006/3154	Not Controlled Action	Completed
Development of Halyard Field off the west coast of WA	2010/5611	Not Controlled Action	Completed
Development of iron ore facilities	2013/7013	Not Controlled Action	Completed
Development of Mutineer and Exeter petroleum fields for oil production, Permit	2003/1033	Not Controlled Action	Completed
Differential Global Positioning System (DGPS)	2001/445	Not Controlled Action	Completed
Drilling between Kalbarri and Cliff Head	2005/2185	Not Controlled Action	Completed
Drilling of 12 Hydrocarbon Exploration Wells, Permit Area WA-371-P	2006/3005	Not Controlled Action	Completed
Drilling of an exploration well Gats-1 in Permit Area WA-261-P	2004/1701	Not Controlled Action	Completed
Drilling of exploration wells, Permit areas WA-301-P to WA-305-P	2002/769	Not Controlled Action	Completed
Eagle-1 Exploration Drilling, North West Shelf, WA	2019/8578	Not Controlled Action	Completed
Echo A Development WA-23-L, WA-24-L	2005/2042	Not Controlled Action	Completed
Echuca Shoals-2 Exploration of Appraisal Well	2006/3020	Not Controlled Action	Completed
Establishment of a 12.7 ha Gypsum Mine	2007/3398	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

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Exploration drilling well WA-155-P(1)	2003/971	Not Controlled Action	Completed
Exploration of appraisal wells	2006/3065	Not Controlled Action	Completed
Exploration Well (Taunton-2)	2002/731	Not Controlled Action	Completed
Exploration Well AC/P23	2001/234	Not Controlled Action	Completed
Exploration Well in Permit Area WA-155-P(1)	2002/759	Not Controlled Action	Completed
Exploratory drilling in permit area WA-225-P	2001/490	Not Controlled Action	Completed
Extension of Simpson Oil Platforms & Wells	2002/685	Not Controlled Action	Completed
Hadda 1,Flying Foam 1,Magnat 1 exploration drill	2004/1697	Not Controlled Action	Completed
HCA05X Macedon Experimental Survey	2004/1926	Not Controlled Action	Completed
Hess Exploration Drilling Programme	2007/3566	Not Controlled Action	Completed
Huascaran-1 exploration well (WA-292-P)	2001/539	Not Controlled Action	Completed
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed
INDIGO West Submarine Telecommunications Cable, WA	2017/8126	Not Controlled Action	Completed
Infill Production Well (Griffin-9)	2001/417	Not Controlled Action	Completed
Jansz-2 and 3 Appraisal Wells	2002/754	Not Controlled Action	Completed
Kaleidoscope exploration well	2001/182	Not Controlled Action	Completed
Klammer 2D Seismic Survey	2002/868	Not Controlled Action	Completed
Mahimahi Aquaculture Facility	2002/891	Not Controlled Action	Completed
Maia-Gaea Exploration wells	2000/17	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Manaslu - 1 and Huascaran - 1 Offshore Exploration Wells	2001/235	Not Controlled Action	Completed
Mermaid Marine Australia Desalination Project	2011/5916	Not Controlled Action	Completed
Montara-3 Offshore Hydrocarbon Exploration Well Permit Area AC/RL3	2001/489	Not Controlled Action	Completed
Montesa-1 and Bultaco-1 Exploration Wells	2000/102	Not Controlled Action	Completed
Murujuga archaeological excavation, collection and sampling, Dampier Archipelago, WA	2014/7160	Not Controlled Action	Completed
North Rankin B gas compression facility	2005/2500	Not Controlled Action	Completed
Oman Australia Cable Installation, WA	2021/8922	Not Controlled Action	Completed
Oman Australia Cable - Marine Route Survey	2020/8731	Not Controlled Action	Completed
Onslow Power Infrastructure Upgrade Project, Onslow, WA	2014/7314	Not Controlled Action	Completed
Onslow Water Supply Infrastructure Upgrade Project, Onslow, WA	2014/7329	Not Controlled Action	Completed
P30 Hydrocarbon Exploration Well	2001/293	Not Controlled Action	Completed
Pipeline System Modifications Project	2000/3	Not Controlled Action	Completed
Port Expansion and Dredging	2003/1265	Not Controlled Action	Completed
Port Hedland Channel Risk and Optimisation Project, WA	2017/7915	Not Controlled Action	Completed
Project Highclere Geophysical Survey	2021/9023	Not Controlled Action	Completed
Saucepan 1 Exploration Well ACP23	2000/2	Not Controlled Action	Completed
Scientific Sonar Trial	2002/680	Not Controlled Action	Completed
Searipple gas and condensate field development	2000/89	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Seismic Survey, Bremer Basin, Mentelle Basin and Zeewyck Sub-basin	2004/1700	Not Controlled Action	Completed
Spool Base Facility	2001/263	Not Controlled Action	Completed
Subsea Gas Pipeline From Stybarrow Field to Griffin Venture Gas Export Pipeline	2005/2033	Not Controlled Action	Completed
sub-sea tieback of Perseus field wells	2004/1326	Not Controlled Action	Completed
Telstra North Rankin Spur Fibre Optic Cable	2016/7836	Not Controlled Action	Completed
Thevenard Island Retirement Project	2015/7423	Not Controlled Action	Completed
To construct and operate an offshore submarine fibre optic cable, WA	2014/7373	Not Controlled Action	Completed
WA-295-P Kerr-McGee Exploration Wells	2001/152	Not Controlled Action	Completed
Wanda Offshore Research Project, 80 km north-east of Exmouth, WA	2018/8293	Not Controlled Action	Completed
Western Flank Gas Development	2005/2464	Not Controlled Action	Completed
Wheatstone 3D seismic survey, 70km north of Barrow Island	2004/1761	Not Controlled Action	Completed
Yellowfin Tuna Aquaculture Trial	2003/1115	Not Controlled Action	Completed
Not controlled action (particular manner)			
'Kate' 3D marine seismic survey, exploration permits WA-320-P and WA-345-P, 60km	2005/2037	Not Controlled Action (Particular Manner)	Post-Approval
'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 (Particular Manner)	Post-Approval
2 (3D) Marine Seismic Surveys	2009/4994	Not Controlled Action (Particular	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
2D and 3D Seismic Survey	2011/6197	Not Controlled Action (Particular Manner)	Post-Approval
2D and 3D seismic surveys	2005/2151	Not Controlled Action (Particular Manner)	Post-Approval
2D marine seismic survey	2012/6296	Not Controlled Action (Particular Manner)	Post-Approval
2D Marine Seismic Survey	2009/4728	Not Controlled Action (Particular Manner)	Post-Approval
2D Marine Seismic Survey in Permit Area WA-337-P	2003/1158	Not Controlled Action (Particular Manner)	Post-Approval
2D marine seismic survey of Braveheart,Kurrajong,Sunshine and Crocodile	2006/2917	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Marine Survey	2001/363	Not Controlled Action (Particular Manner)	Post-Approval
2D seismic survey	2008/4493	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic survey	2009/5076	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey	2005/2146	Not Controlled Action (Particular Manner)	Post-Approval
2D seismic survey in permit areas WA-274P and WA-281P	2004/1521	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
2D Seismic Survey Permit Area WA-352-P	2008/4628	Not Controlled Action (Particular Manner)	Post-Approval
2D seismic survey within permit WA-291	2007/3265	Not Controlled Action (Particular Manner)	Post-Approval
2 geotechnical surveys - preliminary and final	2006/2886	Not Controlled Action (Particular Manner)	Post-Approval
3D marine seismic survey	2008/4281	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey	2008/4437	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey, Permit AC/P 23	2005/2364	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey (WA-482-P, WA-363-P), WA	2013/6761	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
3D marine seismic Survey - Maxima 3D MSS	2006/2945	Not Controlled Action (Particular Manner)	Post-Approval
3D marine seismic survey over petroleum title WA-268-P	2007/3458	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Surveys - Contos CT-13 & Supertubes CT-13, offshore WA	2013/6901	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
3D seismic survey	2006/2715	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey, Browse Basin, WA	2009/5048	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey, near Scott Reef, Browse Basin	2005/2126	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey, WA	2008/4428	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey in the Carnarvon Bsin on the North West Shelf	2002/778	Not Controlled Action (Particular Manner)	Post-Approval
3D sesmic survey	2006/2781	Not Controlled Action (Particular Manner)	Post-Approval
AC/P37 3D Seismic Survey Ashmore Cartier	2007/3774	Not Controlled Action (Particular Manner)	Post-Approval
Acheron Non-Exclusive 2D Seismic Survey	2008/4565	Not Controlled Action (Particular Manner)	Post-Approval
Acheron Non-Exclusive 2D Seismic Survey	2009/4968	Not Controlled Action (Particular Manner)	Post-Approval
Agrippina 3D Seismic Marine Survey	2009/5212	Not Controlled Action (Particular Manner)	Post-Approval
Apache Northwest Shelf Van Gogh Field Appraisal Drilling Program	2007/3495	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Aperio 3D Marine Seismic Survey, WA	2012/6648	Not Controlled Action (Particular Manner)	Post-Approval
Artemis-1 Drilling Program (WA-360-P)	2010/5432	Not Controlled Action (Particular Manner)	Post-Approval
Aurora MC3D Marine Seismic Survey	2010/5510	Not Controlled Action (Particular Manner)	Post-Approval
Australia to Singapore Fibre Optic Submarine Cable System	2011/6127	Not Controlled Action (Particular Manner)	Post-Approval
Babylon 3D Marine Seismic Survey, Commonwealth Waters, nr Exmouth WA	2013/7081	Not Controlled Action (Particular Manner)	Post-Approval
Balnaves Condensate Field Development	2011/6188	Not Controlled Action (Particular Manner)	Post-Approval
Bassett 3D Marine Seismic Survey	2010/5538	Not Controlled Action (Particular Manner)	Post-Approval
Bonaparte 2D & 3D marine seismic survey	2011/5962	Not Controlled Action (Particular Manner)	Post-Approval
Bonaventure 3D seismic survey	2006/2514	Not Controlled Action (Particular Manner)	Post-Approval
Braveheart 2D Infill Marine Seismic Survey 100km offshore	2008/4442	Not Controlled Action (Particular Manner)	Post-Approval
Braveheart 2D Marine Seismic Survey	2005/2322	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	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Canis 3D Marine Seismic Survey	2008/4492	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
Cartier East and Cartier West 3D Marine Seismic Surveys	2009/5230	Not Controlled Action (Particular Manner)	Post-Approval
Caswell MC3D Marine Seismic Survey	2012/6594	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
Charon 3D Marine Seismic Survey	2007/3477	Not Controlled Action (Particular Manner)	Post-Approval
Conduct an exploration drilling campaign	2011/5964	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
Coverack Marine Seismic Survey	2001/399	Not Controlled Action (Particular Manner)	Post-Approval
Cue Seismic Survey within WA-359-P, WA-361-P and WA-360-P	2007/3647	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
CVG 3D Marine Seismic Survey	2012/6654	Not Controlled Action (Particular Manner)	Post-Approval
DAVROS MC 3D marine seismic survey northwaet of Dampier, WA	2013/7092	Not Controlled Action (Particular Manner)	Post-Approval
Decommissioning of the Legendre facilities	2010/5681	Not Controlled Action (Particular Manner)	Post-Approval
Deep Water Drilling Program	2010/5532	Not Controlled Action (Particular Manner)	Post-Approval
Deep Water Northwest Shelf 2D Seismic Survey	2007/3260	Not Controlled Action (Particular Manner)	Post-Approval
Demeter 3D Seismic Survey, off Dampier, WA	2002/900	Not Controlled Action (Particular Manner)	Post-Approval
Diesel Fuel Bunker Operation	2012/6289	Not Controlled Action (Particular Manner)	Post-Approval
Draeck 3D Marine Seismic Survey, WA-205-P	2006/3067	Not Controlled Action (Particular Manner)	Post-Approval
Drilling 35-40 offshore exploration wells in deep water	2008/4461	Not Controlled Action (Particular Manner)	Post-Approval
Drilling of Exploration & Appraisal Wells Braveheart-1 & Cornea-3	2009/5160	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
Eendracht Multi-Client 3D Marine Seismic Survey	2009/4749	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Effect of marine seismic sounds to demersal fish and pearl oysters, north-west WA	2018/8169	Not Controlled Action (Particular Manner)	Post-Approval
Endurance 3D Marine Seismic Data Acquisition Survey	2007/3667	Not Controlled Action (Particular Manner)	Post-Approval
Enfield M3 & Vincent 4D Marine Seismic Surveys	2008/3981	Not Controlled Action (Particular Manner)	Completed
Enfield M3 4D, Vincent 4D & 4D Line Test Marine Seismic Surveys	2008/4122	Not Controlled Action (Particular Manner)	Post-Approval
Enfield M4 4D Marine Seismic Survey	2008/4558	Not Controlled Action (Particular Manner)	Post-Approval
Enfield oilfield 3D Seismic Survey	2006/3132	Not Controlled Action (Particular Manner)	Post-Approval
Exmouth West 2D Marine Seismic Survey	2008/4132	Not Controlled Action (Particular Manner)	Post-Approval
Exploration Drilling Campaign	2011/6047	Not Controlled Action (Particular Manner)	Post-Approval
Exploration Drilling Campaign, Browse Basin, WA-341-P, AC-P36 and WA-343-P	2013/6898	Not Controlled Action (Particular Manner)	Post-Approval
Exploration drilling of Zeus-1 well	2008/4351	Not Controlled Action (Particular Manner)	Post-Approval
Exploration Drilling Program - Permit areas - WA-314-P, WA-315-P, WA-398-P.	2008/4064	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Fletcher-Finucane Development, WA26-L and WA191-P	2011/6123	Not Controlled Action (Particular Manner)	Post-Approval
Foxhound 3D Non-Exclusive Marine Seismic Survey	2009/4703	Not Controlled Action (Particular Manner)	Post-Approval
Gazelle 3D Marine Seismic Survey in WA-399-P and WA-42-L	2010/5570	Not Controlled Action (Particular Manner)	Post-Approval
Geco Eagle 3D Marine Seismic Survey	2008/3958	Not Controlled Action (Particular Manner)	Post-Approval
Geoscience Australia - Marine survey in Browse Basin to acquire data to assist assessment of CO2 sto	2013/6747	Not Controlled Action (Particular Manner)	Post-Approval
Gicea 3D Marine Seismic Survey	2008/4389	Not Controlled Action (Particular Manner)	Post-Approval
Gigas 2D Pilot Ocean Bottom Cable Marine Seismic Survey	2007/3839	Not Controlled Action (Particular Manner)	Post-Approval
Glencoe 3D Marine Seismic Survey WA-390-P	2007/3684	Not Controlled Action (Particular Manner)	Post-Approval
Greater Western Flank Phase 1 gas Development	2011/5980	Not Controlled Action (Particular Manner)	Post-Approval
Grimalkin 3D Seismic Survey	2008/4523	Not Controlled Action (Particular Manner)	Post-Approval
Guacamole 2D Marine Seismic Survey	2008/4381	Not Controlled Action (Particular Manner)	Post-Approval
Harmony 3D Marine Seismic Survey	2012/6699	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Harpy 1 exploration well	2001/183	Not Controlled Action (Particular Manner)	Post-Approval
Honeycombs MC3D Marine Seismic Survey	2012/6368	Not Controlled Action (Particular Manner)	Post-Approval
Huzzas MC3D Marine Seismic Survey (HZ-13) Carnarvon Basin, offshore WA	2013/7003	Not Controlled Action (Particular Manner)	Post-Approval
Huzzas phase 2 marine seismic survey, Exmouth Plateau, Northern Carnarvon Basin, WA	2013/7093	Not Controlled Action (Particular Manner)	Post-Approval
Ichthys 3D Marine Seismic Survey	2010/5550	Not Controlled Action (Particular Manner)	Post-Approval
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	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
Judo Marine 3D Seismic Survey within and adjacent to WA-412-P	2009/4801	Not Controlled Action (Particular Manner)	Post-Approval
Judo Marine 3D Seismic Survey within and adjacent to WA-412-P	2008/4630	Not Controlled Action (Particular Manner)	Post-Approval
Julimar Brunello Gas Development Project	2011/5936	Not Controlled Action (Particular Manner)	Post-Approval
Kingtree & Ironstone-1 Exploration Wells	2011/5935	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Klimt 2D Marine Seismic Survey	2007/3856	Not Controlled Action (Particular Manner)	Post-Approval
Koolama 2D Seismic Survey Dampier Basin	2010/5420	Not Controlled Action (Particular Manner)	Post-Approval
Kraken, Lusca & Asperus 3D Marine Seismic Survey	2013/6730	Not Controlled Action (Particular Manner)	Post-Approval
Laverda 3D Marine Seismic Survey and Vincent M1 4D Marine Seismic Survey	2010/5415	Not Controlled Action (Particular Manner)	Post-Approval
Laying a submarine optical fibre telecommunications cable, Perth to Singapore and Jakarta	2014/7332	Not Controlled Action (Particular Manner)	Post-Approval
Leopard 2D marine seismic survey	2005/2290	Not Controlled Action (Particular Manner)	Post-Approval
Lion 2D Marine Seismic Survey	2007/3777	Not Controlled Action (Particular Manner)	Post-Approval
Macedon Gas Field Development	2008/4605	Not Controlled Action (Particular Manner)	Post-Approval
Marine Geotechnical Drilling Program	2008/4012	Not Controlled Action (Particular Manner)	Post-Approval
Marine reconnaissance survey	2008/4466	Not Controlled Action (Particular Manner)	Post-Approval
Mariner Non-Exclusive 2D Seismic Survey	2011/6172	Not Controlled Action (Particular Manner)	Post-Approval
Marine Seismic Survey for oil and gas in Commonwealth waters off the WA coast.	2004/1802	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Marine Seismic Survey in Permit WA-481P	2012/6626	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
Munmorah 2D seismic survey within permits WA-308/9-P	2003/970	Not Controlled Action (Particular Manner)	Post-Approval
North Perth Marine Survey	2011/6067	Not Controlled Action (Particular Manner)	Post-Approval
Ocean Bottom Cable Seismic Program, WA-264-P	2007/3844	Not Controlled Action (Particular Manner)	Post-Approval
Ocean Bottom Cable Seismic Survey	2005/2017	Not Controlled Action (Particular Manner)	Post-Approval
Octantis 3D Marine Seismic Survey, Permit Area AC/P41 off northern Western Australia	2007/3369	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Canning Multi Client 2D Marine Seismic Survey	2010/5393	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Drilling Campaign	2011/5830	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Fibre Optic Cable Network Construction & Operation, Port Hedland WA to Darwin NT	2014/7223	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Gas Exploration Drilling Campaign	2012/6384	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Onslow Seawater Desalination Plant Marine Geophysical Investigation	2020/8794	Not Controlled Action (Particular Manner)	Post-Approval
Orcus 3D Marine Seismic Survey in WA-450-P	2010/5723	Not Controlled Action (Particular Manner)	Post-Approval
Osprey and Dionysus Marine Seismic Survey	2011/6215	Not Controlled Action (Particular Manner)	Post-Approval
Outer Canning exploration drilling program off NW coast of WA	2012/6618	Not Controlled Action (Particular Manner)	Post-Approval
Palta-1 exploration well in Petroleum Permit Area WA-384-P	2011/5871	Not Controlled Action (Particular Manner)	Post-Approval
Phoenix 3D Seismic Survey, Bedout Sub-Basin	2010/5360	Not Controlled Action (Particular Manner)	Post-Approval
Pilot Appraisal Well - Torosa South 1	2008/3991	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 Headland Outer Harbour Pre-construction Pilling program	2012/6341	Not Controlled Action (Particular Manner)	Post-Approval
Port of Port Hedland channel marker replacement project, WA	2017/8010	Not Controlled Action (Particular Manner)	Post-Approval
Port Walcott upgrade, dredging & spoil disposal, & channel realignment	2006/2806	Not Controlled Action (Particular Manner)	Post-Approval
Pyrenees 4D Marine Seismic Monitor Survey, HCA12A	2012/6579	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Pyrenees-Macedon 3D marine seismic survey	2005/2325	Not Controlled Action (Particular Manner)	Post-Approval
Quiberon 2D Seismic Survey, permit area WA-385P, offshore of Carnarvon	2009/5077	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
Repsol 3d & 2D Marine Seismic Survey	2012/6658	Not Controlled Action (Particular Manner)	Post-Approval
Rose 3D Seismic Program	2008/4239	Not Controlled Action (Particular Manner)	Post-Approval
Rosebud 3D Marine Seismic Survey in WA-30-R and TR/5	2012/6493	Not Controlled Action (Particular Manner)	Post-Approval
Rydal-1 Petroleum Exploration Well, WA	2012/6522	Not Controlled Action (Particular Manner)	Post-Approval
Salsa 3D Marine Seismic Survey	2010/5629	Not Controlled Action (Particular Manner)	Post-Approval
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
Schild MC3D Marine Seismic Survey	2012/6373	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Schild Phase 11 MC3D Marine Seismic Survey, Browse Basin	2013/6894	Not Controlled Action (Particular Manner)	Post-Approval
Scott Reef Seismic Research	2006/2647	Not Controlled Action (Particular Manner)	Post-Approval
Searcher bathymetry & geochemical seismic survey, Brawse Basin,Timor Sea,WA	2013/6980	Not Controlled Action (Particular Manner)	Post-Approval
search for HMAS Sydney	2006/3071	Not Controlled Action (Particular Manner)	Post-Approval
Skorpion Marine Seismic Survey WA	2001/416	Not Controlled Action (Particular Manner)	Post-Approval
Sovereign 3D Marine Seismic Survey	2011/5861	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
Study of behavioural responses of Austn Humpback Whales to seismic surveys, offshore Dongara, WA	2013/6927	Not Controlled Action (Particular Manner)	Post-Approval
Stybarrow 4D Marine Seismic Survey	2011/5810	Not Controlled Action (Particular Manner)	Post-Approval
Stybarrow Baseline 4D marine seismic survey	2008/4530	Not Controlled Action (Particular Manner)	Post-Approval
Tantabiddi Boat Ramp Sand Bypassing	2015/7411	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Tidepole Maz 3D Seismic Survey Campaign	2007/3706	Not Controlled Action (Particular Manner)	Post-Approval
Tiffany 3D Seismic Survey	2010/5339	Not Controlled Action (Particular Manner)	Post-Approval
Torosa-5 Apraisal Well, WA-30-R	2008/4430	Not Controlled Action (Particular Manner)	Post-Approval
Tortilla 2D Seismic Survey, WA	2011/6110	Not Controlled Action (Particular Manner)	Post-Approval
Tow West Atlas wreck from present location to boundary of EEZ	2010/5652	Not Controlled Action (Particular Manner)	Post-Approval
Tridacna 3D Ocean Bottom Cable Marine Seismic Survey	2011/5959	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	2010/5679	Not Controlled Action (Particular Manner)	Post-Approval
Undertake a three dimensional marine seismic survey	2010/5715	Not Controlled Action (Particular Manner)	Post-Approval
Vampire 2D Non Exclusive Seismic Survey, WA	2010/5543	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Veritas Voyager 2D Marine Seismic Survey	2009/5151	Not Controlled Action (Particular Manner)	Post-Approval
Vincent M1 and Enfield M5 4D Marine Seismic Survey	2010/5720	Not Controlled Action (Particular Manner)	Post-Approval
Warramunga Non-Inclusive 3D Seismic Survey	2008/4553	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
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
Woodside Southern Browse 3D Seismic Survey, WA	2007/3534	Not Controlled Action (Particular Manner)	Post-Approval
Zeemeermin MC3D seismic survey, Browse Basin, Offshore WA	2009/5023	Not Controlled Action (Particular Manner)	Post-Approval
Zeppelin 3D Seismic Survey	2011/6148	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Referral decision			
2D Marine Seismic Survey	2008/4623	Referral Decision	Completed
3D Marine Seismic Survey in the offshore northwest Carnarvon Basin	2011/6175	Referral Decision	Completed
3D Seismic Survey	2008/4219	Referral Decision	Completed
Aurora extension MC3D Marine Seismic Survey	2011/5887	Referral Decision	Completed
Bianchi 3D Marine Seismic Survey, Carnavon Basin, WA	2013/7078	Referral Decision	Completed
BRSN08 3D Marine Seismic Survey	2008/4582	Referral Decision	Completed
CVG 3D Marine Seismic Survey	2012/6270	Referral Decision	Completed
Enfield 4D Marine Seismic Surveys, Production Permit WA-28-L	2005/2370	Referral Decision	Completed
Experimental Study of Behavioural and Physiological Impact on Fish of Seismic Ex	2006/2625	Referral Decision	Completed
Exploration Drilling 2014/2015 WA-481-P	2013/7043	Referral Decision	Completed
Outer Harbour Development and associated marine and terrestial infrastructure	2008/4148	Referral Decision	Completed
Pilot Appraisal Well - Torosa South-1	2008/3985	Referral Decision	Completed
Rose 3D Seismic acquisition survey	2008/4220	Referral Decision	Completed
Seismic Data Acquisition, Browse Basin	2010/5475	Referral Decision	Completed
Stybarrow Baseline 4D Marine Seismic Survey (Permit Areas WA-255-P, WA-32-L, WA-	2008/4165	Referral Decision	Completed
Two Dimensional Transition Zone Seismic Survey - TP/7 (R1)	2010/5507	Referral Decision	Completed
Varanus Island Compression Project	2012/6698	Referral Decision	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Referral decision			

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
Ancient coastline at 90-120m depth	South-west
Ashmore Reef and Cartier Island and surrounding Commonwealth waters	North-west
Canyons linking the Argo Abyssal Plain with the Scott Plateau	North-west
Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	North-west
Carbonate bank and terrace system of the Sahul Shelf	North-west
Commonwealth marine environment surrounding the Houtman Abrolhos Islands	South-west
Commonwealth marine environment within and adjacent to the west coast inshore lagoons	South-west
Commonwealth waters adjacent to Ningaloo Reef	North-west
Continental Slope Demersal Fish Communities	North-west
Exmouth Plateau	North-west
Glomar Shoals	North-west
Mermaid Reef and Commonwealth waters surrounding Rowley Shoals	North-west
Perth Canyon and adjacent shelf break, and other west coast canyons	South-west
Seringapatam Reef and Commonwealth waters in the Scott Reef Complex	North-west
Wallaby Saddle	North-west
Western demersal slope and associated fish communities	South-west
Western rock lobster	South-west

Biologically Important Areas [Resource Information]

Scientific Name	Behaviour	Presence
Dugong		
Dugong dugon Dugong [28]	Breeding	Known to occur
Dugong dugon Dugong [28]	Calving	Known to occur
Dugong dugon Dugong [28]	Foraging (high density seagrass beds)	Known to occur
Dugong dugon Dugong [28]	Nursing	Known to occur
Marine Turtles		
Caretta caretta Loggerhead Turtle [1763]	Foraging	Known to occur
Caretta caretta Loggerhead Turtle [1763]	Internesting	Known to occur
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]	Foraging	Likely to occur
Chelonia mydas Green Turtle [1765]	Internesting	Known to occur

Scientific Name	Behaviour	Presence
Chelonia mydas Green Turtle [1765]	Internesting	Likely to occur
Chelonia mydas Green Turtle [1765]	Internesting buffer	Likely 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]	Migration corridor	Known to occur
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur
Chelonia mydas Green Turtle [1765]	Nesting	Likely to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Foraging	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Foraging	Likely 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

Scientific Name	Behaviour	Presence
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
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur
Seabirds		
Anous stolidus Common Noddy [825]	Foraging	Known to occur
Anous stolidus Common Noddy [825]	Foraging (provisioning young)	Known to occur
Anous tenuirorstris melanops Australian Lesser Noddy [26000]	Foraging (provisioning young)	Known to occur
Ardenna pacifica Wedge-tailed Shearwater [84292]	Breeding	Known to occur
Ardenna pacifica Wedge-tailed Shearwater [84292]	Foraging (in high numbers)	Known to occur
Fregata ariel Lesser Frigatebird [1012]	Breeding	Known to occur
Fregata minor Greater Frigatebird [1013]	Breeding	Known to occur

Scientific Name	Behaviour	Presence
Hydroprogne caspia Caspian Tern [808]	Foraging (provisioning young)	Known to occur
Larus pacificus Pacific Gull [811]	Foraging (in high numbers)	Known to occur
Onychoprion anaethetus Bridled Tern [82845]	Foraging (in high numbers)	Known to occur
Onychoprion fuscata Sooty Tern [82847]	Foraging	Known to occur
Pelagodroma marina White-faced Storm-petrel [1016]	Foraging (in high numbers)	Known to occur
Phaethon lepturus White-tailed Tropicbird [1014]	Breeding	Known to occur
Pterodroma mollis Soft-plumaged Petrel [1036]	Foraging (in high numbers)	Known to occur
Puffinus assimilis tunneyi Little Shearwater [59363]	Foraging (in high numbers)	Known to occur
Sterna dougallii Roseate Tern [817]	Breeding	Known to occur
Sterna dougallii Roseate Tern [817]	Foraging	Known to occur
Sterna dougallii Roseate Tern [817]	Foraging (provisioning young)	Known to occur
Sternula albifrons sinensis Little Tern [82850]	Resting	Known to occur
Sternula nereis Fairy Tern [82949]	Breeding	Known to occur

Scientific Name	Behaviour	Presence
Sternula nereis Fairy Tern [82949]	Foraging (in high numbers)	Known to occur
Sula leucogaster Brown Booby [1022]	Breeding	Known to occur
Sula sula Red-footed Booby [1023]	Breeding	Known to occur
Thalasseus bengalensis Lesser Crested Tern [66546]	Breeding	Known to occur
Seals		
Neophoca cinerea Australian Sea Lion [22]	Foraging (male)	Likely to occur
Neophoca cinerea Australian Sea Lion [22]	Foraging (male and female)	Known to occur
Sharks		
Carcharodon carcharias White Shark [64470]	Foraging	Known to occur
Rhincodon typus Whale Shark [66680]	Foraging	Known to occur
Rhincodon typus Whale Shark [66680]	Foraging (high density prey)	Known to occur
Whales		
Balaenoptera musculus Blue and Pygmy Blue Whale [36]	Foraging (on migration)	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Foraging	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Known Foraging Area	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Migration	Known to occur

Scientific Name	Behaviour	Presence
Megaptera novaeangliae Humpback Whale [38]	Migration	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Migration (north)	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Migration (north and south)	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Resting	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 Aboriginal Cultural Heritage Inquiry System Report for Hydrocarbon Spill EMBA

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Register

Search Criteria

No Aboriginal Cultural Heritage (ACH) Register in Shapefile - VI Hub Ops EMBA 1 of 9

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*.

All Aboriginal cultural heritage in Western Australia is protected, whether or not the ACH has been reported or exists on the Register.

The information provided is made available in good faith and is predominately based on the information provided to the Department of Planning, Lands and Heritage by third parties. The information is provided solely on the basis that readers will be responsible for making their own assessment as to the accuracy of the information. If you find any errors or omissions in our records, including our maps, it would be appreciated if you provide the details to the Department via https://achknowledge.dplh.wa.gov.au/ach-enquiry-form and we will make every effort to rectify it as soon as possible.

Copyright

Coordinates

Map coordinates are based on the GDA 94 Datum.

Basemap Copyright

Department of Planning, Lands and Heritage

GOVERNMENT OF WESTERN AUSTRALIA

Aboriginal Cultural Heritage Inquiry System

Map of Aboriginal Cultural Heritage (ACH) Register

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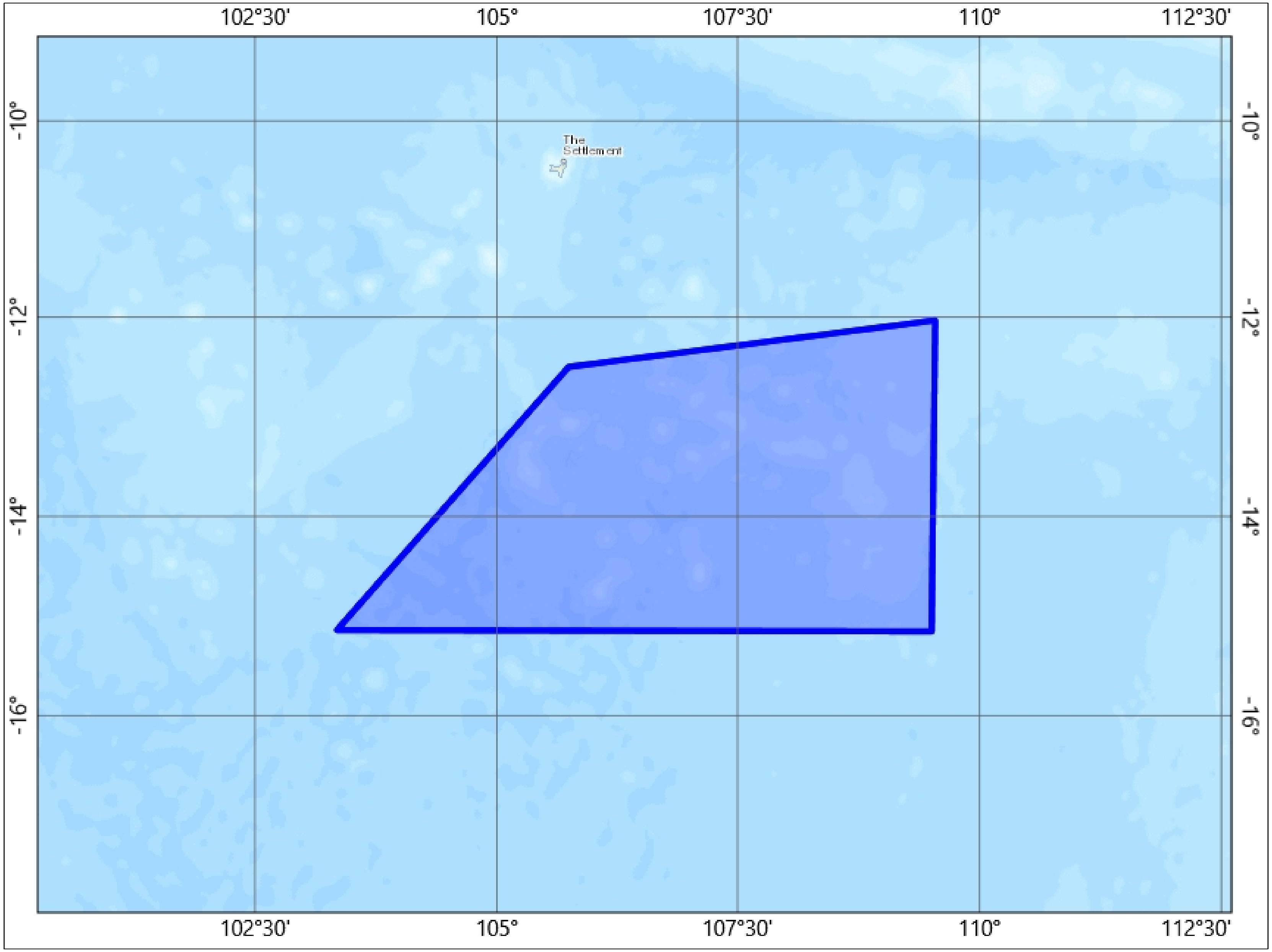


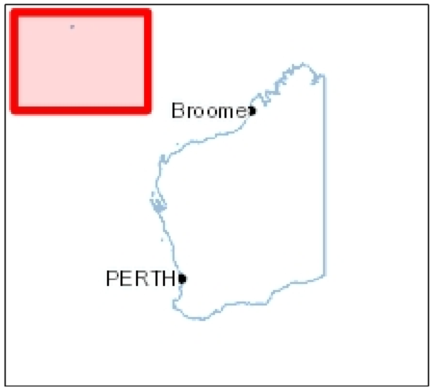
Legend

- Aboriginal Cultural Heritage (ACH) Register
- Search Area
- Aboriginal Community
  - *Permanent*
  - *Seasonal*
  - *Town Based*
- Town
- Road
- River
- Local Government Authority

219.57 kilometres

Map Scale 1 : 6,650,000

GCS GDA 1994



Map created: 21/05/2024 9:55:46 AM by: GIS_NET_USER

Identifier: 882802

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Register

Search Criteria

No Aboriginal Cultural Heritage (ACH) Register in Shapefile - VI Hub Ops EMBA 2 0f 9

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Map of Aboriginal Cultural Heritage (ACH) Register

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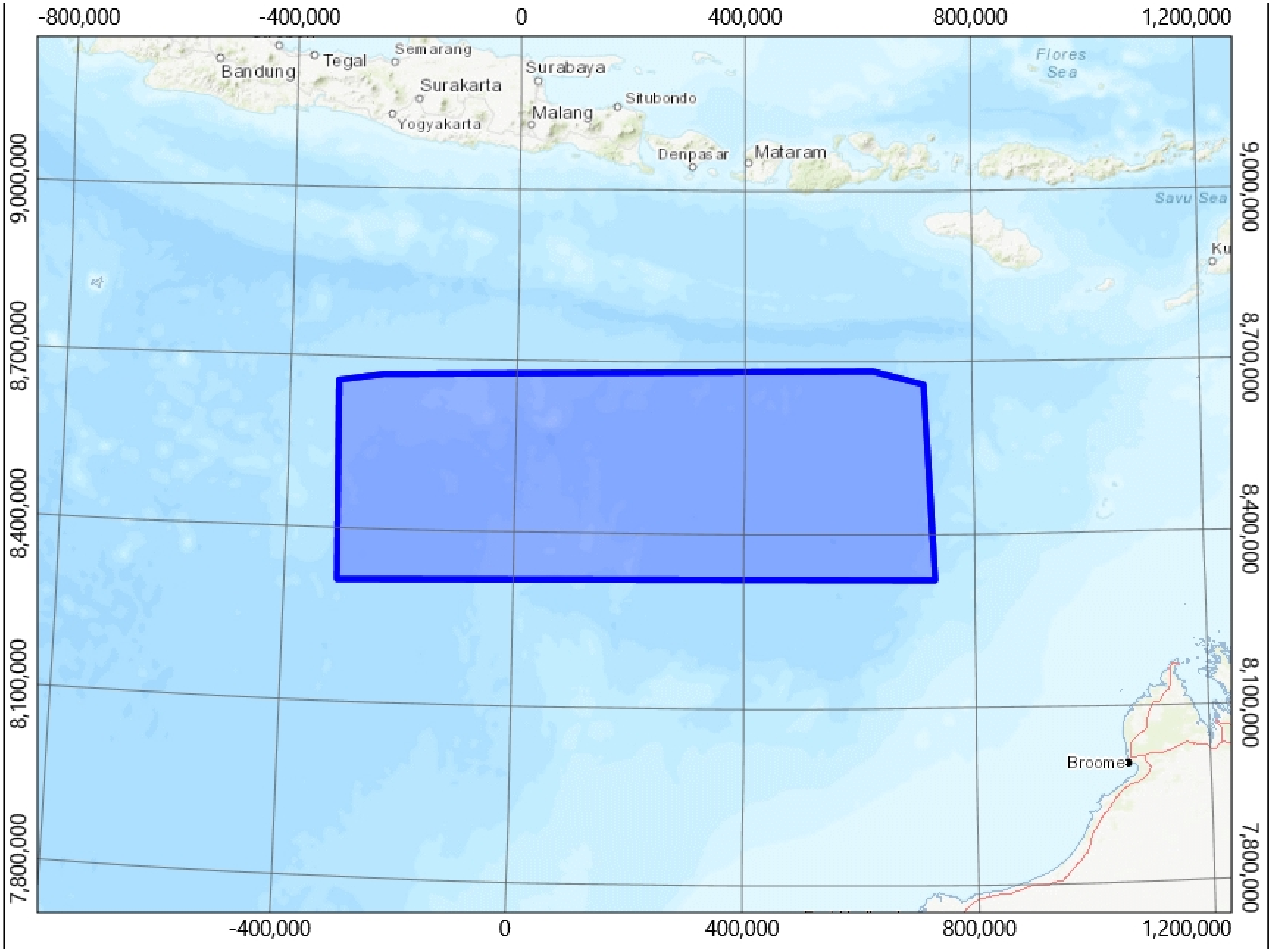


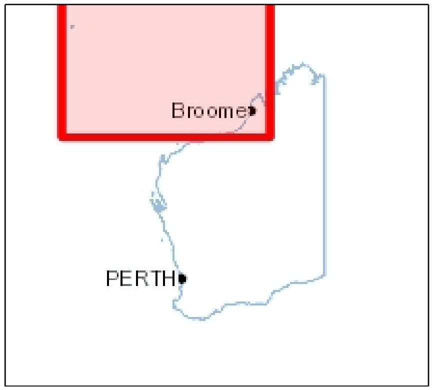
Legend

- Aboriginal Cultural Heritage (ACH) Register
- Search Area
- Aboriginal Community
  - *Permanent*
  - *Seasonal*
  - *Town Based*
- Town
- Road
- River
- Local Government Authority

342.44 kilometres

Map Scale 1 : 10,380,000

MGA Zone 50 (GDA94)



Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Register

Search Criteria

No Aboriginal Cultural Heritage (ACH) Register in Shapefile - VI Hub Ops EMBA 3 of 9

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Basemap Copyright

Department of Planning, Lands and Heritage

GOVERNMENT OF WESTERN AUSTRALIA

Aboriginal Cultural Heritage Inquiry System

Map of Aboriginal Cultural Heritage (ACH) Register

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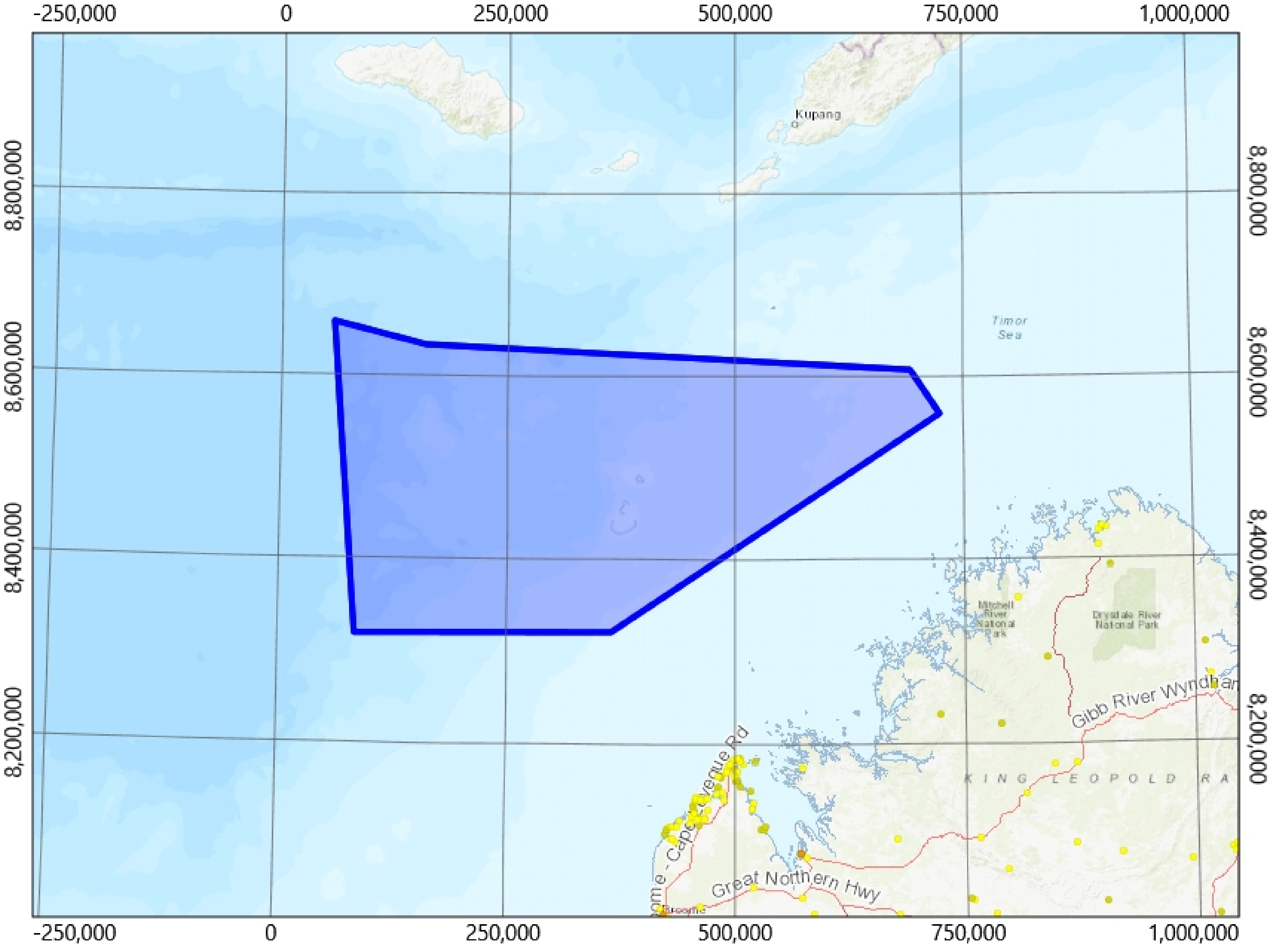


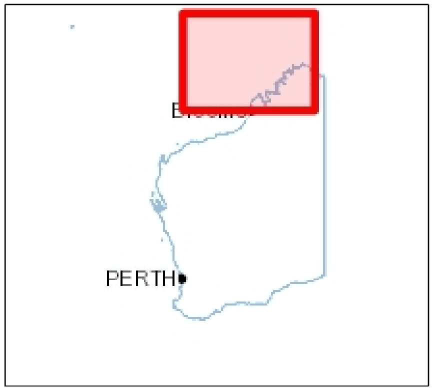
Legend

- Aboriginal Cultural Heritage (ACH) Register
- Search Area
- Aboriginal Community
  - *Permanent*
  - *Seasonal*
  - *Town Based*
- Town
- Road
- River
- Local Government Authority

217.14 kilometres

Map Scale 1 : 6,580,000

MGA Zone 51 (GDA94)



Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Register

Search Criteria

No Aboriginal Cultural Heritage (ACH) Register in Shapefile - VI Hub Ops EMBA 4 of 9

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.

All Aboriginal cultural heritage in Western Australia is protected, whether or not the ACH has been reported or exists on the Register.

The information provided is made available in good faith and is predominately based on the information provided to the Department of Planning, Lands and Heritage by third parties. The information is provided solely on the basis that readers will be responsible for making their own assessment as to the accuracy of the information. If you find any errors or omissions in our records, including our maps, it would be appreciated if you provide the details to the Department via https://achknowledge.dplh.wa.gov.au/ach-enquiry-form and we will make every effort to rectify it as soon as possible.

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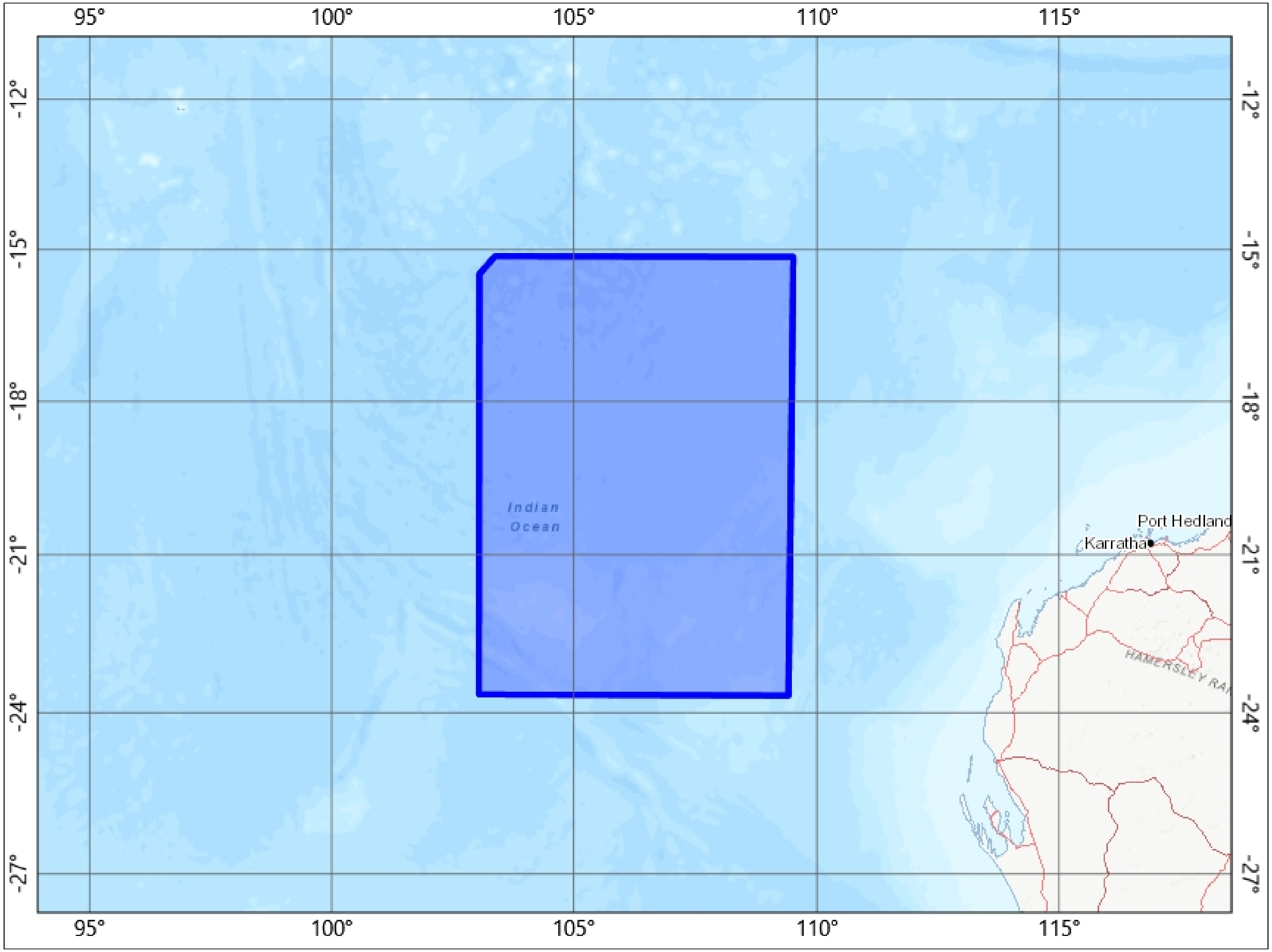

Legend

- Aboriginal Cultural Heritage (ACH) Register
- Search Area
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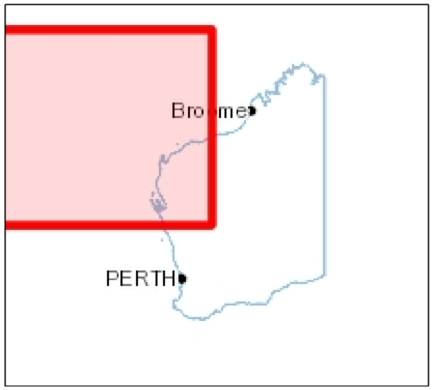
437.78 kilometres

Map Scale 1 : 13,270,000

GCS GDA 1994



Search Criteria

90 Aboriginal Cultural Heritage (ACH) Register in Shapefile - VI Hub Ops EMBA 5 of 9

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Copyright

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

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ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
508	POINT MURAT 03	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P07503
563	POINT MURAT 01	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P07501
564	POINT MURAT 02	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P07502
628	CAMP THIRTEEN BURIAL	No	Yes	No	No Gender / Initiation Restrictions	Register	Burial	*Registered Knowledge Holder names available from DPLH	P07434
811	URALA 94 B	No	No	No	No Gender / Initiation Restrictions	Register	Midden	*Registered Knowledge Holder names available from DPLH	P07322
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
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
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
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

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
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
1062	LEGENDRE 11	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	P07204
1105	LEGENDRE 02	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P07195
1109	LEGENDRE 06.	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Shell	*Registered Knowledge Holder names available from DPLH	P07199
1110	LEGENDRE 07.	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Shell	*Registered Knowledge Holder names available from DPLH	P07200
6078	ROSEMARY ISLAND 10	No	Yes	No	No Gender / Initiation Restrictions	Register	Engraving	*Registered Knowledge Holder names available from DPLH	P07019
6311	POINT MURAT.	No	Yes	No	No Gender / Initiation Restrictions	Register	Burial; Artefacts / Scatter; Camp; Midden; Other	*Registered Knowledge Holder names available from DPLH	P06628
6541	URALA STATION WEST	Yes	No	Yes	No Gender / Initiation Restrictions	Register	Ritual / Ceremonial	*Registered Knowledge Holder names available from DPLH	P06438
6596	POINT ANDERSON.	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Camp; Hunting Place; Midden; Shell; Water Source	*Registered Knowledge Holder names available from DPLH	P06341
6723	MULANDA 2	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06257
6724	MULANDA 3	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06258
6754	OSPREY BAY 6	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06165
6755	OSPREY BAY INTERDUNAL 1	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06166
6757	BLOODWOOD CREEK MIDDEN 1	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06168

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
6758	BLOODWOOD CREEK MIDDEN 2	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06169
6760	BLOODWOOD CREEK SHORELINE	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06171
6761	LOW POINT MIDDEN	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06172
6762	MILYERING MIDDEN	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06173
6764	CAMP 17 SOUTH MIDDENS	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06175
6765	CAMP 17 NORTH MIDDENS	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06176
6769	MULANDA 1	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06180
6782	28 MILE CREEK NORTH 1	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06140
6784	MANDU MANDU CREEK SOUTH	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06142
6785	MANDU MANDU CREEK NORTH	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06143
6790	YARDIE CREEK SOUTH 1	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06148
6799	YARDIE BEACH MIDDEN	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06157
6800	OYSTER STACKS MIDDEN	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06158
6801	NORTH T-BONE BAY	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06159
6802	OSPREY BAY 1	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06160
6803	OSPREY BAY 2	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06161
6804	OSPREY BAY 3	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06162

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6805	OSPREY BAY 4	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06163
6806	OSPREY BAY 5	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P06164
6827	CORAL BAY SKELETON	No	No	No	No Gender / Initiation Restrictions	Register	Burial	*Registered Knowledge Holder names available from DPLH	P06132
7126	MESA CAMP	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P05792
7203	BAUBOODJOO POINT (Bruboodjoo Midden Site)	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Camp; Hunting Place; Midden	*Registered Knowledge Holder names available from DPLH	P05707
7205	TWIN HILL FISHING PLACE.	No	No	No	No Gender / Initiation Restrictions	Register	Hunting Place	*Registered Knowledge Holder names available from DPLH	P05709
7206	WEALJUGOO MIDDEN.	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Camp; Hunting Place; Midden	*Registered Knowledge Holder names available from DPLH	P05710
7211	MAUD LANDING.	No	No	No	No Gender / Initiation Restrictions	Register	Burial; Camp; Meeting Place; Water Source	*Registered Knowledge Holder names available from DPLH	P05715
7254	SANDY BAY NORTH	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P05652
7265	LAKE SIDE VIEW	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P05664
7286	KAPOK WELL BURIAL	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Burial	*Registered Knowledge Holder names available from DPLH	P05632
7299	YARDIE CREEK	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P05645
7300	MANDU MANDU CK ROCKSHELTERS	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Artefacts / Scatter	*Registered Knowledge Holder names available from DPLH	P05646
7303	TULKI WELL MIDDEN	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P05649
7304	PILGRAMUNNA BAY MIDDEN	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P05650
7305	MANGROVE BAY.	No	Yes	No	No Gender / Initiation Restrictions	Register	Burial; Artefacts / Scatter; Hunting Place; Midden	*Registered Knowledge Holder names available from DPLH	P05651
7332	URALA STATION 12	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P05574

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7382	ROCKY POINT MIDDEN COMPLEX	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P05570
7385	URALA STATION 11	No	Yes	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P05573
7906	DELAMBRE ISLAND SOUTH.	No	No	No	No Gender / Initiation Restrictions	Register	Artefacts / Scatter; Water Source	*Registered Knowledge Holder names available from DPLH	P04954
9737	ENDERBY ISLAND 06: BOILER B	No	Yes	No	No Gender / Initiation Restrictions	Register	Engraving; Quarry	*Registered Knowledge Holder names available from DPLH	P02449
10381	VLAMING HEAD	Yes	No	Yes	No Gender / Initiation Restrictions	Register	Ritual / Ceremonial; Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	P01799
11328	GAP WELL	No	No	No	No Gender / Initiation Restrictions	Register	Engraving	*Registered Knowledge Holder names available from DPLH	P00836
11402	URALA DUNE BURIAL	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Burial; Artefacts / Scatter; Midden	*Registered Knowledge Holder names available from DPLH	P00752
11458	NINGALOO (near)	No	No	No	No Gender / Initiation Restrictions	Register	Painting	*Registered Knowledge Holder names available from DPLH	P00701
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

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11820	ENDERBY ISLAND 01	No	No	No	No Gender / Initiation Restrictions	Register	Engraving	*Registered Knowledge Holder names available from DPLH	P00364
16793	Site B	No	No	No	No Gender / Initiation Restrictions	Register	Midden; Shell	*Registered Knowledge Holder names available from DPLH	
17193	Ningaloo Station	No	No	No	No Gender / Initiation Restrictions	Register	Burial	*Registered Knowledge Holder names available from DPLH	
28615	MP08-53	Yes	Yes	Yes	No Gender / Initiation Restrictions	Register	Ritual / Ceremonial; Creation / Dreaming Narrative; Water Source	*Registered Knowledge Holder names available from DPLH	
37522	Mindurru (Ashburton River)	Yes	Yes	Yes		Register	Creation / Dreaming Narrative	*Registered Knowledge Holder names available from DPLH	

Department of Planning, Lands and Heritage

GOVERNMENT OF WESTERN AUSTRALIA

Aboriginal Cultural Heritage Inquiry System

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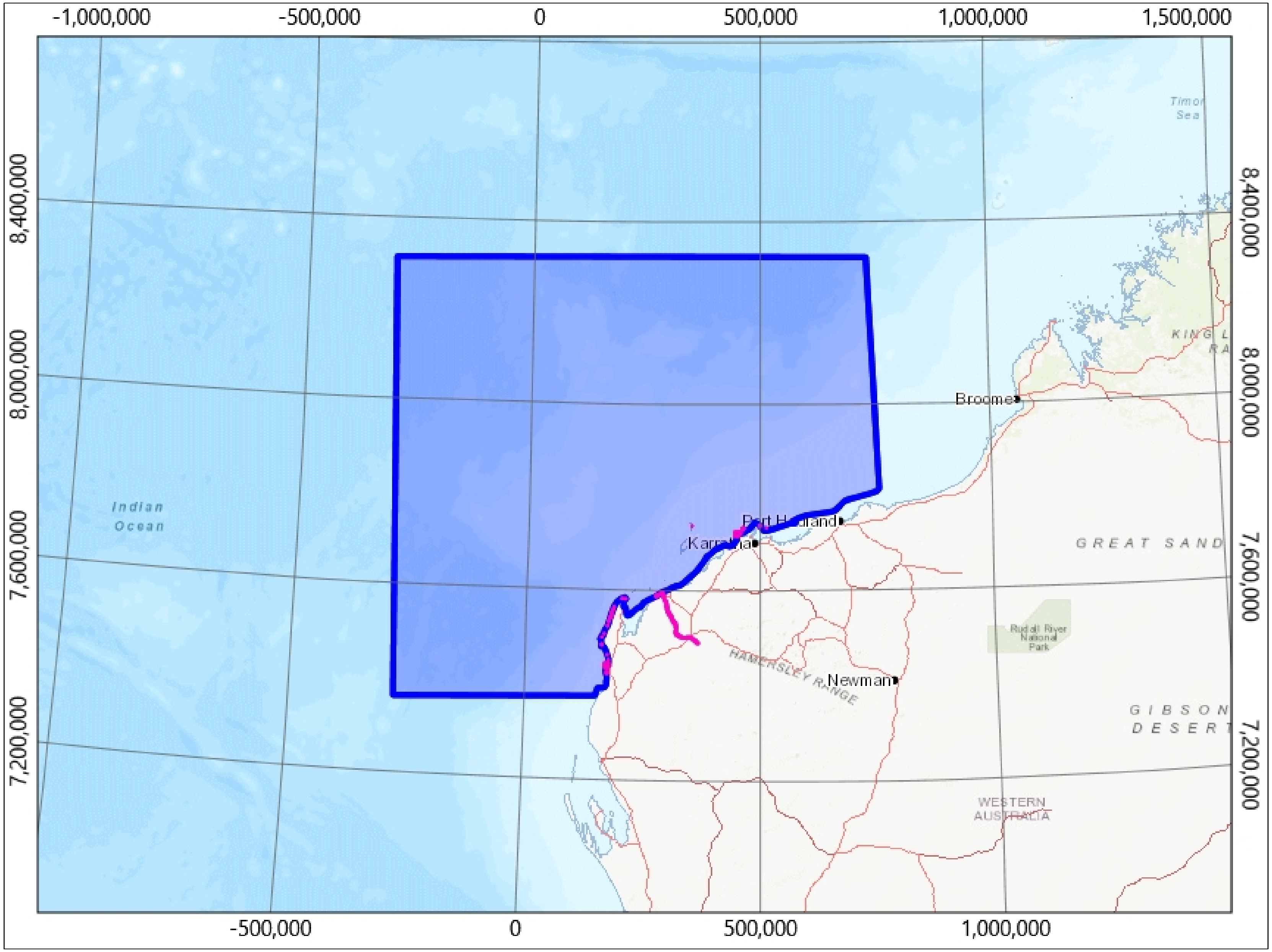

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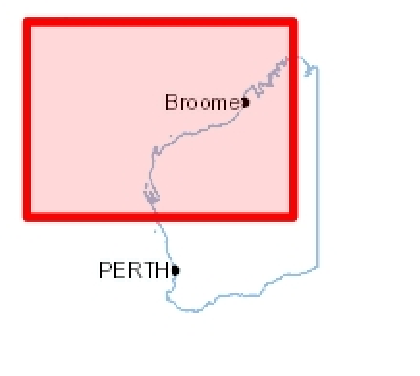

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The information provided is made available in good faith and is predominately based on the information provided to the Department of Planning, Lands and Heritage by third parties. The information is provided solely on the basis that readers will be responsible for making their own assessment as to the accuracy of the information. If you find any errors or omissions in our records, including our maps, it would be appreciated if you provide the details to the Department via https://achknowledge.dplh.wa.gov.au/ach-enquiry-form and we will make every effort to rectify it as soon as possible.

Copyright

Coordinates

Map coordinates are based on the GDA 94 Datum.

Basemap Copyright

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Topographic basemap sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community.

Department of Planning, Lands and Heritage

Aboriginal Cultural Heritage Inquiry System

Map of Aboriginal Cultural Heritage (ACH) Register

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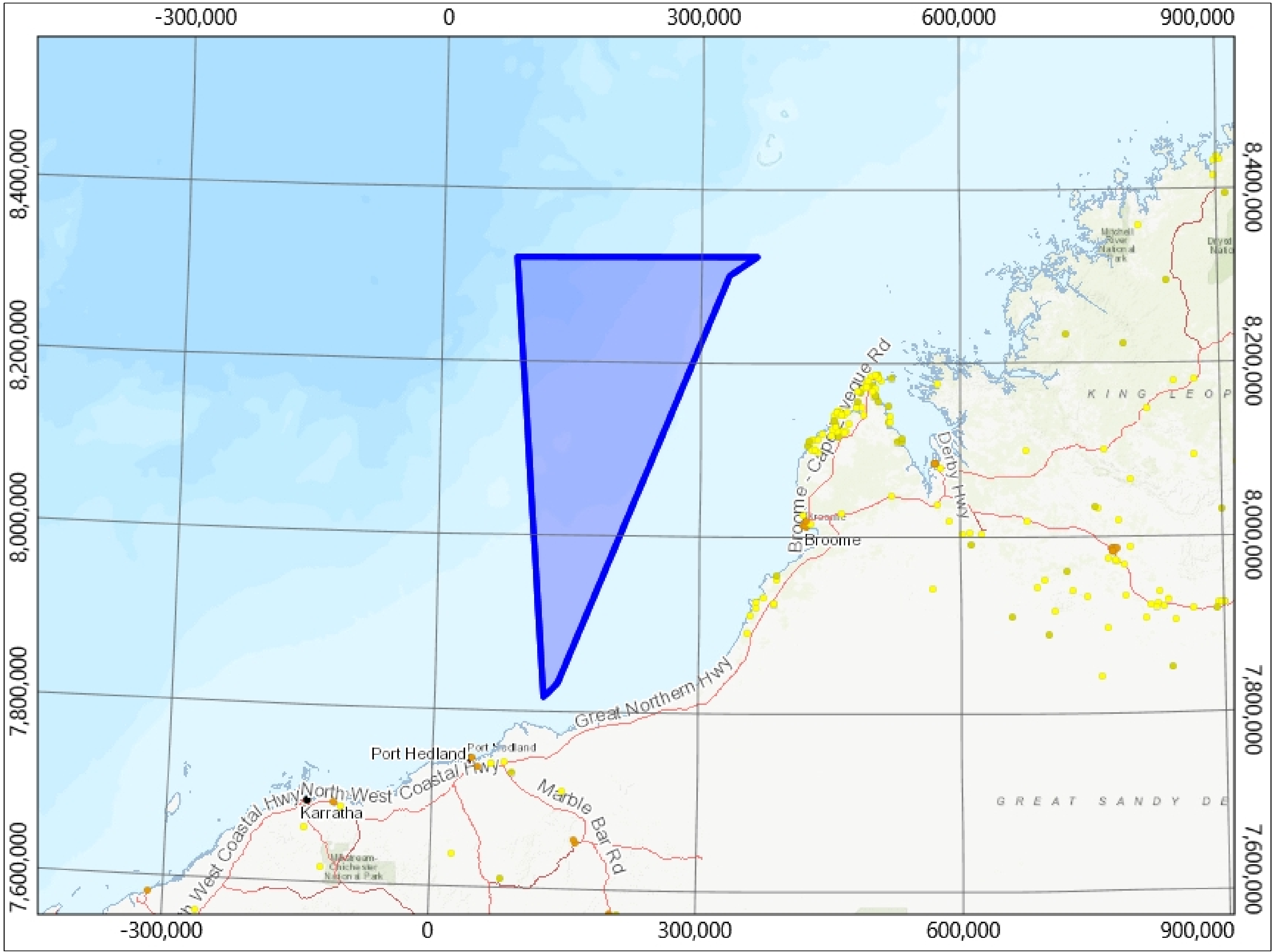


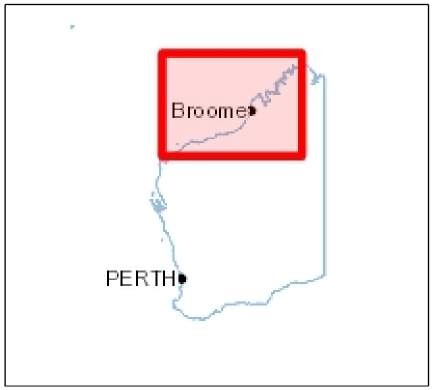
Legend

- Aboriginal Cultural Heritage (ACH) Register
- Search Area
- Aboriginal Community
  - *Permanent*
  - *Seasonal*
  - *Town Based*
- Town
- Road
- River
- Local Government Authority

230.62 kilometres

Map Scale 1 : 6,990,000

MGA Zone 51 (GDA94)



Map created: 21/05/2024 10:05:11 AM by: GIS_NET_USER

Identifier: 882812

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Register

Search Criteria

No Aboriginal Cultural Heritage (ACH) Register in Shapefile - VI Hub Ops EMBA 7 of 8

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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Copyright

Coordinates

Map coordinates are based on the GDA 94 Datum.

Basemap Copyright

Satellite, Hybrid, Road basemap sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, HERE, DeLorme, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community.

Topographic basemap sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community.

Department of Planning, Lands and Heritage

GOVERNMENT OF WESTERN AUSTRALIA

Aboriginal Cultural Heritage Inquiry System

Map of Aboriginal Cultural Heritage (ACH) Register

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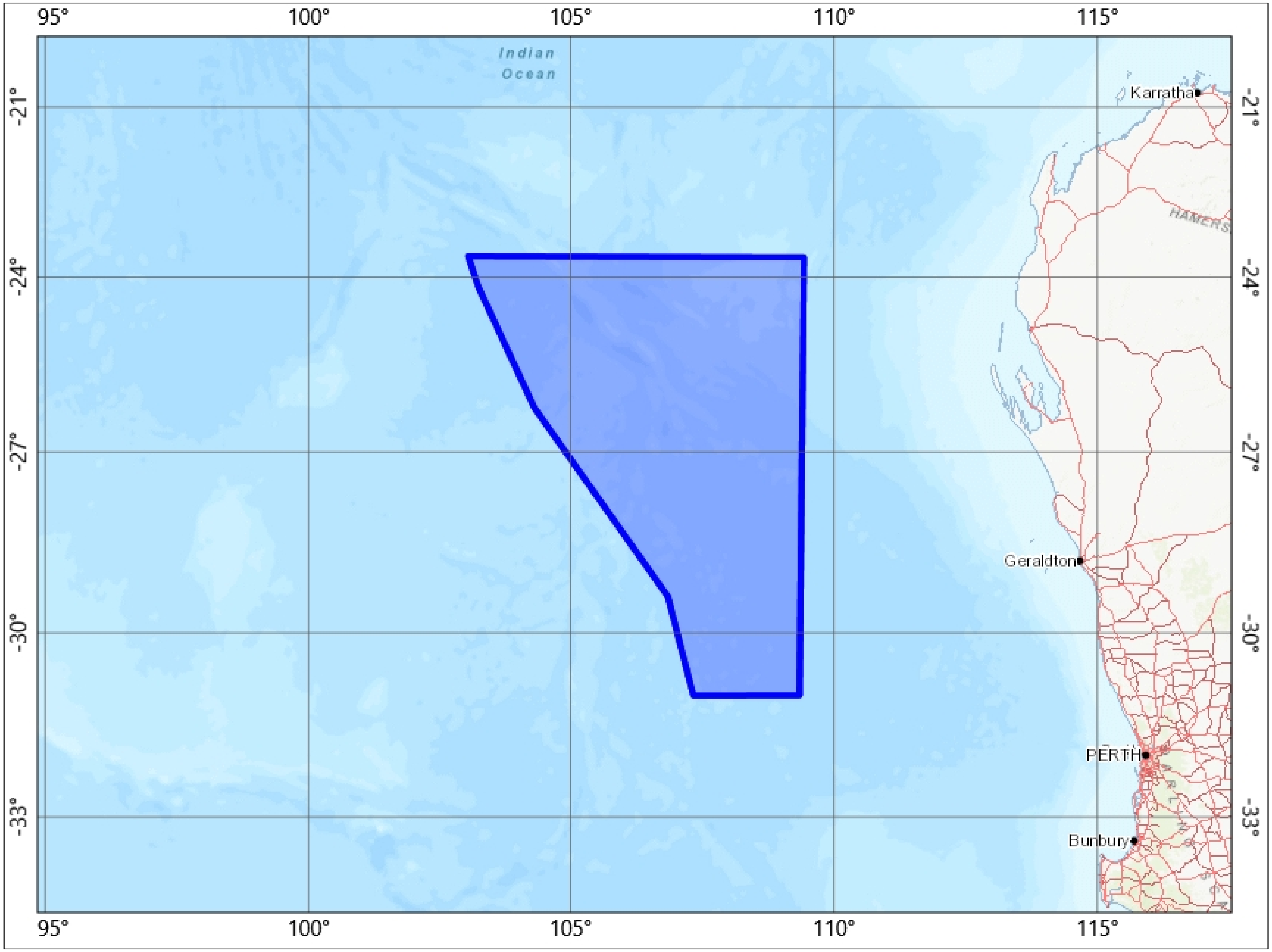


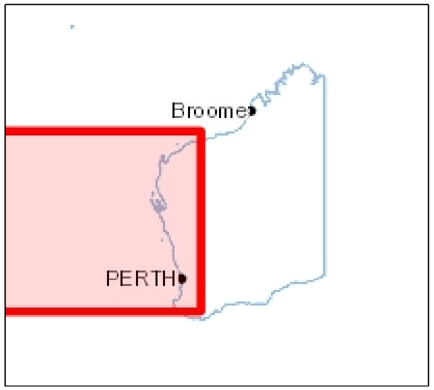
Legend

- Aboriginal Cultural Heritage (ACH) Register
- Search Area
- Aboriginal Community
  - *Permanent*
  - *Seasonal*
  - *Town Based*
- Town
- Road
- River
- Local Government Authority

403.07 kilometres

Map Scale 1 : 12,210,000

GCS GDA 1994



Search Criteria

2 Aboriginal Cultural Heritage (ACH) Register in Shapefile - VI Hub Ops EMBA 8 of 8

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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South West Settlement ILUA Disclaimer

Your heritage enquiry is on land within or adjacent to the following Indigenous Land Use Agreement(s): Yued Indigenous Land Use Agreement.

On 8 June 2015, six identical Indigenous Land Use Agreements (ILUAs) were executed across the South West by the Western Australian Government and, respectively, the Yued, Whadjuk People, Gnaala Karla Booja, Ballardong People, South West Boojarah #2 and Wagyl Kaip & Southern Noongar groups, and the South West Aboriginal Land and Sea Council (SWALSC).

The ILUAs bind the parties (including 'the State', which encompasses all State Government Departments and certain State Government agencies) to enter into a Noongar Standard Heritage Agreement (NSHA) when conducting Aboriginal Heritage Surveys in the ILUA areas, unless they have an existing heritage agreement. It is also intended that other State agencies and instrumentalities enter into the NSHA when conducting Aboriginal Heritage Surveys in the ILUA areas. It is recommended a NSHA is entered into, and an 'Activity Notice' issued under the NSHA, if there is a risk that an activity will 'impact' (i.e. by excavating, damaging, destroying or altering in any way) an Aboriginal heritage site. The Aboriginal Heritage Due Diligence Guidelines, which are referenced by the NSHA, provide guidance on how to assess the potential risk to Aboriginal heritage.

Likewise, from 8 June 2015 the Department of Energy, Mines, Industry Regulation and Safety (DEMIRS) in granting Mineral, Petroleum and related Access Authority tenures within the South West Settlement ILUA areas, will place a condition on these tenures requiring a heritage agreement or a NSHA before any rights can be exercised.

If you are a State Government Department, Agency or Instrumentality, or have a heritage condition placed on your mineral or petroleum title by DEMIRS, you should seek advice as to the requirement to use the NSHA for your proposed activity. The full ILUA documents, maps of the ILUA areas and the NSHA template can be found at https://www.wa.gov.au/organisation/department-of-the-premier-and-cabinet/south-west-native-title-settlement.

Further advice can also be sought from the Department of Planning, Lands and Heritage via https://achknowledge.dplh.wa.gov.au/ach-enquiry-form.

Copyright

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 94 Datum.

Basemap Copyright

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Topographic basemap sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community.

Aboriginal Cultural Heritage Inquiry System

List of Aboriginal Cultural Heritage (ACH) Register

ID	Name	Boundary Restricted	Boundary Reliable	Culturally Sensitive	Culturally Sensitive Nature	Status	Place Type	Knowledge Holders	Legacy ID
6498	DIRK HARTOG ISLAND	No	No	No	No Gender / Initiation Restrictions	Register	Traditional Structure	*Registered Knowledge Holder names available from DPLH	P06448
7124	DORRE ISLAND	No	No	No	No Gender / Initiation Restrictions	Register	Burial	*Registered Knowledge Holder names available from DPLH	P05790

Department of Planning, Lands and Heritage

GOVERNMENT OF WESTERN AUSTRALIA

Aboriginal Cultural Heritage Inquiry System

Map of Aboriginal Cultural Heritage (ACH) Register

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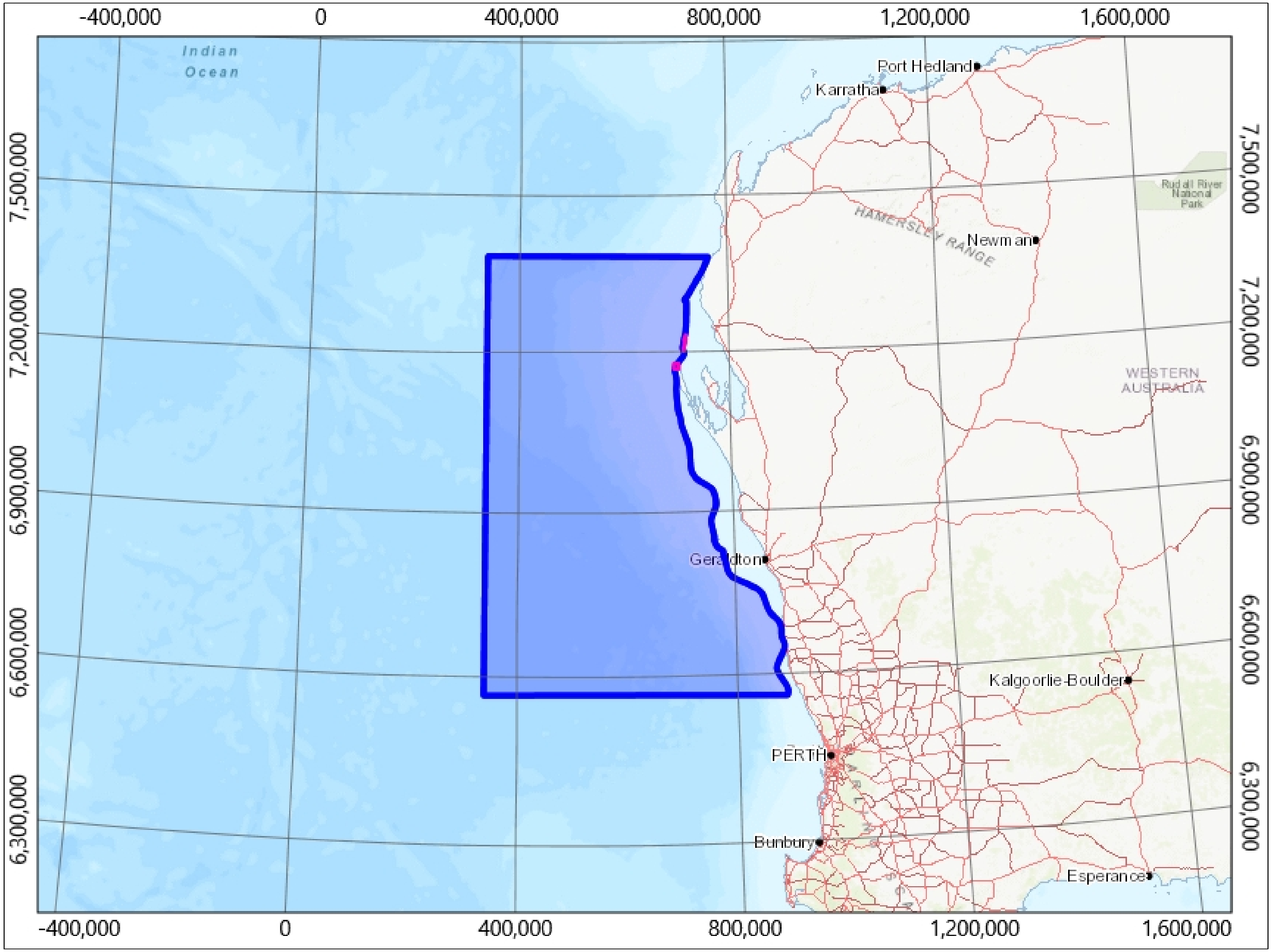


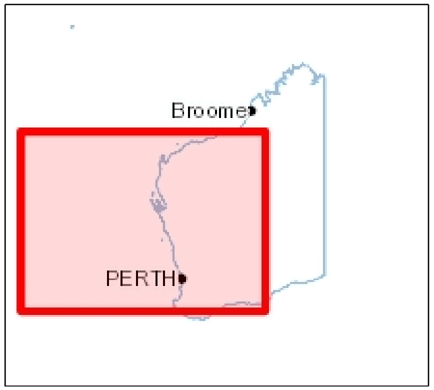
Legend

- Aboriginal Cultural Heritage (ACH) Register
- Search Area
- Aboriginal Community
  - *Permanent*
  - *Seasonal*
  - *Town Based*
- Town
- Road
- River
- Local Government Authority

401.79 kilometres

Map Scale 1 : 12,180,000

MGA Zone 49 (GDA94)



Santos

Appendix F Examples of Consultation Material

From:	Consultation, Santos
To:	[redacted]
Cc:	Consultation, Santos
Subject:	FOR DISCUSSION | Preliminary Consultation for Proposed Offshore Activities
Date:	Monday, 29 May 2023 2:58:04 PM
Attachments:	Santos Decommissioning EMBA Map.pdf image001.png Santos Drilling and PA EMBA Map.pdf

Dear [redacted]

Santos is contacting you as we are preparing to undertake consultation activities for a number of proposed activities in Commonwealth and WA State waters.

Based on a review of publicly available information, we have identified that [redacted] may have functions, interests or activities that may be affected by these proposed activities.

Preliminary consultation

Santos would like to meet with you to discuss whether the functions, interests or activities of [redacted] may be affected, including consideration of any values or sensitivities of importance.

If you consider that they may be affected by our proposed activities, we can then discuss consultation methods appropriate to [redacted] information needs and interests.

This engagement is a preliminary step ahead of consultation for each activity, which is planned to commence on **26 June 2023**. Consultation is required under Commonwealth and State environmental Regulations and a key part of preparing Environment Plans (EPs) for each activity. Regulator-accepted EPs are required before any petroleum activity can commence.

Proposed Activities Offshore WA

The table below provides a summary of proposed activities, some of which have been consulted on previously with environment plans (EPs) under Regulator assessment.

Environment Plan	Activity summary	EP status
Drilling + Plug and Abandonment Activities		
Spar-Halyard	+ Drilling of a development well (infill) to support ongoing production at the Varanus Island (VI) Hub. The well is approximately 114 km north of Onslow. Activity commencement is planned from Q1 2024	+ New activity for consultation
WA-63-L	+ Drilling of up to four exploration wells to support future production through the VI Hub Operations. Activity commencement is planned from Q1 2024. WA-63-L is approximately 107 km north of Onslow.	+ New activity for consultation
Simpson	+ Plug and abandonment activities of eight wells no longer required for production via the offshore Simpson facility. The wells are approximately 102 km west of Dampier. Activity commencement is planned from Q2 2024.	+ New activity for consultation
Gibson	+ Plug and abandonment activities of four wells no longer required for production via the offshore Gibson facility. The wells are approximately 113 km north east of	+ New activity for consultation

	Onslow. Activity is planned for Q2 2024.	
Mutineer Exeter Fletcher Finucane (MEFF)	+ Plug and abandonment activities for 12 wells no longer required for production. The MEFF wells are approximately 147 km north of Dampier. Activity is planned for Q2 2024.	+ Under assessment by Regulator
Decommissioning Activities		
Harriet Joint Venture (HJV) Decommissioning	+ Decommissioning of the HJV field, comprising removal of all platforms and substructures, as well as pipelines associated with the Simpson facility. The HJV field is approximately 117 km west of Dampier and 117 km north east of Onslow. Activity commencement planned is from Q1 2024.	+ New activity for consultation
MEFF Decommissioning	+ Decommissioning of the MEFF field, comprising partial removal of subsea infrastructure. The MEFF field is approximately 147 km north of Dampier. Activity commencement is anticipated from Q3 2024.	+ Under assessment by Regulator
Campbell Decommissioning	+ Removal of the platform and substructures of the Campbell facility, which is approximately 105 km west of Dampier. Activity commencement is planned from Q1 2024.	+ New activity for consultation
WA-20-L	+ Leave in-situ one plugged and abandoned wellhead, approximately 101 km north of Dampier. The WA-20-L petroleum permit is subject to an ongoing environmental monitoring for the duration of the EP to monitor for gas release.	+ Under assessment by Regulator
WA-1-P	+ Leave in situ three plugged and abandoned wellheads. Activity is ongoing following environment plan acceptance. The nearest well is approximately 85 km north-northwest of Dampier.	+ New activity for consultation

We have attached two maps – one for drilling and plug and abandonment activities and one for decommissioning activities.

These maps depict locations for proposed activities, as well as a consolidated Environment That May Be Affected (EMBA) for all proposed activities. 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.

We have used these consolidated EMBAs to identify persons or organisations who may have functions, interests or activities that may be affected (‘relevant persons’) for all activities.

We have also developed consultation information sheets for each activity, which can be found on our web site to provide further details for you to understand if your functions, interests or activities may be affected. A QR Code linking to this site is also provided for convenience.

Additional resources

More information about how community members can participate in environmental approvals for activities proposed in Commonwealth waters has been published by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA). This brochure sets out titleholders' responsibilities for consultation, as well as opportunities for relevant persons to provide guidance for consultation expectations.

Next steps

Please let us know whether:

- You need additional information to understand if you may be affected.
- You consider you may be relevant and would like to discuss consultation methods.
- You would like to provide feedback now on any of the above proposed activities.

If you have previously been consulted on Santos activities currently under assessment, you are welcome to provide additional feedback, which will be included in updates to respective EPs under assessment. If you have no further comment to make, then your previous feedback will be carried forward in the updated EP.

Importantly, we recognise that there may be some sensitivities about sharing culturally sensitive information so we will take your guidance on the best approach when undertaking consultation activities.

Please also us know if you would like any sensitive information you provide to remain private. If requested, Santos will ensure your information remains confidential between us and the regulator and will not be published or otherwise made publicly available. Santos will handle your information in accordance with our Offshore Western Australia Consultation Privacy Policy, which can be found here.

We look forward to hearing from you soon.

[redacted]

[redacted]

As a service provider to

Santos Limited, Level 7, 100 St Georges Tce
Perth WA 6000
[redacted]

https://www.santos.com/

From: [redacted]
To: [redacted]
Cc: [redacted]
Subject: FOR CONSULTATION | Proposed Carnarvon Basin Activities
Date: Monday, 26 June 2023 9:22:32 PM
Attachments: image002.png

Dear [redacted]

Santos is contacting you as again as preliminary consultation for proposed activities in the Carnarvon Basin has closed.

We are now asking for relevant persons to provide any feedback on the proposed activities outlined in the table below by **26 July 2023**.

More information on each proposed activity can be found via links provided below to activity fact sheets, which are published on our web site.

Environment Plan	Activity summary	EP status
Drilling + Plug and Abandonment Activities		
Spar-Halyard	Drilling of a development well (infill) to support ongoing production at the Varanus Island (VI) Hub. The well is approximately 114 km north of Onslow. Activity commencement is planned from Q1 2024.	New activity for consultation
Simpson	Plug and abandonment activities of eight wells no longer required for production via the offshore Simpson facility. The wells are approximately 102 km west of Dampier. Activity commencement is planned from Q2 2024.	New activity for consultation
Gibson	Plug and abandonment activities of four wells no longer required for production via the offshore Gibson facility. The wells are approximately 113 km north east of Onslow. Activity is planned for Q2 2024.	New activity for consultation
Mutineer Exeter Fletcher Finucane (MEFF)	Plug and abandonment activities for 12 wells no longer required for production. The MEFF wells are approximately 147 km north of Dampier. Activity is planned for Q2 2024.	Under assessment by Regulator
Decommissioning Activities		
Harriet Joint Venture (HJV) Decommissioning	Decommissioning of the HJV field, comprising removal of all platforms and substructures, as well as pipelines associated with the Simpson facility. The HJV field is approximately 117 km west of Dampier and 117 km north east of Onslow. Activity commencement planned is from Q1 2024.	New activity for consultation
MEFF Decommissioning	Decommissioning of the MEFF field, comprising partial removal of subsea infrastructure. The MEFF field is approximately 147 km north of Dampier. Activity commencement is anticipated from	Under assessment by Regulator

	Q3 2024.	
Campbell Decommissioning	Removal of the platform and substructures of the Campbell facility, which is approximately 105 km west of Dampier. Activity commencement is planned from Q1 2024.	New activity for consultation
WA-20-L	Leave in-situ one plugged and abandoned wellhead, approximately 101 km north of Dampier. The WA-20-L petroleum permit is subject to an ongoing environmental monitoring for the duration of the EP to monitor for gas release.	Under assessment by Regulator
WA-1-P	Leave in situ three plugged and abandoned wellheads. Activity is ongoing following environment plan acceptance. The nearest well is approximately 85 km north-northwest of Dampier.	New activity for consultation

Providing feedback

As part of consultation, we are asking for relevant persons to provide any feedback on proposed activities by **26 July 2023**.

If you have previously been consulted on Santos activities currently under assessment, you are welcome to provide additional feedback, which will be included in updates to respective EPs under assessment. If you have no further comment to make, then your previous feedback will be carried forward in the updated EP.

Please let us know if you would like any sensitive information you provide to remain private. If requested, Santos will ensure your information remains confidential between us and the regulator and will not be published or otherwise made publicly available. Santos will handle your information in accordance with our Offshore Western Australia Consultation Privacy Policy, which can be found here.

Activity notifications and emergency communications

Please let us know if you require notification prior to the start and upon activity completion.

We would also appreciate any preferred arrangements to support communications in the event of an emergency that may impact your functions, interests or activities.

Additional resources

More information about how community members can participate in environmental approvals for activities proposed in Commonwealth waters has been published in a brochure by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).

Regards

[redacted]

[redacted]
Consultation Lead

As a service provider to

Santos

[redacted]

From: [redacted]
To:
Cc:
Subject: RE: FOR CONSULTATION | Proposed Carnarvon Basin Activities
Date: Wednesday, 19 July 2023 4:34:06 PM
Attachments: image001.png
image002.png

Dear [redacted]

Santos is sending you this reminder email as the feedback period for consultation on the activities outlined below closes on **Wednesday 26 July 2023**.

Consultation is required under Commonwealth and State Environmental Regulations and is a key part of preparing Environment Plans (EPs) for our proposed activities. Regulator-accepted EPs are required before any petroleum activity can commence.

Providing feedback

Please provide feedback at the earliest opportunity so we can assess your feedback and respond in a timely manner.

A summary of your feedback and our response will be included in the relevant Environment Plan, which will be submitted to the Regulator for assessment.

Please let us know if you would like any sensitive information you provide to remain private. If requested, Santos will ensure your information remains confidential between us and the Regulator and will not be published or otherwise made publicly available. Santos will handle your information in accordance with our Offshore Western Australia Consultation Privacy Policy, which can be found here.

You can provide feedback via return email or call us toll free on **1800 267 600**.

As previously advised, if you have already been consulted on Santos' activities currently under assessment, you are welcome to provide additional feedback, which will be included in updates to respective EPs under assessment. If you have no further comment to make, then your previous feedback will be carried forward in the updated EP.

Activity notifications and emergency communications

Please let us know if you require notification prior to the start and upon activity completion.

If you would like to be notified in the instance of an emergency situation that may impact your functions, interested or activities, please let us know.

Please visit our website if you would like to know more about our proposed activities.

Regards

Santos Consultation Team

Santos

t: +61 1800 267 600 | e: offshore.consultation@santos.com
Santos.com | Follow us on LinkedIn, Facebook and Twitter

From: [redacted]
Sent: Thursday, June 29, 2023 8:32 PM
To: [redacted]
Cc: [redacted]
Subject: FOR CONSULTATION | Proposed Carnarvon Basin Activities

Dear [redacted]

Santos is contacting you as we are asking for relevant persons to provide any feedback on the proposed activities outlined in the table below.

More information on each proposed activity, some of which are under regulator assessment, can be found via links provided below to activity fact sheets, which are published on our web site.

Environment Plan	Activity summary	EP status
Drilling + Plug and Abandonment Activities		
Spar-Halyard	Drilling of a development well (infill) to support ongoing production at the Varanus Island (VI) Hub. The well is approximately 114 km north of Onslow. Activity commencement is planned from Q1 2024.	New activity for consultation
Simpson	Plug and abandonment activities of eight wells no longer required for production via the offshore Simpson facility. The wells are approximately 102 km west of Dampier. Activity commencement is planned from Q2 2024.	New activity for consultation
Gibson	Plug and abandonment activities of four wells no longer required for production via the offshore Gibson facility. The wells are approximately 113 km north east of Onslow. Activity is planned for Q2 2024.	New activity for consultation
Mutineer Exeter Fletcher Finucane (MEFF)	Plug and abandonment activities for 12 wells no longer required for production. The MEFF wells are approximately 147 km north of Dampier. Activity is planned for Q2	Under assessment by Regulator

	2024.	
Decommissioning Activities		
[Harriet Joint Venture (HJV) Decommissioning]()	Decommissioning of the HJV field, comprising removal of all platforms and substructures, as well as pipelines associated with the Simpson facility. The HJV field is approximately 117 km west of Dampier and 117 km north east of Onslow. Activity commencement planned is from Q1 2024.	New activity for consultation
[MEFF Decommissioning]()	Decommissioning of the MEFF field, comprising partial removal of subsea infrastructure. The MEFF field is approximately 147 km north of Dampier. Activity commencement is anticipated from Q3 2024.	Under assessment by Regulator
[Campbell Decommissioning]()	Removal of the platform and substructures of the Campbell facility, which is approximately 105 km west of Dampier. Activity commencement is planned from Q1 2024.	New activity for consultation
[WA-20-L]()	Leave in-situ one plugged and abandoned wellhead, approximately 101 km north of Dampier. The WA-20-L petroleum permit is subject to an ongoing environmental monitoring for the duration of the EP to monitor for	Under assessment by Regulator

	gas release.	
WA-1-P	Leave in situ three plugged and abandoned wellheads. Activity is ongoing following environment plan acceptance. The nearest well is approximately 85 km north-northwest of Dampier.	New activity for consultation

Providing feedback

As part of consultation, we are asking for relevant persons to provide any feedback on proposed activities by **26 July 2023**.

If you have previously been consulted on Santos' activities currently under assessment, you are welcome to provide additional feedback, which will be included in updates to respective EPs under assessment. If you have no further comment to make, then your previous feedback will be carried forward in the updated EP.

Please let us know if you would like any sensitive information you provide to remain private. If requested, Santos will ensure your information remains confidential between us and the regulator and will not be published or otherwise made publicly available. Santos will handle your information in accordance with our Offshore Western Australia Consultation Privacy Policy, which can be found here.

Activity notifications and emergency communications

Please let us know if you require notification prior to the start and upon activity completion.

We look forward to hearing from you.

Regards

Santos Consultation Team

Santos

t: +61 1800 267 600 | e: offshore.consultation@santos.com
Santos.com | Follow us on LinkedIn, Facebook and Twitter

Santos acknowledges the Traditional Owners and Custodians of the lands on which we operate. We pay our respects to their Elders past, present and emerging.

From: Consultation, Santos <Offshore.consultation@santos.com>
Sent: Tuesday, July 9, 2024 2:58 PM
To: [redacted]
Cc: Consultation, Santos <Offshore.consultation@santos.com>
Subject: CONSULTATION | Carnarvon Basin | Varanus Island Hub Operations Environment Plan

Consultation on:

- **Varanus Island Hub Operations Environment Plan**

Santos is contacting you as we are proposing to revise the environment plan for our Varanus Island Hub Operations, which is the base of Santos' Western Australian energy portfolio and has been in operation since 1986. These facilities are located 127 km northwest of Karratha.
The revision of the environment plan is planned to cover the commissioning and operation of a replacement development well called Halyard-2. A link is embedded in the image below to a fact sheet published on our Consultation Hub at https://www.santos.com/offshoreconsultation/carnarvon/, which provides more information.
The fact sheet includes information on proposed activities; potential impacts, risks and management measures; and the presence, based on a review of publicly available information, of environmental, social, economic and cultural features and/or values within the Environment That May Be Affected (**EMBA**).
Once regulatory approval has been obtained, Halyard-2 will replace the existing Halyard-1 well which is going to be suspended.

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 environmental plans, which are assessed by the National Offshore Petroleum Safety and Environmental Management Authority (**NOPSEMA**).
This input is used by Santos to refine or change:

- Proposed control measures to manage activity impacts, and
- Proposed mitigation measures to reduce potential impacts from unplanned events.

Activity Implications
While we have assessed that you are unlikely to be affected by impacts from planned activities given the distance of your interests to the Varanus Island Hub, we note from our planning activities that your functions, interests and activities may potentially be affected by impacts from an unplanned **event**, specifically in the unlikely event of a worst-case spill.
For planning purposes, we have modelled the maximum potential extent of all major unplanned spill events under all seasonal conditions to define the EMBA. A map showing the EMBA for the Halyard-2 well is included in the linked fact sheet for reference.
The EMBA is a conservative representation of the potential extent of a spill and does not consider implementation of spill response mitigation measures, which would reduce the size of a spill and therefore reduce the EMBA. Also, there is no single event that could ever result in the whole EMBA being affected at the same time as it is a representation of numerous spill scenarios overlain in a pictorial representation.
Spill response mitigation measures are included in the Varanus Island Hub Operations Oil Pollution Emergency Plan (**OPEP**). The OPEP sets out the process to manage a spill. The OPEP identifies and prioritises spill response strategies for all potential spill events and describes how Santos prepares to respond in the remote event of a spill.

Providing Input
Please contact us by **22 July 2024** if you consider you may be a relevant person and wish to participate in the consultation process. You can provide feedback by return email or call us toll free on **1800 267 600**.
If you would like to provide input now, please note that a summary of your feedback will be included in the environmental plan, including our assessment of your input and our response to you.
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 below to read in full.

We look forward to hearing from you soon.
Regards
Santos Consultation Team

From: Consultation, Santos
To: [redacted]
Cc: Consultation, Santos
Subject: REVISION | Carnarvon Basin | Halyard-2 Operations Varanus Island Hub Operations Environment Plan
Date: Friday, 9 August 2024 2:25:01 PM

Dear [redacted],

Santos is contacting you to provide an activity update on the commissioning, start-up and operation of the Halyard 2 well at our Varanus Island Hub in Western Australia.

It is anticipated that the commissioning of the Halyard 2 well to the Varanus Island Hub will take place in Q1 2025, followed by operation of the well through the hub. The well is expected to operate for a short duration and cease production in 2026.

As noted in our 2023 Halyard -2 fact sheet (Santos-Consultation-Spar-Halyard-Development-Well.pdf), Santos also plans to undertake the activities described in the accepted Varanus Island Hub Operations EP in relation to the Halyard-2 well. The commissioning, start-up and operation of the Halyard-2 well will be addressed via a revision to the Varanus Island Hub Operations (Commonwealth) EP (VI Hub Operations EP).

We would like to highlight that there are no new material impacts or risks from the Halyard-2 well commissioning, start-up and operation over and above those already described in the in-force and publicly available VI Hub Operations EP, available at this link Industry environment plans (nopsema.gov.au).

However, for your convenience, the tables below present the details of the Halyard-2 commissioning, start-up and operations activities as well as the associated impacts, risks and control measures that will be included in the VI Hub Operations EP revision.

We have extended the consultation period for Halyard-2 to allow relevant persons time to consider this additional information and provide any further input they may have on these activities. We request you provide any further input by **23 August 2024.** We will consider your further input on the proposed Halyard-2 activities, along with any input that you may have previously provided, and include it in the revision to the VI Hub Operations EP. Please let us know if you would like any sensitive information you provide to remain private. If requested, Santos will ensure your information remains confidential between us and the regulator and will not be published or otherwise made publicly available. Santos will handle your information in accordance with our Offshore Western Australia Consultation Privacy Policy, which can be found here.

Table 1: Halyard-2 well commissioning, start-up and ongoing operational activities and associated emissions and discharges

Activity	Description	Typical Emissions and Discharges
Pressurise Greater East Spar (GES) system, including East Spar Pipeline	Pressurisation is via John Brookes gas from VI. It will take place over approximately 3 days.	There will be noise emissions from the pressurisation of Greater East Spar system during commissioning and start-up. This will not increase noise emissions above routine operations. There are no other associated discharges.
Subsea valve operation	As per normal operating conditions, subsea valve operations are required during commissioning and start-up.	When subsea valves are operated, due to the open loop system design, 2-5 L of hydraulic fluids (dependant on valve size) are discharged each time the valve is operated (closed), resulting in approximately 25 L released during commissioning and start up. There are no other associated discharges.
Priming activities on subsea infrastructure	Mono Ethylene Glycol (MEG) is injected via control system from John Brookes Platform into the Halyard-2 tree and is not discharged.	No emissions or discharges. The MEG remains in a closed tested system and is not discharged. This is also required for normal cold well start-up activities already described in the VI Hub Commonwealth EP.
Treated seawater displacement (from Halyard-2 tie in spool)	Treated seawater (approximately 0.7m^3) is displaced to East Spar slug catcher on VI using Halyard-2 production gas as a one-off activity.	No emissions relevant to the VI Hub Commonwealth Operations EP. Discharges to VI are managed via the VI State EP.
Ongoing operation of the Halyard-2 well	The Halyard-2 well is expected to operate for a short duration and cease production in 2026.	Emissions and discharges relating to the ongoing operation of the well are limited to subsea valve operation, as described above, and noise emissions generated by the operation of the subsea well and greenhouse gas emissions from the producing well.
Vessel based Inspection, Maintenance, Monitoring and Repair activities	Vessel based IMMR activities may be required to support the ongoing operation of the Halyard-2 well. These activities are unchanged from those already described in Section 2.7 of the VI Hub Operations EP. In summary they include: + General inspections + Integrity and corrosion control + Equipment and infrastructure installation, cleaning, repair and modification + Marine growth removal + Well intervention + Life extension works	Emissions and discharges associated with vessel based IMMR are unchanged from those described in the VI Hub Operations EP and are summarised in Table 2 and 3 below.

Table 2: Halyard-2 Well Commissioning, Start-up and Operation Environmental Impacts and Control Measures

Impact	Event	Impact Description	Control measures required to manage impact of activity	Does this increase impacts in the in-force VI Hub Operations EP?
Acoustic disturbance to marine fauna	During commissioning, start-up and routine operation, noise generation from pressurisation of Greater East Spar system & priming of the subsea infrastructure during commissioning of the Halyard-2 well and during ongoing operations. During vessel based IMMR, noise is generated from vessels and subsea inspection equipment such as remotely operated vehicles, geophysical equipment, marine growth cleaning, pigging, modification and replacement of components.	Commissioning and production equipment noise will be inaudible within 1 km of the platform. A support vessel using main engines and bow thrusters to maintain position will become inaudible above background noise within an approximately 20-km radius. Geophysical equipment noise is estimated to be within a 1.5-km radius. Elevated underwater noise has the potential to change marine fauna behaviour such as attraction, avoidance and disorientation. The Sensitivity of fauna to elevated noise levels varies depending on individual	Santos procedures for interacting with marine fauna.	No Refer to EP Section 6.1 for further information.

		response.		
Light emissions	During commissioning, start-up and routine operation, there are no light emissions from commissioning, start-up or operation of the subsea Halyard-2. During vessel based IMMR, lighting will be required for operational, safety and navigational purposes during planned but not routine night operations. Lighting may include spot lighting on an as-needed basis.	None for commissioning, start-up and operations. Limited light 'spill' or 'glow' onto waters from support vessels.	Lighting will be used only as required for safe work conditions and navigational purposes.	No Refer to EP Section 6.2 for further information.
Greenhouse gas emissions	During commissioning, start-up and routine operation of the Halyard-2 well, no emissions will be generated within Commonwealth waters. Greenhouse gases will be generated through the consumption of gases by the customer. These are Scope 3 emissions. As Halyard-2 well is a direct replacement of the Halyard-1 well, targeting the same reservoir. There is no increase in greenhouse gases associated with the replacement. During vessel based IMMR, emissions are generated by vessels and equipment used for IMMR activities.	GHG emissions attributable to Halyard-2 are of a relatively small volume and the associated potential incremental environmental impacts from the well would be negligible.	+ National Greenhouse and Energy Reporting Scheme and National Pollutant Inventory (NPI) reporting – estimation of greenhouse gas, energy and criteria pollutants. + Comply with the requirements of the Safeguard Mechanism, including purchase and/or surrender of Australian carbon credit units for any emissions above the baseline for the year, as determined by the Clean Energy Regulator. + Vessels comply with Marine Order 97 (Marine Pollution – Air Pollution).	No Refer to EP Section 6.3 for further information.
Atmospheric emissions	During commissioning, start-up and routine operation all activities are undertaken at VI and there are no infield vessels. There are no atmospheric emissions in Commonwealth waters. During vessel based IMMR, emissions are generated by support vessels and subsea inspection equipment such as remotely operated vehicles.	Emissions such as sulphur oxides and nitrogen oxides area discharged to the atmosphere through: + Support vessel engines + Incinerators to manage waste + Ozone-depleting substances in closed-system rechargeable refrigeration systems.	+ Vessels comply with Marine Order 97 (Marine Pollution – Air Pollution). + Vessels planned maintenance system. + International Air Pollution Prevention Certificate. + Ozone-depleting substance handling procedures. + Waste incineration management.	No
Seabed disturbance	During commissioning, start-up and operations there are no seabed disturbances. Seabed impacts from drilling and installation of the well are described in the accepted Halyard-2 Drilling and Completions EP. During vessel based IMMR, potential seabed disturbance (temporary) may occur in the operational area due to: + vessel anchoring (non-routine) + cleaning of subsea infrastructure + subsea IMMR activities (e.g., diving; cutting; welding; installation, replacement or modification of subsea equipment, wet parking of equipment)	IMMR impacts would be minor seabed disturbance, sedimentation or water quality impacts (i.e., increased turbidity).	+ Vessels planned maintenance system. + Prevention of dropped object procedure and dropped object recovery. + Anchoring and equipment deployment management to minimise impacts.	No Refer to EP Section 6.5 for further information.
Physical presence and interaction with other marine users	During commissioning, start-up and operation the Halyard-2 well is managed at Varanus Island and therefore will not result in interactions with other marine users. During vessel based IMMR, vessels may operate 24 hours a day.	Vessel interaction with other marine users will be temporary and intermittent when in the operational area for IMMR activities.	+ Navigation lighting and aids. + Seafarer Certification. + Constant bridge watch on support vessels. + Notify AHO and AMSA's JRCC prior to commencement of vessel based IMMR at all subsea wells with no PSZ.	No Refer to EP Section 6.6 for further information.
Operational discharges	During commissioning, start-up and operations, hydraulic oil will be discharged during subsea valve actuation. During commissioning and start-up this release will be no more than 25 L.	Given the nature of the discharge, the small volumes released, high levels of dilution and the nature of the marine environment in the vicinity of the operational area, impacts to the marine environment are expected to be negligible.	+ Santos chemical selection procedure. + Deck cleaning and product selection. + Garbage management. + Vessel oily mixture system. + Sewage system	No Refer to EP Section 6.7 for further information.

	During routine operations valves will remain open. Santos plans annual testing of shut down systems where the valves will be closed resulting in a release of no more than 25L. During vessel based IMMR, planned discharges from support vessels within the operational area may include deck drainage, sewage and grey water, food wastes, cooling water, bilge water, ballast water and brine.			

Table 3: Halyard-2 Well Commissioning, Start-up and Operations Environmental Risks (i.e. unplanned activities) and Control Measures

Risk	Event	Risk Description	Control measures required to manage impact of activity	Does this increase risks in-force VI Hub Operations EP?
Introduction of Invasive Marine Species	NA for commissioning, start-up and operations. During vessel based IMMR, introduction of invasive marine species may occur due to: + biofouling on support vessels and external/internal (e.g., sea chests, seawater systems) niches.	The impact would be localised (i.e. to seabed within the operational area) to widespread if successfully translocated to new areas via ocean currents or project equipment transit.	+ Santos Invasive Marine Species Management Plan + Current anti-foulant system. + Ballast water management.	No Refer to EP Section 7.1 for further information
Marine Fauna Interaction	NA for commissioning, start-up and operations. During vessel based IMMR, there is the potential for vessels or equipment from the vessels to interact with marine fauna.	Interaction may include potential strike or collision, potentially resulting in severe injury or mortality.	+ Protected Marine Fauna Interaction and Sighting Procedure. + Constant bridge watch on support vessels.	No Refer to EP Section 7.2 for further information
Release of Solid Objects	NA for commissioning, start-up and operations. During vessel based IMMR, solid objects can be accidentally released to the marine environment, such as: + non-hazardous solid wastes, such as paper and packaging + hazardous solid wastes, such as batteries, fluorescent tubes and aerosol cans + equipment and materials, such as hard hats, tools, or infrastructure parts.	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.	+ Dropped object prevention and recovery procedures.	No Refer to EP Section 7.3 for further information
Hazardous Liquid Release	During commissioning, start-up and operations, hydraulic fluid from the Halyard electro-hydraulic umbilical could be released from damage to or loss of integrity of the electro-hydraulic umbilical. During vessel based IMMR, the worst-case credible scenarios for spill of hazardous liquid materials (not including diesel or condensate) to the marine environment, in terms of volume of liquids released, are considered to be those resulting from transfer of chemicals or hydraulic oils between a support vessel. The maximum volume of hazardous liquids that could be released is likely to be small (less than 4 m^3) and limited to the volume of individual containers (e.g., drums) stored on support vessels.	The releases are likely to have negligible ecological effects given the volumes that could be released and open ocean environment.	+ Planned subsea and offshore maintenance. + Dropped object prevention procedure. + Hazardous chemical management procedures. General chemical management procedures. + Vessel spill response plan (SOPEP/SMPEP). + Remotely operated vehicle (ROV) inspection and maintenance procedures.	No Refer to EP Section 7.4 for further information
Unplanned Hydrocarbon Release	During well commissioning, start up and operations, the worst-case credible scenario is a subsea release of condensate at the wellhead.	In the unlikely event that a release of condensate did occur within the operational area, the potential impacts to the environment would be greatest within several kilometres of the spill location, when the toxic aromatic components of the fuel will be at their highest concentration and when the hydrocarbon is at its thickest on the surface of the receiving waters. Upon release to the marine environment, the condensate will rapidly lose toxicity with time and will spread thinner at the surface as evaporation continues or will become entrained within the water column. The potential sensitive receptors in	+ NOPSEMA accepted WOMP in place. + Well services procedures and criteria. + Planned subsea and offshore maintenance. + Testing and maintenance of emergency shutdown systems and shutdown/ safety valves. + Incident Response Plan detailing the requirements for preparedness and response to emergencies and crises to protect people and the environment. + Dropped object prevention procedure. + Oil pollution emergency plan (OPEP).	No

		the surrounding areas of the spill will include fish, marine mammals, marine reptiles and seabirds at the sea surface.	+ Navigational charting of infrastructure. + Operational monitoring of low flow well leak. + Santos' decommissioning framework.	
	During vessel based IMMR, the worst-case credible scenario is a release of diesel to the marine environment from a support vessel collision with another vessel within the operational area. The maximum credible spill volume is 329m^3.	The release is unlikely to have widespread ecological effects given the nature of the hydrocarbons on board, the finite volumes that could be released, the water depth and the transient nature of marine fauna in this area.	+ Seafarer Certification. + Navigational lighting and aids. + Support vessel positioning. + Dropped object prevention. + Vessel spill response plan. + Refuelling and Chemical Transfer Procedure.	No. Refer to EP Section 7.9 for further information.

Regards

Santos Consultation Team

SEEKING RELEVANT PERSONS

Santos

CARNARVON BASIN DECOMMISSIONING ENVIRONMENT PLANS

Santos is seeking to identify and consult with relevant persons whose functions, interests or activities may be affected by our proposed decommissioning activities off Western Australia's north west coast.

Santos is planning several offshore decommissioning activities offshore Western Australia:

+ **Harriet Joint Venture (HJV):** Decommissioning of the HJV field, comprising removal of all platforms and substructures, as well as pipelines associated with the Simpson facility. The HJV field is approximately 102 km west of Dampier and 105 km north east of Onslow. Activity commencement planned is from Q1 2024.
+ **Mutineer Exeter Fletcher Finucane (MEFF):** Decommissioning of the MEFF field, comprising partial removal of subsea infrastructure. The MEFF field is approximately 147 km north of Dampier. Activity commencement is anticipated from Q4 2024.
+ **Campbell:** Removal of the platform and substructures of the Campbell facility, which is approximately 105 km west of Dampier. Activity commencement is planned from Q1 2024.
+ **WA-20-L:** Leave in-situ one plugged and abandoned wellhead, approximately 101 km north of Dampier. The WA-20-L petroleum permit is subject to an ongoing environmental monitoring for the duration of the EP to monitor for gas release.
+ **WA-1-P:** Leave in situ three plugged and abandoned wellheads. The nearest well is approximately 85 km north-northwest of Dampier. Activity is ongoing following environment plan acceptance.

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 each of 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 consolidated EMBA for all proposed activities. 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.

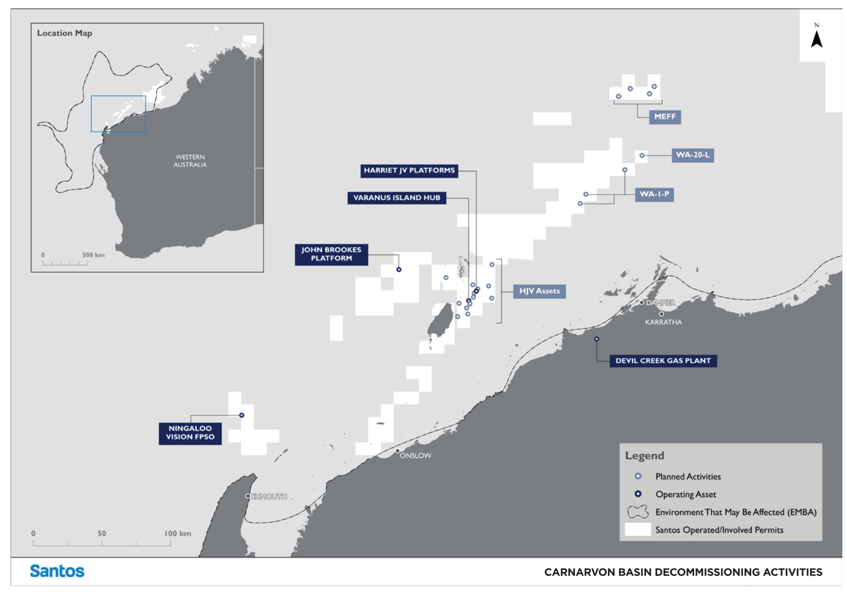
Santos is proposing to implement measures to reduce the impacts and risks of the activities. It is a requirement under relevant environmental legislation that these impacts and risks are reduced to as low as reasonably practicable and to an acceptable level.

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 activities (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 any of these activities, 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 these activities, ahead of submitting environment plans for each of our Carnarvon Basin activities activity to Commonwealth and State Regulators for assessment, depending on the location of activities. These Regulators are the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) and the WA Department of Mines, Industry Regulation and Safety (DMIRS). Regulator acceptance of these environment plans is required before any petroleum activity can begin.

We have prepared consultation information sheets for each activity, 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 **26 June 2023** 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 plans for each activity.

Visit **www.santos.com/offshoreconsultation**, email **offshore.consultation@santos.com** or call **1800 267 600** for more information, to self-identify as relevant person or to provide feedback.

Santos

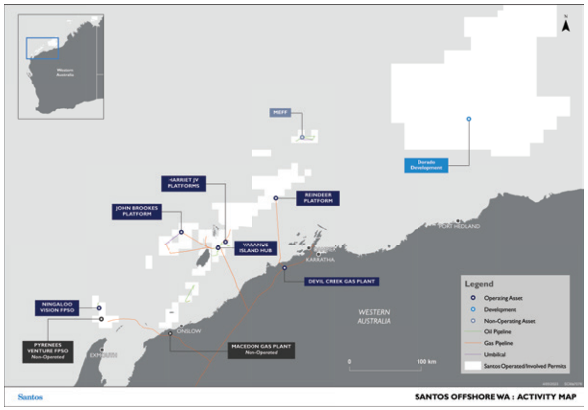
CARNARVON BASIN ENVIRONMENT PLAN CONSULTATION

Santos is now consulting with relevant persons for Drilling, Plug and Abandonment and Decommissioning Environment Plans. Relevant persons are those whose functions, interests or activities may be affected by our proposed activities in the Carnarvon Basin off Western Australia's north west coast.

Proposed activities include:

+ **Spar-Halyard:** Drilling of a development well (infill) to support ongoing production at the Varanus Island (VI) Hub. The well is approximately 114 km north of Onslow. Activity commencement is planned from Q2 2024.
+ **Simpson:** Plug and abandonment activities of eight wells no longer required for production via the offshore Simpson facility. The wells are approximately 102 km west of Dampier. Activity commencement is planned from Q1 2024.
+ **Gibson:** Plug and abandonment activities of four wells no longer required for production via the offshore Gibson facility. The wells are approximately 113 km north east of Onslow. Activity is planned for Q1 2024.
+ **Mutineer Exeter Fletcher Finucane (MEFF):** Plug and abandonment activities for 12 wells no longer required for production. The MEFF wells are approximately 147 km north of Dampier. Activity is planned for first half of 2024.
+ **Harriet Joint Venture (HJV):** Decommissioning of the HJV field, comprising removal of all platforms and substructures, as well as pipelines associated with the Simpson facility. The HJV field is approximately 102 km west of Dampier and 105 km north east of Onslow. Activity commencement is planned from Q1 2024.
+ **MEFF:** Decommissioning of the MEFF field, comprising partial removal of subsea infrastructure. The MEFF field is approximately 147 km north of Dampier. Activity commencement is anticipated from Q4 2024.
+ **Campbell:** Removal of the platform and substructures of the Campbell facility, which is approximately 105 km west of Dampier. Activity commencement is planned from Q1 2024.
+ **WA-20-L:** Leave in-situ one plugged and abandoned wellhead, approximately 101 km north of Dampier. The WA-20-L petroleum permit is subject to an ongoing environmental monitoring for the duration of the environment plan to monitor for gas release.
+ **WA-1-P:** Leave in-situ three legacy plugged and abandoned wellheads. The nearest well is approximately 85 km north-north west of Dampier. Inspection activities will commence following environment plan acceptance.

The map below depicts activity locations for all proposed activities.



We welcome your feedback

We will use feedback from relevant persons to help us manage impacts and risks associated with these activities, ahead of submitting environment plans for each of our Carnarvon Basin activities activity to Commonwealth and State Regulators for assessment, depending on the location of activities.

For more information

More information, including information sheets for each activity, is available at **santos.com/offshoreconsultation**. These information sheets provide details on each proposed activity, the environment that may be affected, potential environmental impacts and risks, and proposed control measures to seek to reduce any impacts and risks to as low as reasonably practicable and an acceptable level.

If you consider you may be a relevant person, please contact us as soon as possible if you require any further information or if you think you are not on our consultation list.

We are asking for relevant persons to provide feedback by 26 July 2023.

CONTACT US

Visit:
santos.com/offshoreconsultation

Phone:
1800 267 600

Email:
offshore.consultation@santos.com

or scan the QR code

Santos

EXMOUTH COMMUNITY LIAISON GROUP

27 July 2023

Presented by **Name Surname**

Santos

Exmouth Community Liaison Group

Disclaimer and important notice

Forward looking statements

This presentation contains forward looking statements that are subject to risk factors associated with the oil and gas industry. It is believed that the expectations reflected in these statements are reasonable but they may be affected by a range of variables which could cause actual results or trends to differ materially, including but not limited to: price fluctuations, actual demand, currency fluctuations, geotechnical factors, drilling and production results, gas commercialisation, development progress, operating results, engineering estimates, reserve estimates, loss of market, industry competition, environmental risks, physical risks, legislative, fiscal and regulatory developments, economic and financial markets conditions in various countries, approvals and cost estimates.

This presentation should not be relied upon as a recommendation or forecast by Santos and no representation or warranty is made as to the accuracy, completeness or reliability of such forward looking statements.

Third party information

Some of the information contained in this presentation is derived from publicly available sources and has not been independently verified. No representation or warranty is made as the accuracy, completeness or reliability of such information.

No offer of securities

Nothing in this presentation should be construed as either an offer to sell or buy, or a solicitation of an offer to buy or sell, Santos securities in any jurisdiction.

References to "Santos"

A reference to "Santos" in this presentation may be a reference to a subsidiary of Santos Limited.

Welcome and Introductions

- Steve Lyon, Production Manager Ningaloo Vision
- Mitchell (Mitch) Sherston, Operations Superintendent - Ningaloo Vision
- Aileen Stewart, Senior Stakeholder Adviser
- Anthony (Tony) Johnson, Stakeholder Consultant
- Luciana Ferreira, Research Scientist, Australian Institute of Marine Science (via Teams)

The Ningaloo Vision Operation

is a joint venture with INPEX, operated by Santos

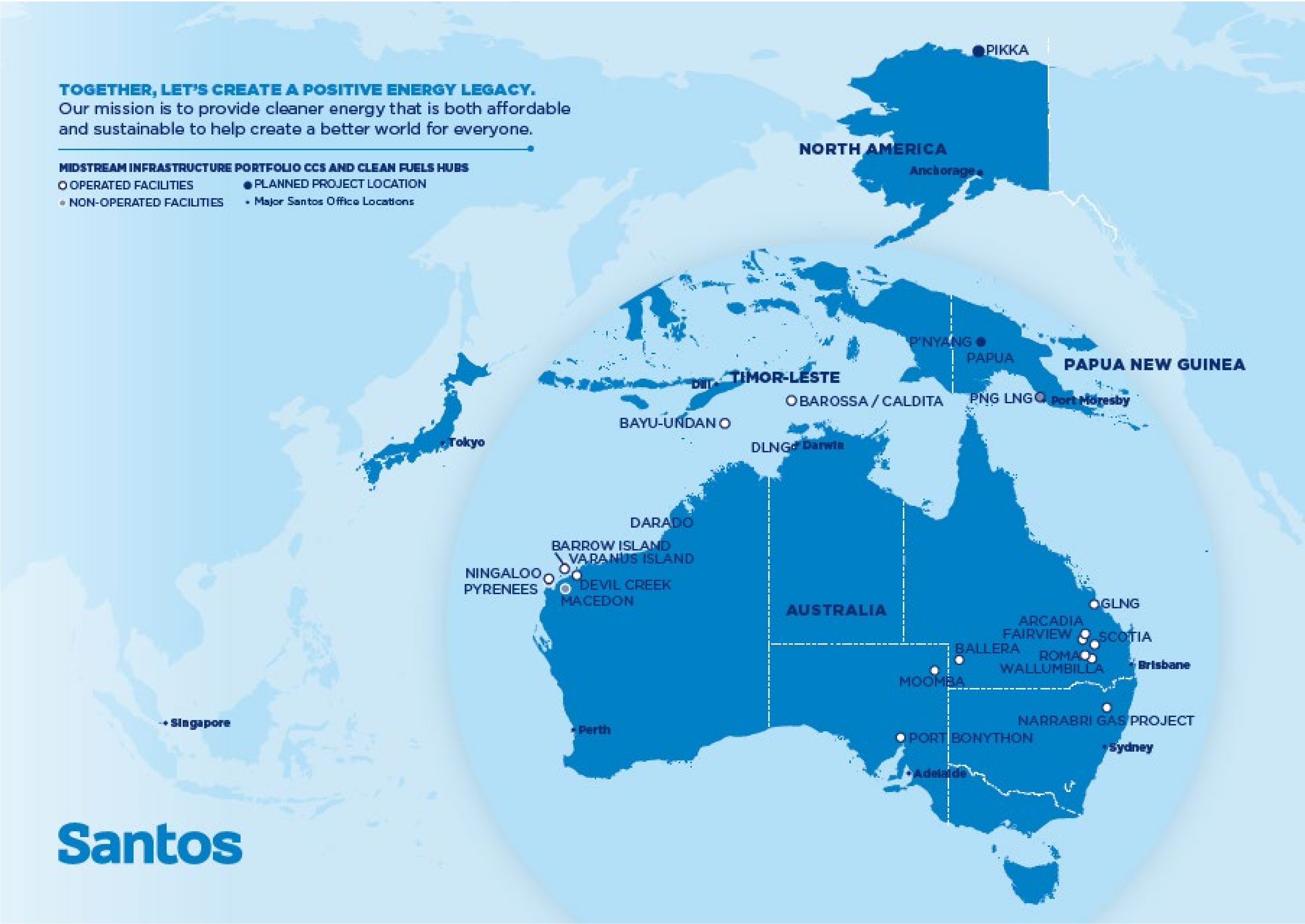
(Santos 52.5% / INPEX 47.5%)

Santos

INPEX

Santos

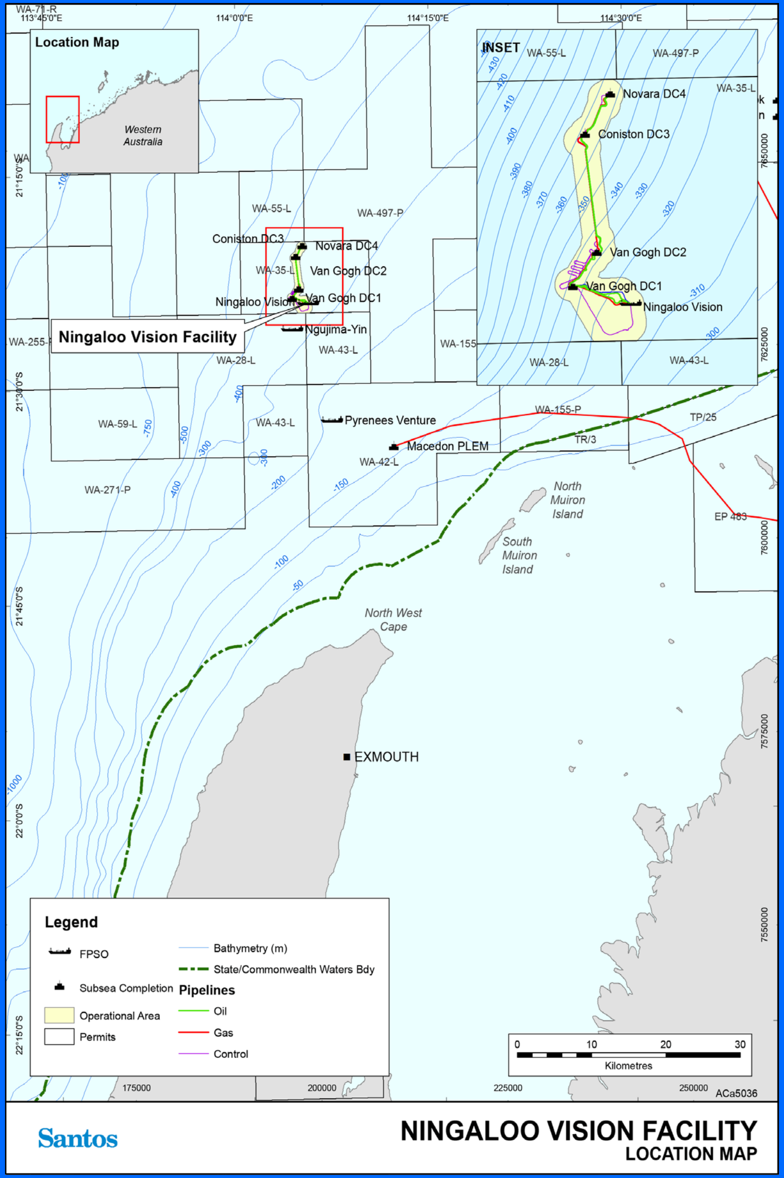
BUSINESS OVERVIEW

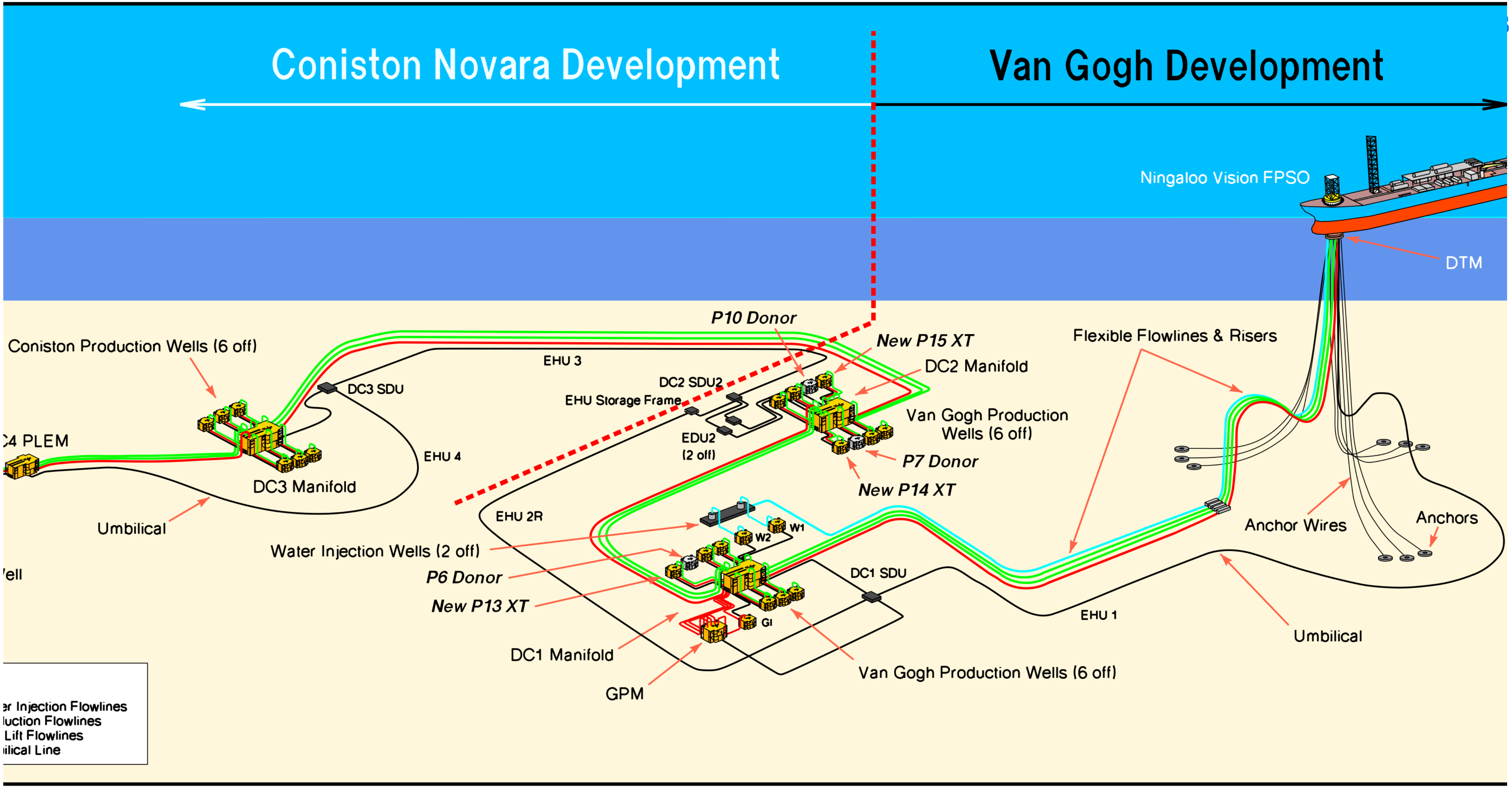

TOGETHER, LET'S CREATE A POSITIVE ENERGY LEGACY.
Our mission is to provide cleaner energy that is both affordable and sustainable to help create a better world for everyone.
MIDSTREAM INFRASTRUCTURE PORTFOLIO CCS AND CLEAN FUELS HUBS
OPERATED FACILITIES
PLANNED PROJECT LOCATION
NON-OPERATED FACILITIES
Major Santos Office Locations
PIKKA
NORTH AMERICA
Anchorage
Tokyo
P'NYANG
PAPUA
PAPUA NEW GUINEA
Dili
TIMOR-LESTE
BAROSSA / CALDITA
PNG LNG
Port Moresby
BAYU-UNDAN
DLNG
Darwin
DARADO
BARROW ISLAND
VARANUS ISLAND
NINGALOO
PYRENEES
DEVIL CREEK
MACEDON
AUSTRALIA
GLNG
ARCADIA
FAIRVIEW
SCOTIA
BALLERA
ROMA
WALLUMBILLA
Brisbane
MOOMBA
NARRABRI GAS PROJECT
PORT BONYTHON
Sydney
Adelaide
Perth
Singapore

NINGALOO VISION OPERATIONS UPDATE

Ningaloo Vision Operations

- Business as usual on the Ningaloo Vision FPSO.
- Facility shutdown being planned for October – 2x weeks; aligned with a subsea campaign using a FSV
- From 1st July, facility is operating under a production intensive emissions baseline -> further strengthening the team's commitment to reduce emissions





VAN GOGH, CONISTON AND NOVARA FIELD SCHEMATIC : NEW VGID2 DEVELOPMENT

STAKEHOLDER CONSULTATION UPDATE

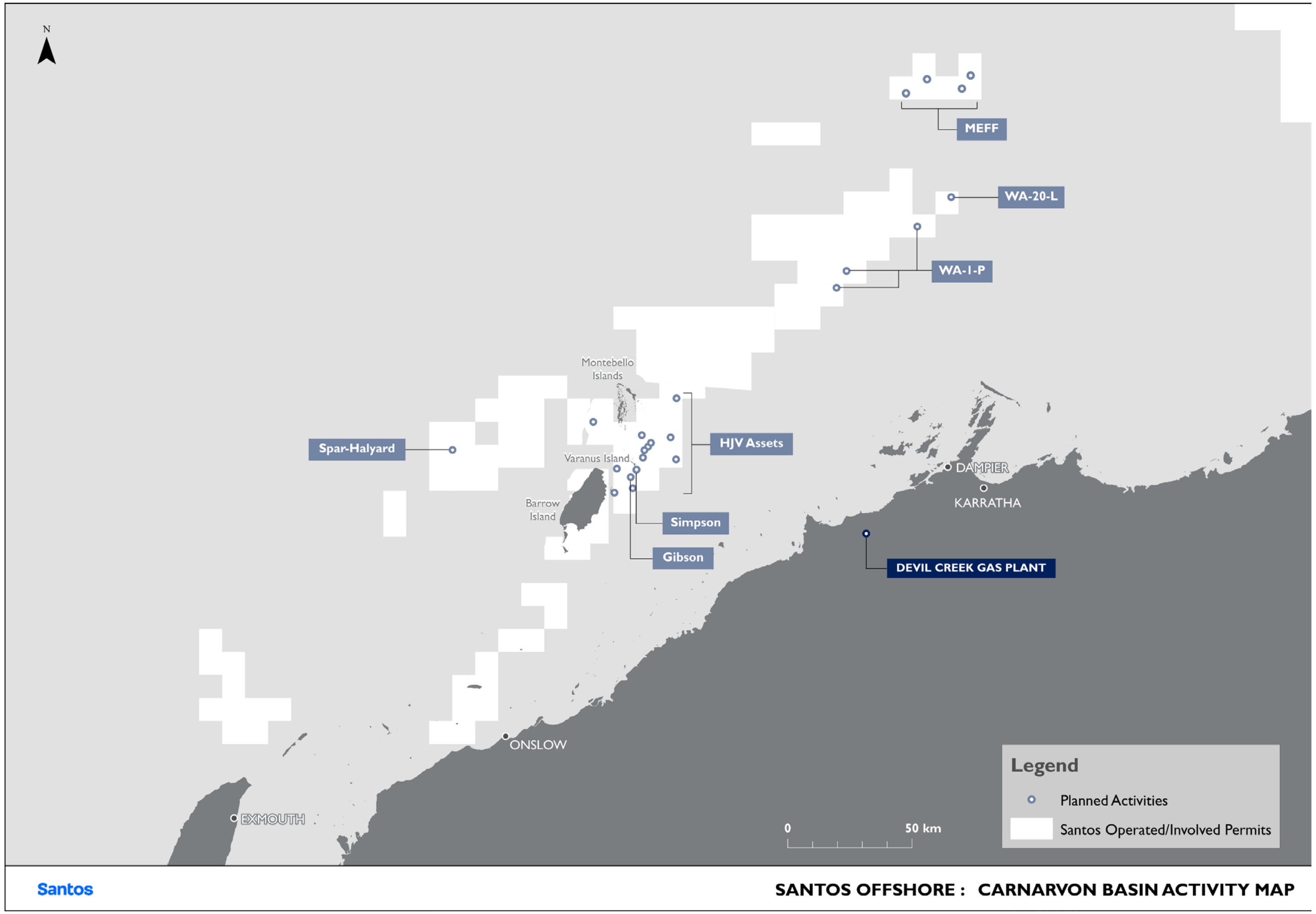
Relevant person consultation

Drilling and P&A Activities

- Spar Halyard – development well
- Mutineer Exeter Fletcher Finucane (MEFF) – P&A 12 wells
- Harriet Joint Venture (HJV) – Simpson – P&A 8 wells
- HJV – Gibson – P&A 4 wells

Decommissioning Activities

- MEFF – removal of most subsea equipment
- HJV – All platforms and Simpson pipelines
- HJV – Campbell – removal of platforms and substructures
- WA-1-P – leave in situ three wellheads
- WA-20-L – leave in situ one wellhead



COMMUNITY AND SOCIAL PERFORMANCE UPDATE

Santos' community investment framework

Our objective is to leave a positive legacy in the communities in which we operate:

We seek to:

- Create a positive legacy and build capacity in the communities where we operate
- Support sustainable communities through investing in local jobs and supporting local businesses
- Create opportunities for local and Indigenous suppliers to increase their capability and capacity to supply

Santos community investment framework

Santos corporate Social Responsibility Pillars.

Santos Community Investment Framework

Guiding principles for community investments

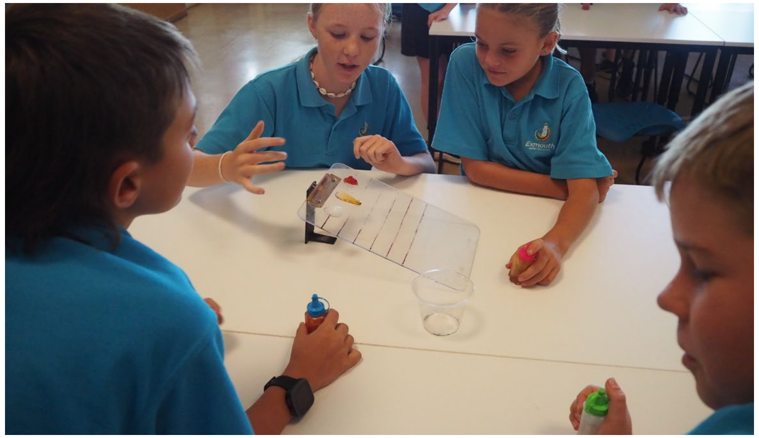
Every community investment will be assessed on the following guiding principles which determine whether there is a strategic fit with the Santos business and brand:

- They must fall within the regional areas where Santos operates
- They must achieve capacity building for communities & meet a community need
- They must be aligned with Santos' Corporate Social Responsibility pillars
- Where possible, they should also provide engagement opportunities for a broader group of stakeholders

Visit our website for more information

www.santos.com/sustainability/community/sponsorships/

Santos community investments – 2023



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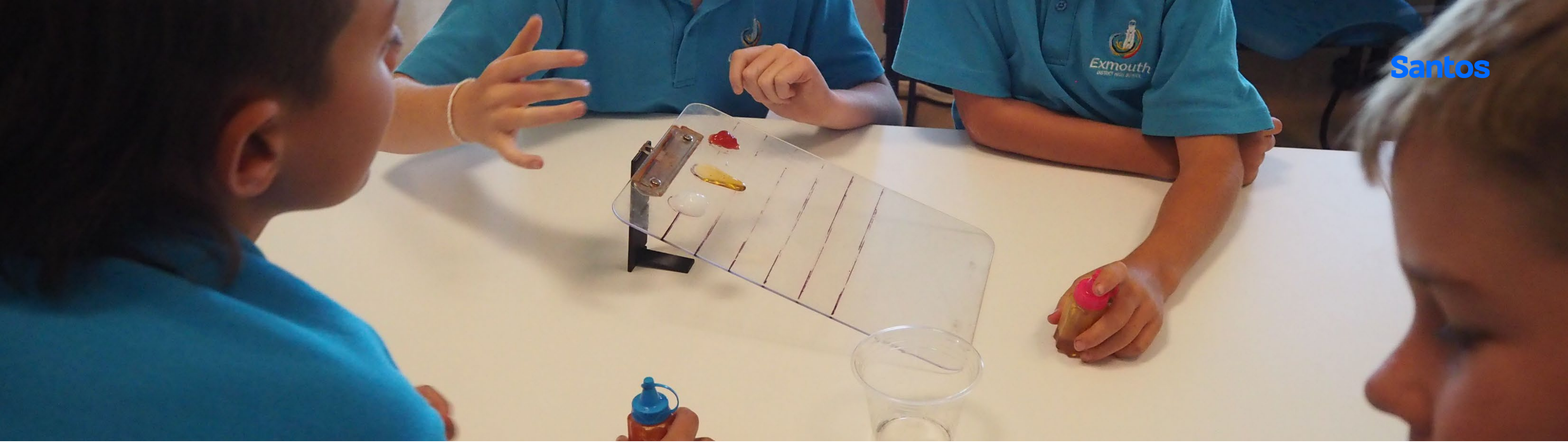
Sponsorships and grants – Exmouth 2023

Organisation	Initiative/Program	Benefit
Community		
Exmouth Shire	Recreation precinct upgrade works	Improved local amenity & family precinct
Exmouth District High School	STEM Technology	Purchase 30 additional iPads to support STEM program
Exmouth District High School	NAIDOC week activities	Support celebration and understanding of aboriginal culture
Exmouth Shire	Community and Sports awards	Recognise importance of volunteers & local participation
Exmouth Netball Club	Club development	Support local community and encourage healthy living
Exmouth Amateur Swimming Club	Club development	Support local community and encourage healthy living
Exmouth Junior Sports Club	Club development	Support local community and encourage healthy living
Santos/INPEX as JV Participants		
Australian Institute of Marine Science	Whale Shark Research	Improve knowledge of whale sharks to support management initiatives
Exmouth CCI	Skills based training program	Build local capacity and workforce
Exmouth Game Fishing Club	GAMEX & Family Fun Day	Support Exmouth's largest community event
Exmouth Shire	Water refill stations	Reduce single use plastics
Exmouth District High School	STEM Technology	See above
Exmouth District High School	Aquatic Program	Improve water safety and encourage healthy living
Exmouth Wildlife Carers	Support for care and veterinary costs	Support local volunteers



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Western Australian Community Partnerships

Santos' broader community partnerships help support the Exmouth Community:

+ Ronald McDonald House Charities - Family Resources Centre, Perth Children's Hospital
+ Lifeline WA - Volunteer Crisis Supporters & regional training programs
+ Energy Club of WA - Next Generation Schools Program
+ AusEarth Ed – Australian Primary Literacy Mathematics and Science Program

.

AIMS WHALE SHARK RESEARCH REPORT

Santos

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PRELIMINARY CONSULTATION – CARNARVON BASIN

Meeting with [redacted]

June 2023

Agenda

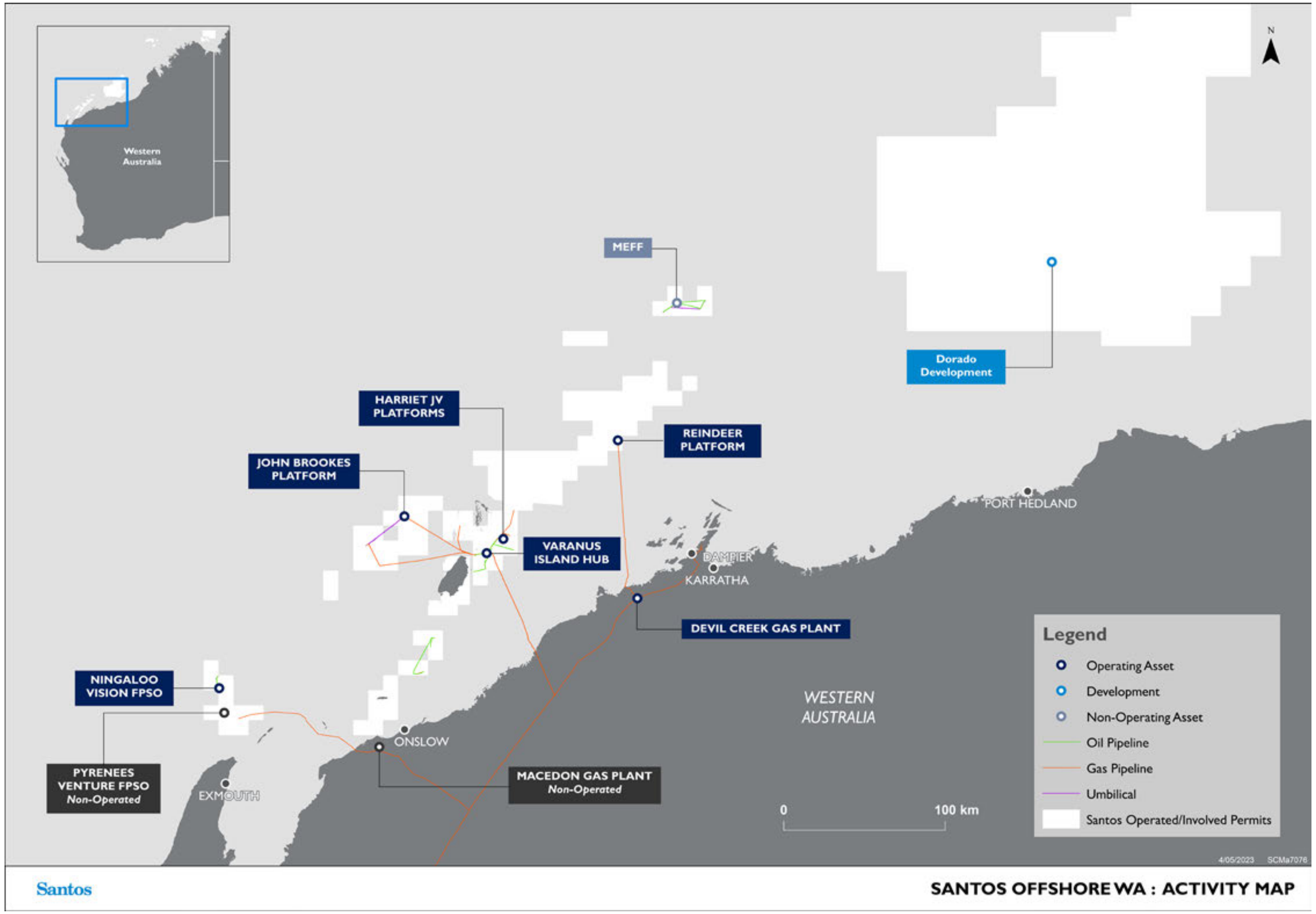
- Meeting purpose
- Introductions
- About [redacted]
- About Santos
- Our consultation approach
- Proposed activities
- Consultation opportunities
- Questions and next steps

Santos

SECTION 1
ABOUT SANTOS

About Santos

- Biggest producer of domestic gas in WA
- First offshore discovery, in the Carnarvon Basin, in the early 1980s
- WA products – gas, oil and condensate
- Interests in three of WA's major dedicated domestic gas plants
- Our business focus:
  - Safe, reliable operations
  - Minimise our social and environmental impacts
  - Near-field exploration opportunities
  - Progressive decommissioning of assets no longer required



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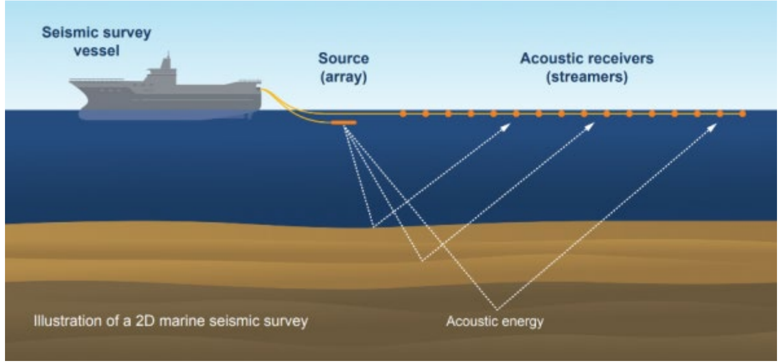
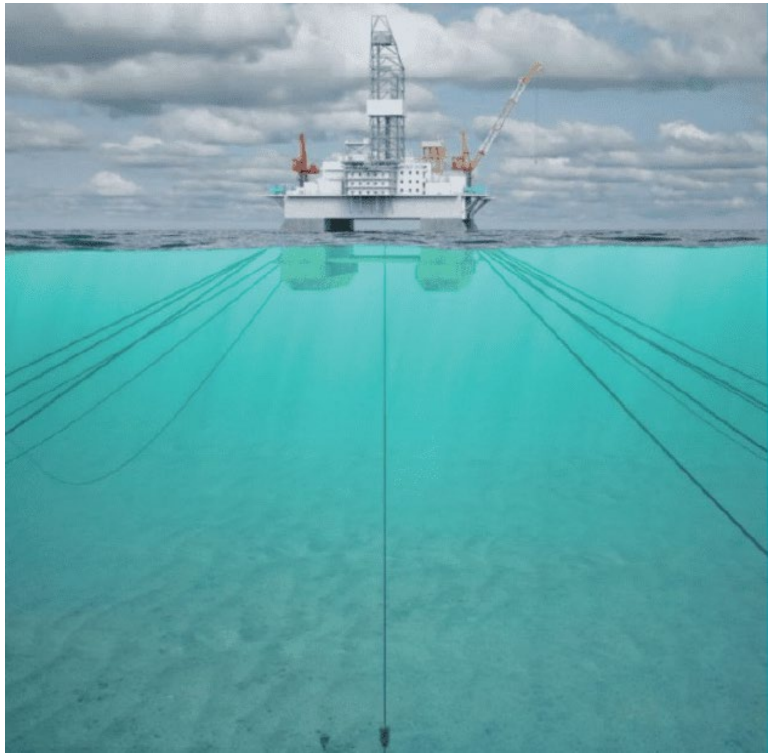
About Oil and Gas Activities

Exploration → Appraisal → Development / Construction → Operations → Decommissioning



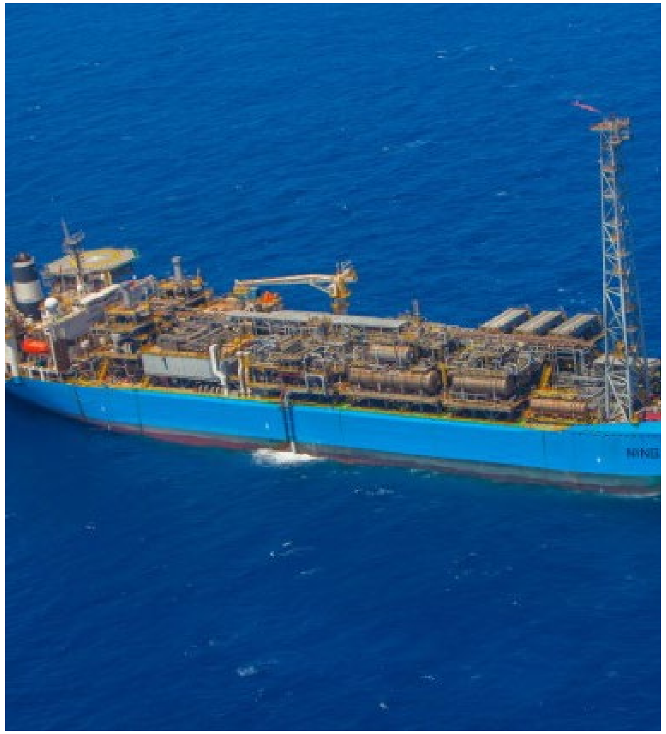


About Santos

Our WA operations

Devil Creek Gas Plant

Varanus Island Gas Plant

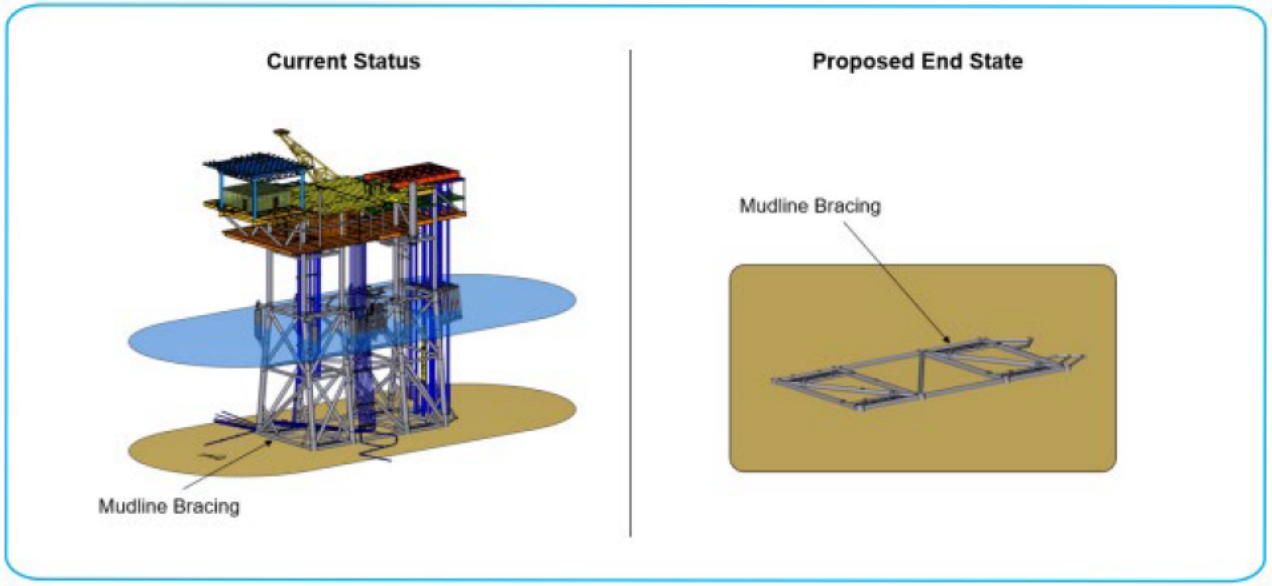


Ningaloo Vision FPSO

About Oil and Gas Activities

Legendre-1 wellhead

Campbell Platform



Harriet Bravo Platform

SECTION 2
OUR CONSULTATION APPROACH

Consultation – Regulatory Requirements

- **Commonwealth waters** – National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA)
- **WA State waters** – Department of Mines, Industry Regulation and Safety (DMIRS)

"In the course of preparing an Environment Plan, a titleholder must consult with relevant persons in accordance with Division 2.2A, Regulation 11A…

"The purpose of consultation under regulation 11A of the Environment Regulations is to ensure that authorities, persons or organisations that are potentially affected by activities are consulted and their input considered in the development of environment plans."

Guideline - Consultation in the course of preparing an environment plan, NOPSEMA

NOPSEMA

"The implementation strategy must provide for appropriate consultation with relevant authorities and other relevant interested persons or organisations…

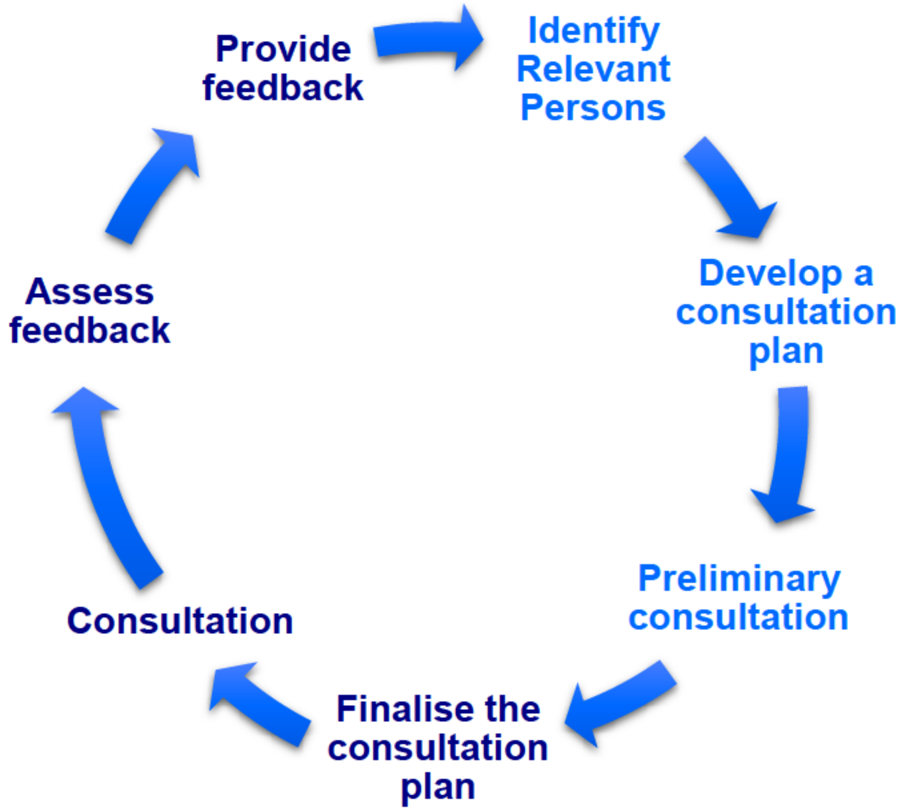
"The identification of potential stakeholders must take into consideration the activity type, location, environmental impacts and risks (planned activities and unplanned events) and relevant stakeholder interests or concerns."

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

Government of **Western Australia**
Department of **Mines, Industry Regulation and Safety**

Consultation – Santos Requirements

- Santos Management System
- Santos EP Consultation Methodology
  - Applied to Commonwealth and State jurisdictions
- Objective for all proposed activities is to **reduce environmental impacts and risks to a level that is ALARP and acceptable** over the life of the activity.
- Consultation feedback helps us to **refine or change proposed management measures** to address potential activity impacts and risks.
- Consultation also helps us to identify and understand environmental, social, economic and cultural features, values and sensitivities not available from publicly available sources.



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Identifying Relevant Persons

We identify the functions, activities and interests of commercial fishers based on:

- EMBA intersect with Cwth and State Fisheries
- Review of government fishery publications (10-year history):
  - Fishery Status Reports (Cwth)
  - State of the Fisheries Reports (WA State)
- Review of other public information sources – eg studies, reports

Identification process is a starting point for conversations with potentially Relevant Persons ahead of formal consultation

Step 1	Identify and assess activity impacts and risks to define the Environment that May Be Affected (EMBA)
Step 2	Consider environmental, social, economic and cultural features that may be impacted
Step 3	Map categories of potentially Relevant Persons to environmental, social, economic and cultural features
Step 4	Research Relevant Person categories to identify authorities, persons and organisations whose functions, interests or activities may be affected

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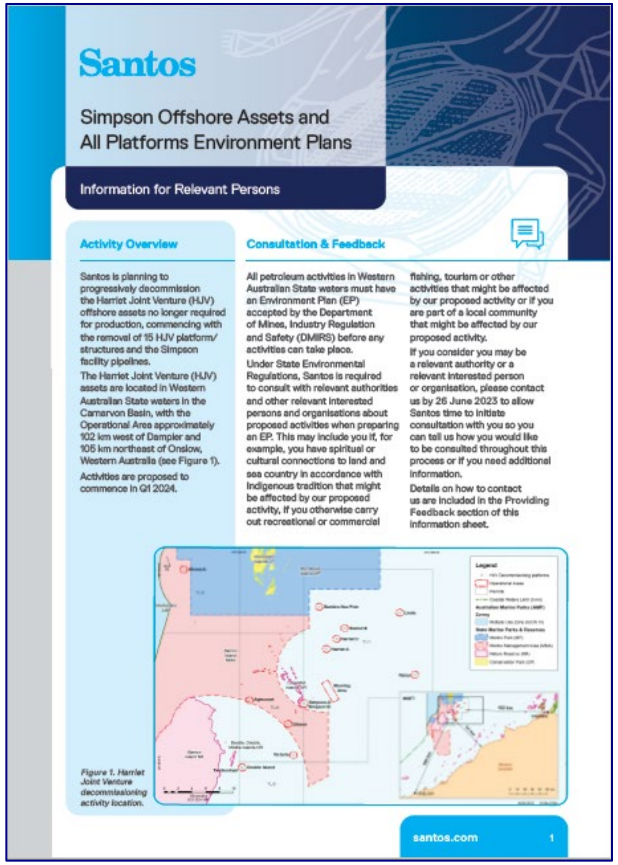
Identifying Relevant Persons

www.Santos.com/offshoreconsultation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Simpson Offshore Assets and All Platforms Environment Plans

Information for Relevant Persons

Activity Overview

Santos is planning to progressively decommission the Harriet Joint Venture (HJV) offshore assets no longer required for production, commencing with the removal of 15 HJV platform/structures and the Simpson facility pipelines.

The Harriet Joint Venture (HJV) assets are located in Western Australian State waters in the Carnarvon Basin, with the Operational Area approximately 102 km west of Dampier and 105 km northeast of Onslow, Western Australia (see Figure 1).

Activities are proposed to commence in Q1 2024.

Consultation & Feedback

All petroleum activities in Western Australian State waters must have an Environment Plan (EP) accepted by the Department of Mines, Industry Regulation and Safety (DMIRS) before any activities can take place.

Under State Environmental Regulations, Santos is required to consult with relevant authorities and other relevant interested persons and organisations about proposed activities when preparing an EP. This may include you 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 proposed activity, 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 you may be a relevant authority or a relevant interested person or organisation, please contact us by 26 June 2023 to allow Santos time to initiate consultation with you so you can tell us how you would like to be consulted throughout this process or if you need additional information.

Details on how to contact us are included in the Providing Feedback section of this information sheet.

Figure 1. Harriet Joint Venture decommissioning activity location.

santos.com 1


SEEKING RELEVANT PERSONS

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CARNARVON BASIN DRILLING AND PLUG AND ABANDONMENT 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.

The environment that may be affected (EMBA) by proposed activities

Seeking Relevant Persons for Environment Plans

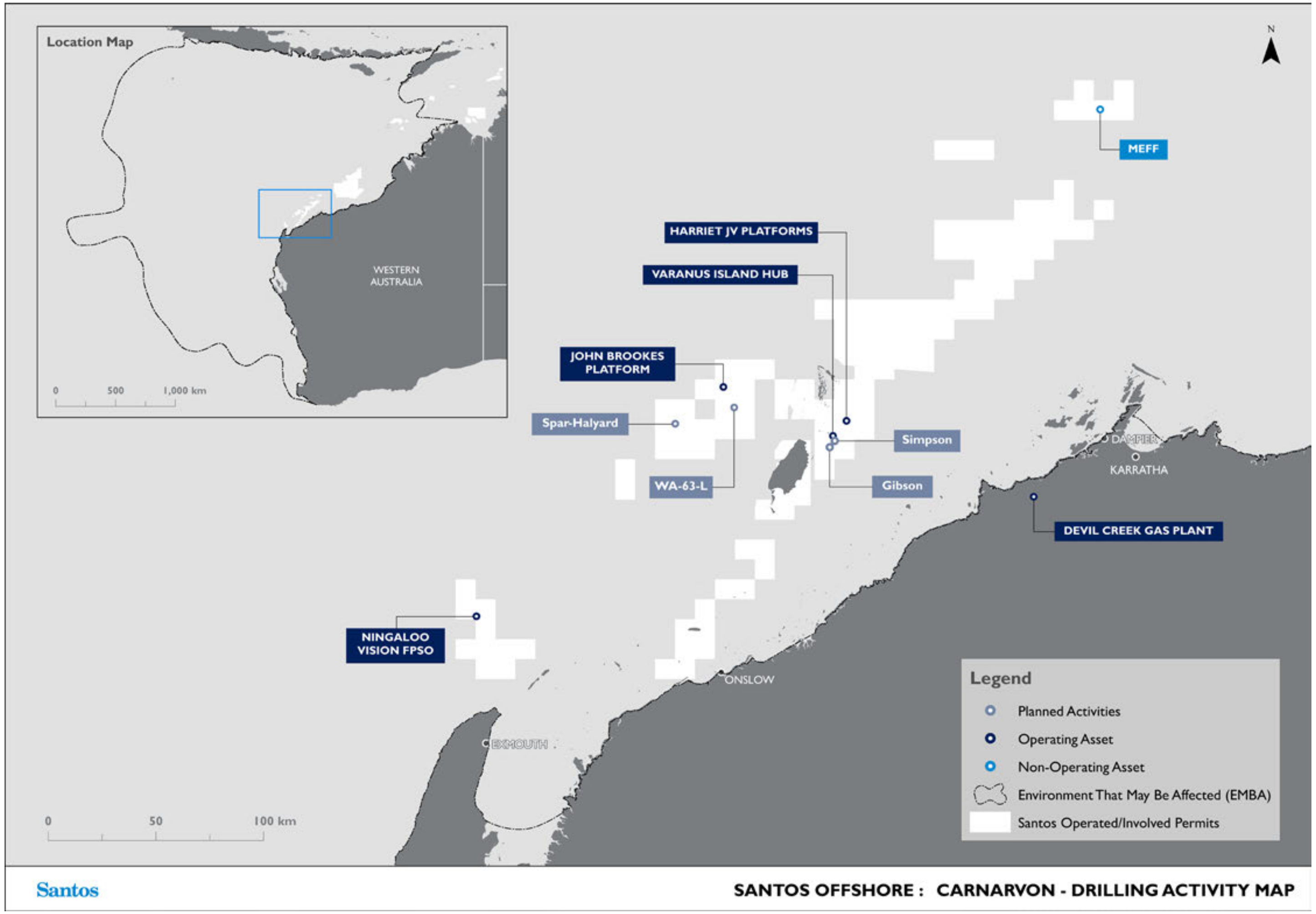
We welcome your feedback

Contact us

SECTION 3
PROPOSED ACTIVITIES

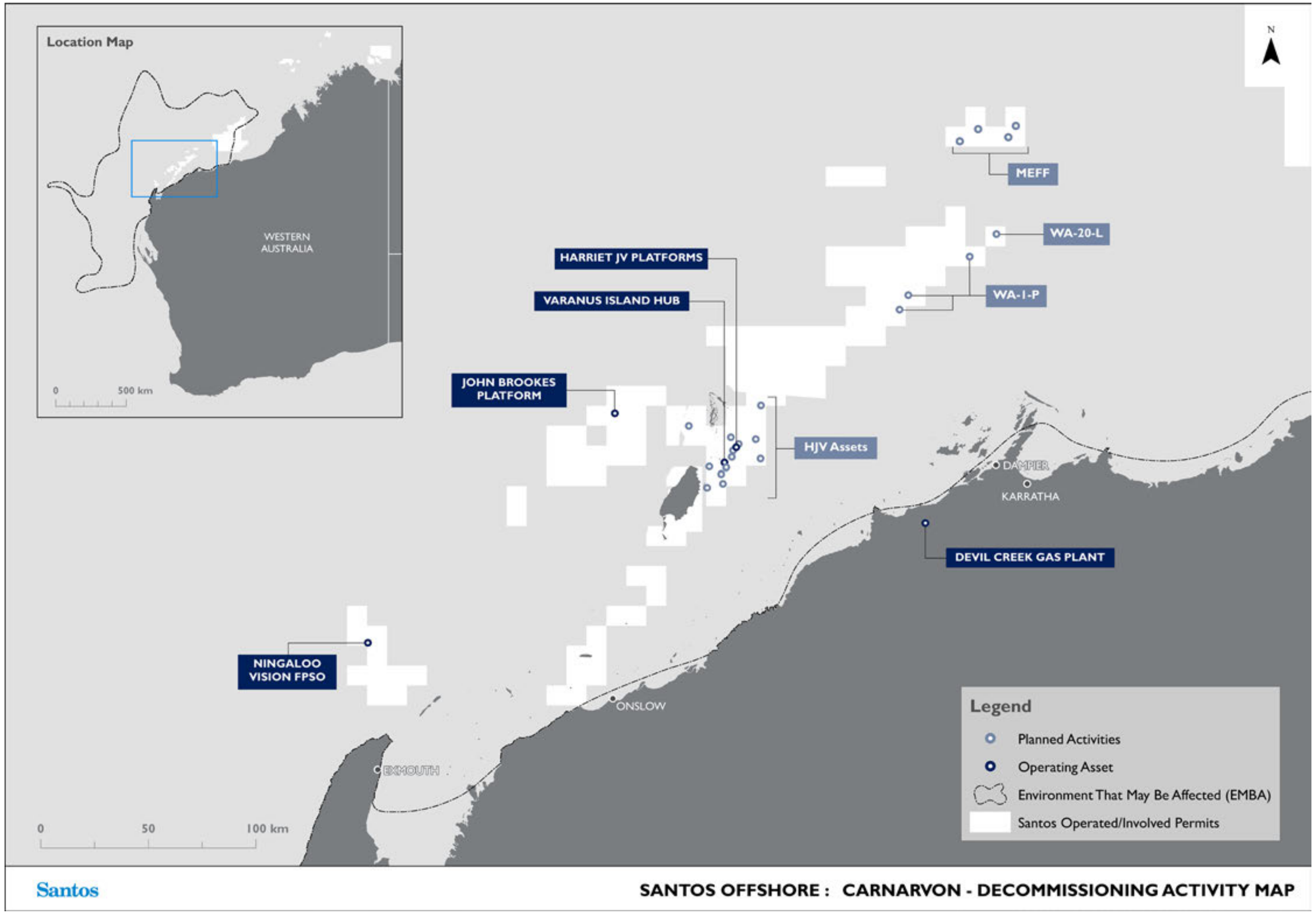
Drilling and Plug & Abandonment

- Spar Halyard – development well
- WA-63-L – up to four exploration wells
- Mutineer Exeter Fletcher Finucane (MEFF) – P&A 12 wells
- Harriet Joint Venture (HJV) – Simpson – P&A 8 wells
- HJV – Gibson – P&A 4 wells



Decommissioning

- MEFF – removal of most subsea equipment
- HJV – All platforms and Simpson pipelines
- HJV – Campbell – removal of platforms and substructures
- WA-1-P – leave in situ three wellheads
- WA-20-L – leave in situ one wellhead



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SECTION 4 CONSULTATION OPPORTUNITIES

Consultation – planned activities and unplanned events

Santos is committed to co-designing consultation approaches that meet the information needs of Relevant Persons.

- **EP consultation**
  - Identification of Relevant Persons – entitlement to fish in EMBA vs active in Operational Area
  - Methods – emails, mail, one-on-one meetings, community drop-in sessions, technical fact sheet, activity summary fact sheets, posters and presentations, social media posts, video clips ….
  - Content – map, location, distance to shore, water depth …
- **Activity notifications**
  - Government, rep body and licence holder expectations – methods and content
- **Emergency communications**
  - Government, rep body and licence holder expectations – methods and content

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Consultation approach – next steps

Santos is committed to co-designing consultation approaches that meet the information needs of Relevant Persons. Opportunities include:

- Emails
- One-on-one meetings
- Community drop-in sessions
- Technical fact sheets
- Activity summary fact sheets
- Posters and presentations
- Social media posts
- Video clips
- Other opportunities

SECTION 5 QUESTIONS AND NEXT STEPS

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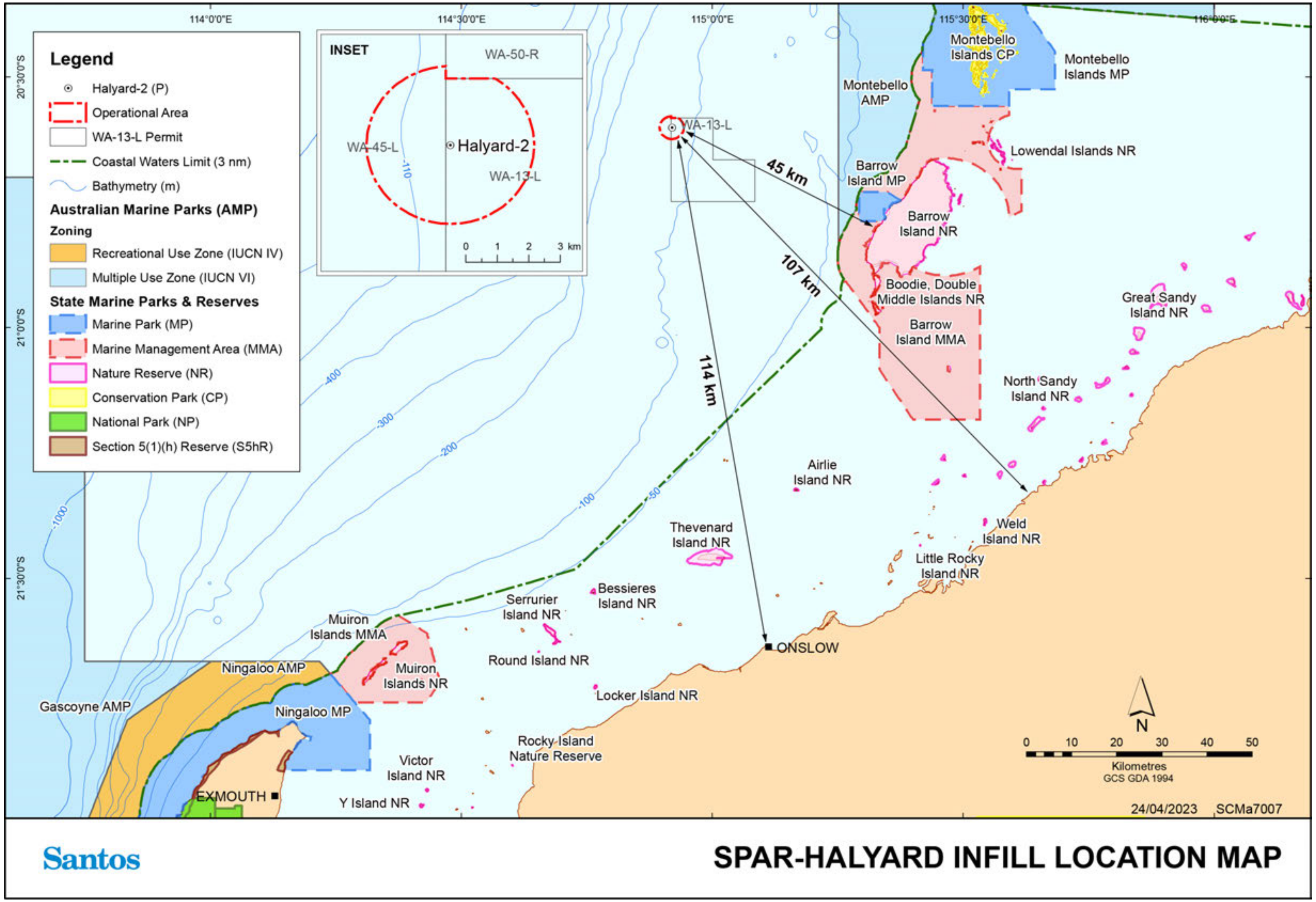
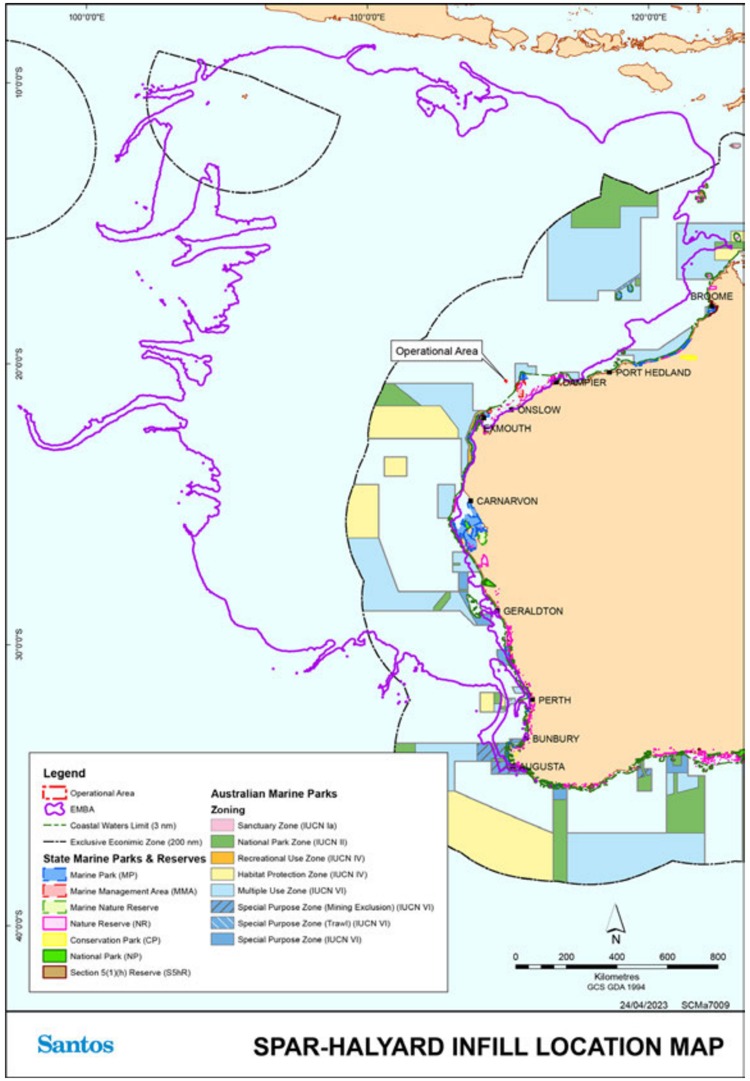
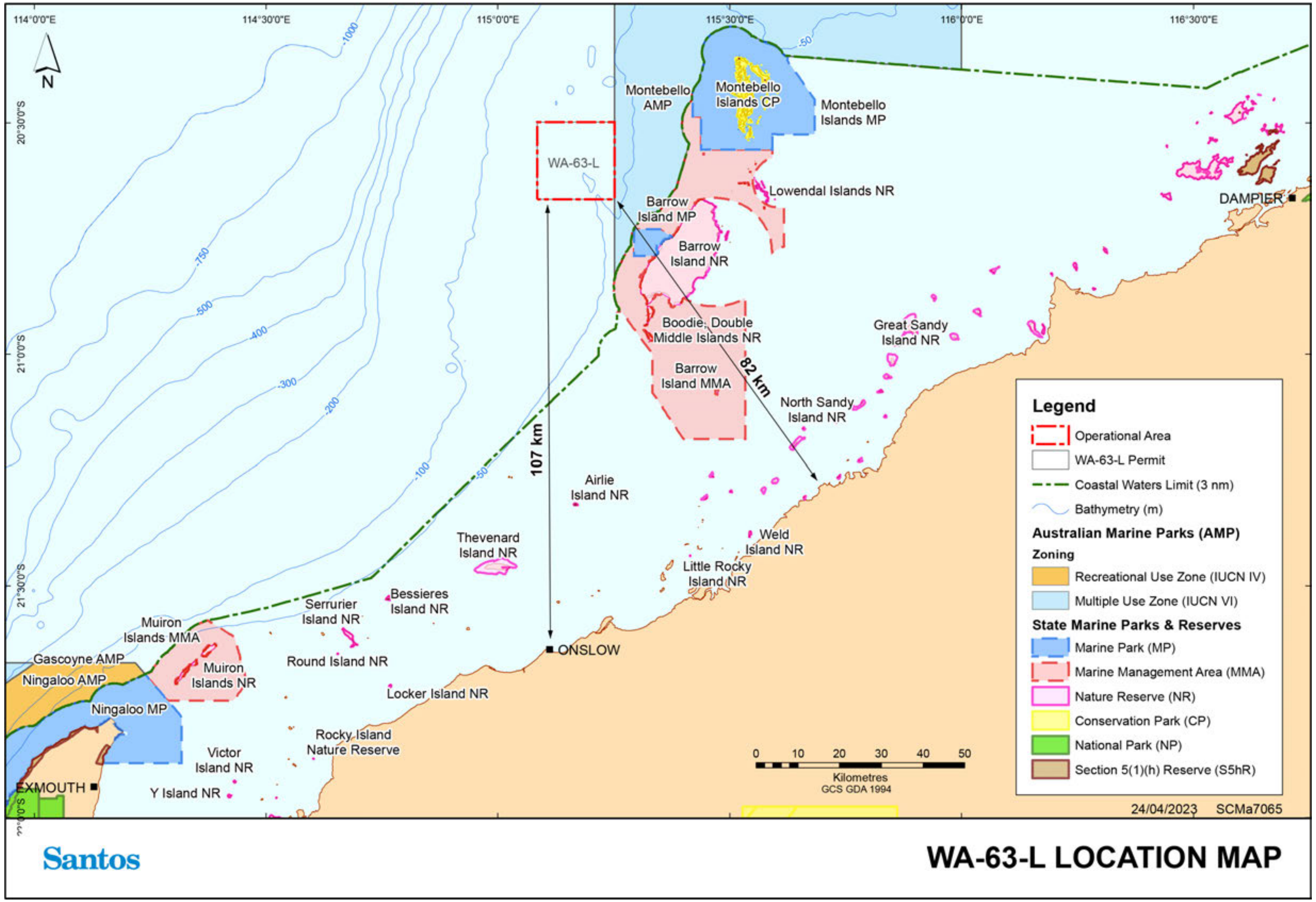
Spar Halyard

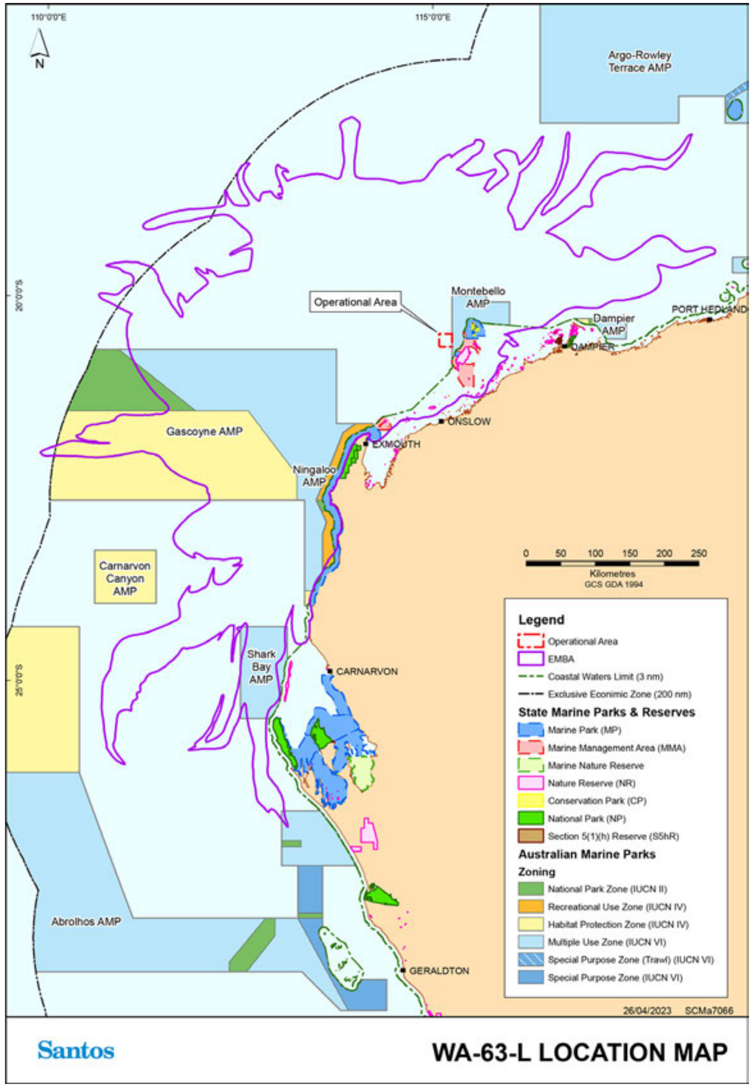




WA-63-L

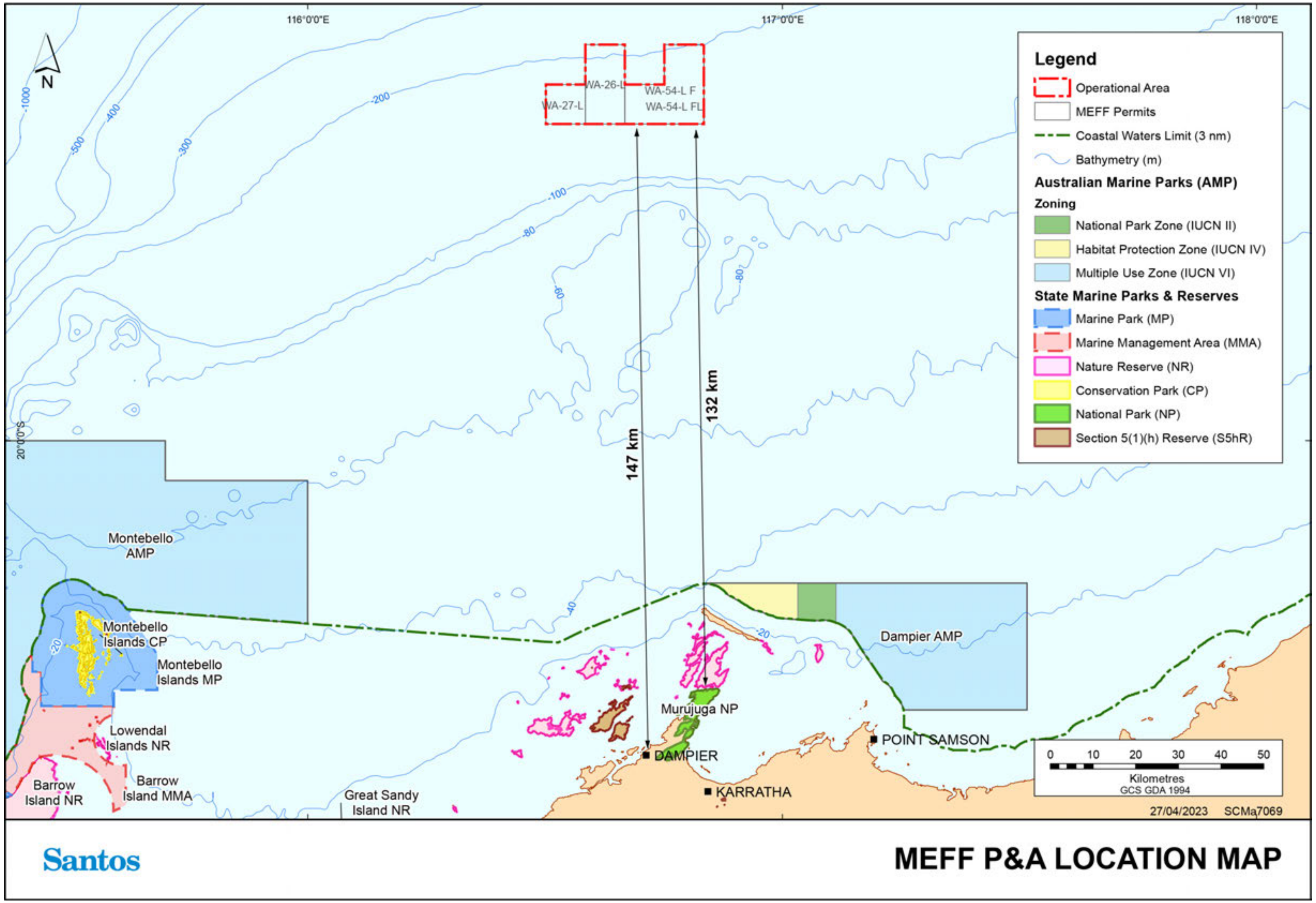


114°0'0"E
114°30'0"E
115°0'0"E
115°30'0"E
116°0'0"E
116°30'0"E
20°30'0"S
21°0'0"S
21°30'0"S
N
WA-63-L
Montebello AMP
Montebello Islands CP
Montebello Islands MP
Lowendal Islands NR
DAMPIER
Barrow Island MP
Barrow Island NR
Boodie, Double Middle Islands NR
Barrow Island MMA
82 km
107 km
Great Sandy Island NR
North Sandy Island NR
Airlie Island NR
Weld Island NR
Little Rocky Island NR
Thevenard Island NR
Bessieres Island NR
Serrurier Island NR
Muiron Islands MMA
Gascoyne AMP
Ningaloo AMP
Muiron Islands NR
Round Island NR
ONSLOW
Locker Island NR
Ningaloo MP
Rocky Island Nature Reserve
Victor Island NR
Y Island NR
EXMOUTH
-1000
-750
-500
-400
-300
-200
-100
-50
Legend
Operational Area
WA-63-L Permit
Coastal Waters Limit (3 nm)
Bathymetry (m)
Australian Marine Parks (AMP)
Zoning
Recreational Use Zone (IUCN IV)
Multiple Use Zone (IUCN VI)
State Marine Parks & Reserves
Marine Park (MP)
Marine Management Area (MMA)
Nature Reserve (NR)
Conservation Park (CP)
National Park (NP)
Section 5(1)(h) Reserve (S5hR)
0 10 20 30 40 50
Kilometres
GCS GDA 1994
24/04/2023 SCMa7065
Santos
WA-63-L LOCATION MAP

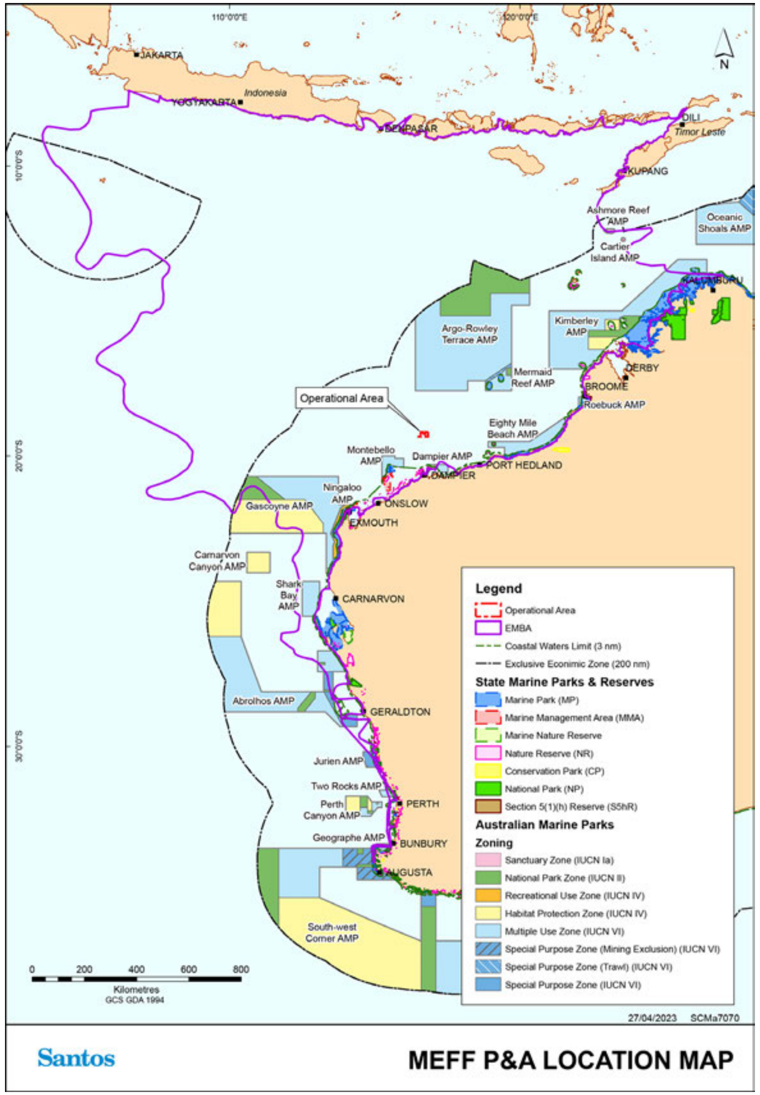


110°0'0"E
115°0'0"E
20°0'0"S
25°0'0"S
N
Argo-Rowley Terrace AMP
Operational Area
Montebello AMP
Dampier AMP
DAMPIER
PORT HEDLAND
ONSLOW
EXMOUTH
Gascoyne AMP
Ningaloo AMP
Carnarvon Canyon AMP
Shark Bay AMP
CARNARVON
Abrolhos AMP
GERALDTON
0 50 100 150 200 250
Kilometres
GCS GDA 1994
Legend
Operational Area
EMBA
Coastal Waters Limit (3 nm)
Exclusive Economic Zone (200 nm)
State Marine Parks & Reserves
Marine Park (MP)
Marine Management Area (MMA)
Marine Nature Reserve
Nature Reserve (NR)
Conservation Park (CP)
National Park (NP)
Section 5(1)(h) Reserve (S5hR)
Australian Marine Parks
Zoning
National Park Zone (IUCN II)
Recreational Use Zone (IUCN IV)
Habitat Protection Zone (IUCN IV)
Multiple Use Zone (IUCN VI)
Special Purpose Zone (Trawl) (IUCN VI)
Special Purpose Zone (IUCN VI)
26/04/2023 SCMa7066
Santos
WA-63-L LOCATION MAP

MEFF P&A

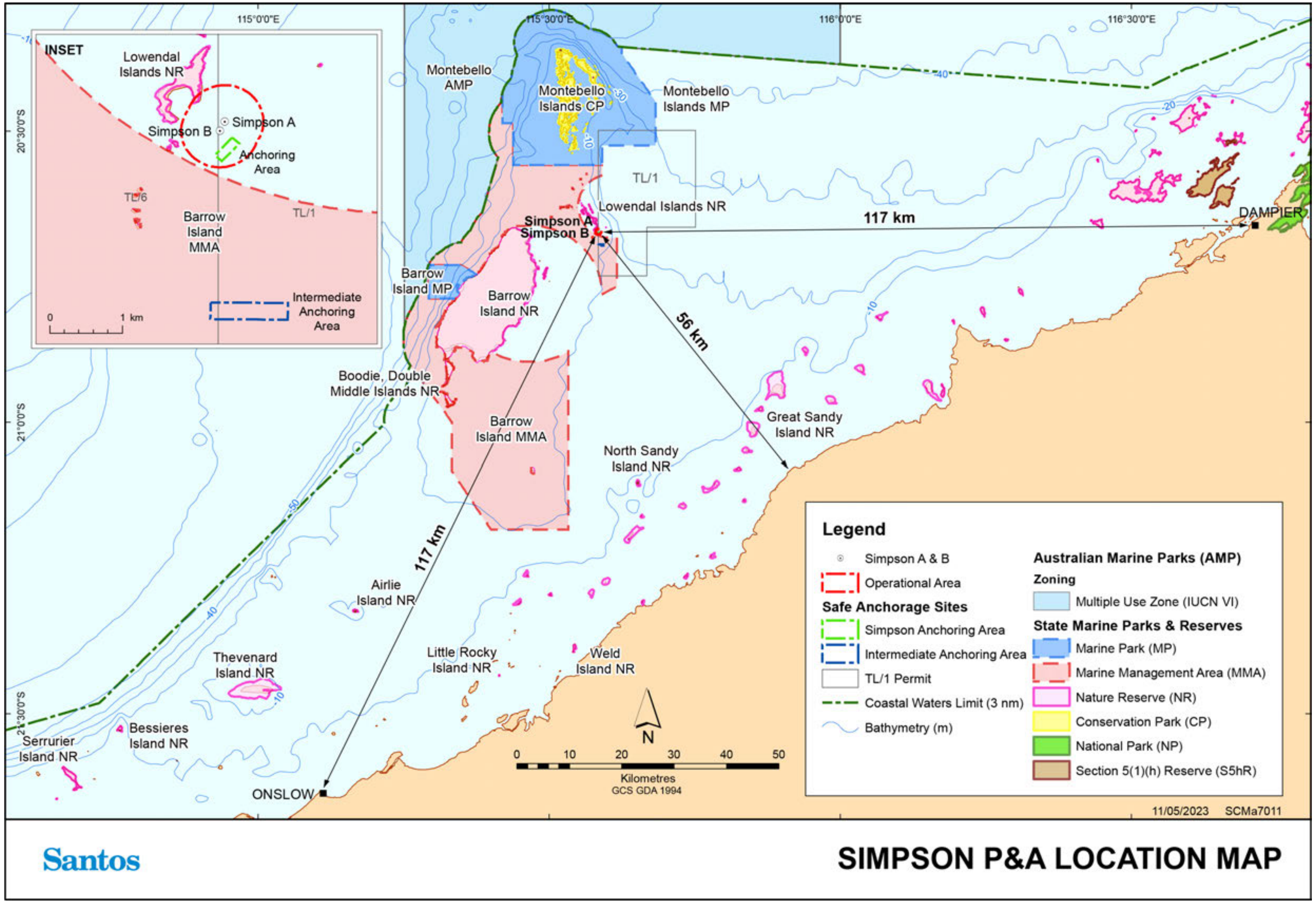


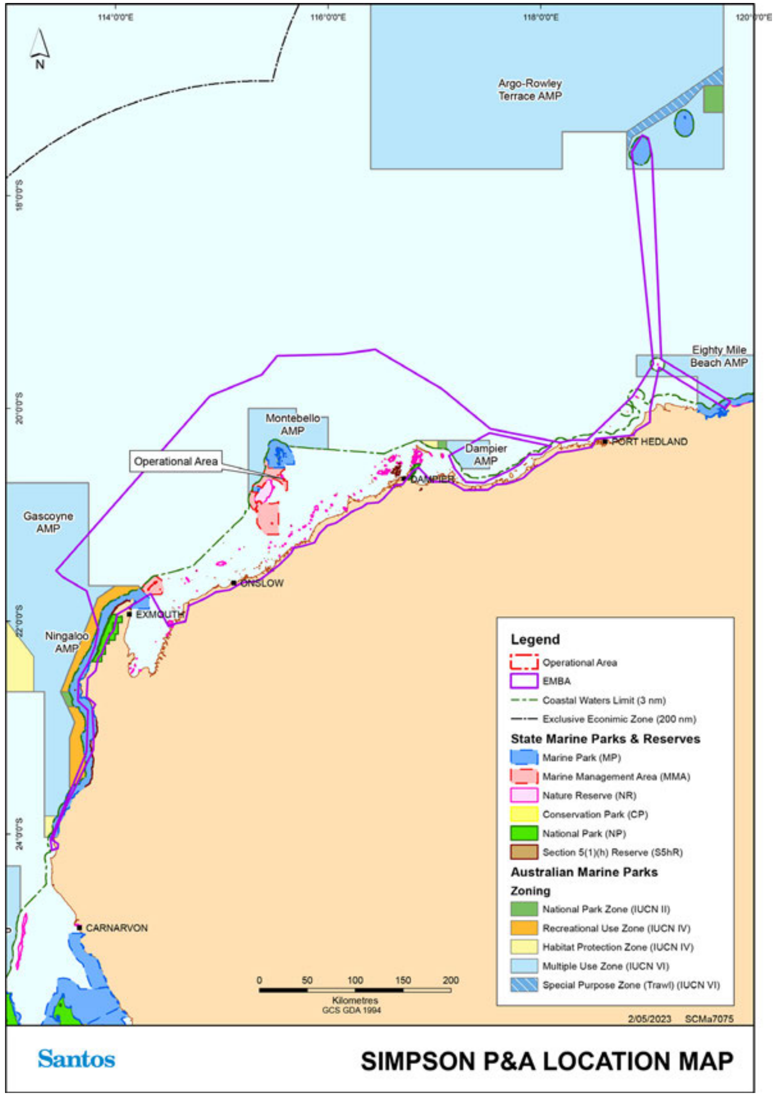
116°0'0"E
117°0'0"E
118°0'0"E
20°0'0"S
N
WA-26-L
WA-27-L
WA-54-L F
WA-54-L FL
147 km
132 km
Legend
Operational Area
MEFF Permits
Coastal Waters Limit (3 nm)
Bathymetry (m)
Australian Marine Parks (AMP)
Zoning
National Park Zone (IUCN II)
Habitat Protection Zone (IUCN IV)
Multiple Use Zone (IUCN VI)
State Marine Parks & Reserves
Marine Park (MP)
Marine Management Area (MMA)
Nature Reserve (NR)
Conservation Park (CP)
National Park (NP)
Section 5(1)(h) Reserve (S5hR)
Montebello AMP
Montebello Islands CP
Montebello Islands MP
Lowendal Islands NR
Barrow Island NR
Barrow Island MMA
Great Sandy Island NR
Murujuga NP
DAMPIER
KARRATHA
POINT SAMSON
Dampier AMP
0 10 20 30 40 50
Kilometres
GCS GDA 1994
27/04/2023 SCMa7069
Santos
MEFF P&A LOCATION MAP



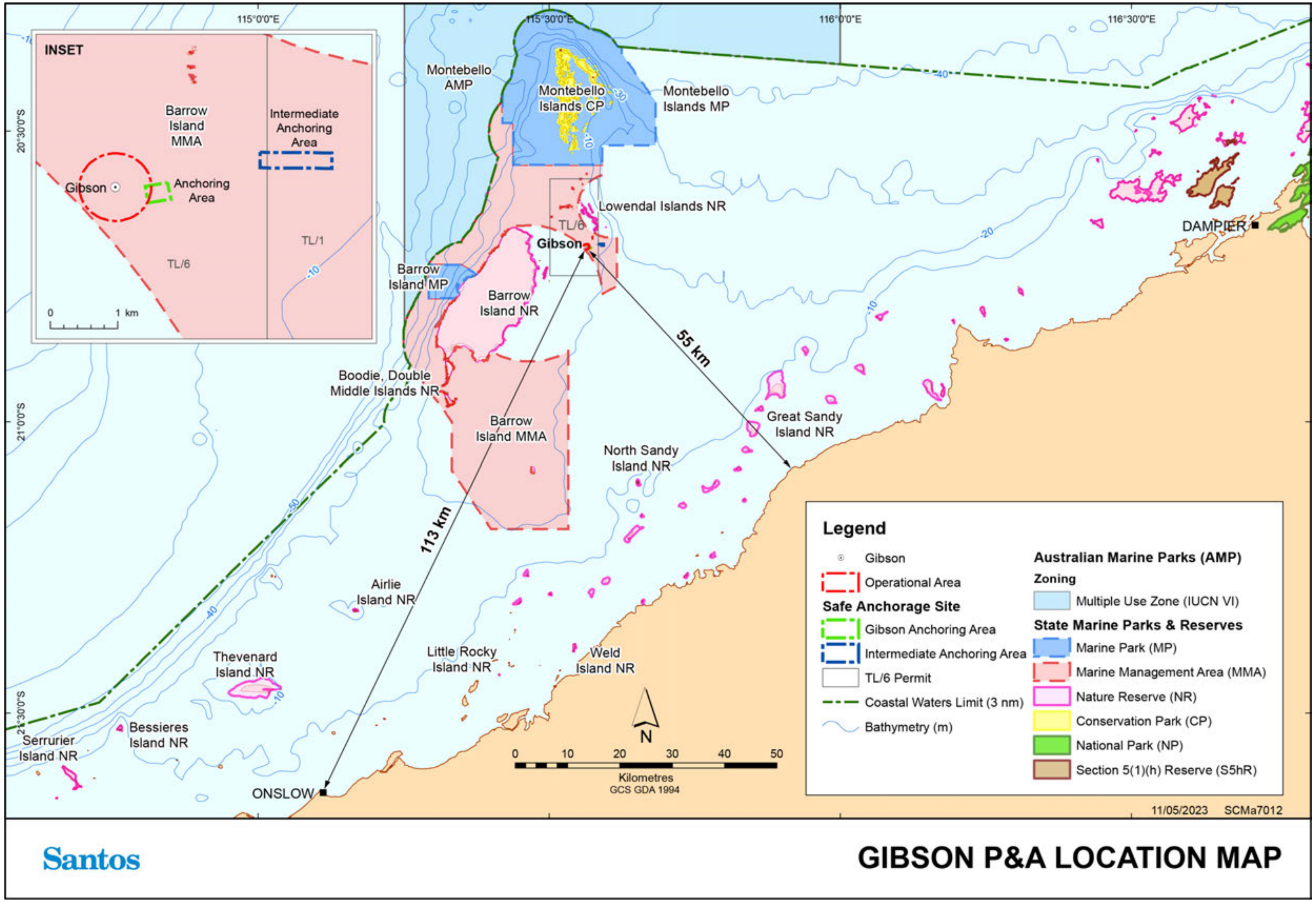
JAKARTA
Indonesia
DENPASAR
DILI
Timor Leste
KUPANG
Ashmore Reef AMP
Cartier Island AMP
Oceanic Shoals AMP
Argo-Rowley Terrace AMP
Kimberley AMP
Mermaid Reef AMP
DERBY
BROOME
Roebuck AMP
Operational Area
Eighty Mile Beach AMP
Montebello AMP
Dampier AMP
DAMPIER
PORT HEDLAND
Ningaloo AMP
Gascoyne AMP
ONSLOW
EXMOUTH
Carnarvon Canyon AMP
Shark Bay AMP
CARNARVON
Abrolhos AMP
GERALDTON
Jurien AMP
Two Rocks AMP
Perth Canyon AMP
PERTH
Geographe AMP
BUNBURY
AUGUSTA
South-west Corner AMP
Legend
Operational Area
EMBA
Coastal Waters Limit (3 nm)
Exclusive Economic Zone (200 nm)
State Marine Parks & Reserves
Marine Park (MP)
Marine Management Area (MMA)
Marine Nature Reserve
Nature Reserve (NR)
Conservation Park (CP)
National Park (NP)
Section 5(1)(h) Reserve (S5hR)
Australian Marine Parks
Zoning
Sanctuary Zone (IUCN Ia)
National Park Zone (IUCN II)
Recreational Use Zone (IUCN IV)
Habitat Protection Zone (IUCN IV)
Multiple Use Zone (IUCN VI)
Special Purpose Zone (Mining Exclusion) (IUCN VI)
Special Purpose Zone (Trawl) (IUCN VI)
Special Purpose Zone (IUCN VI)
0 200 400 600 800
Kilometres
GCS GDA 1994
27/04/2023 SCMa7070
Santos
MEFF P&A LOCATION MAP

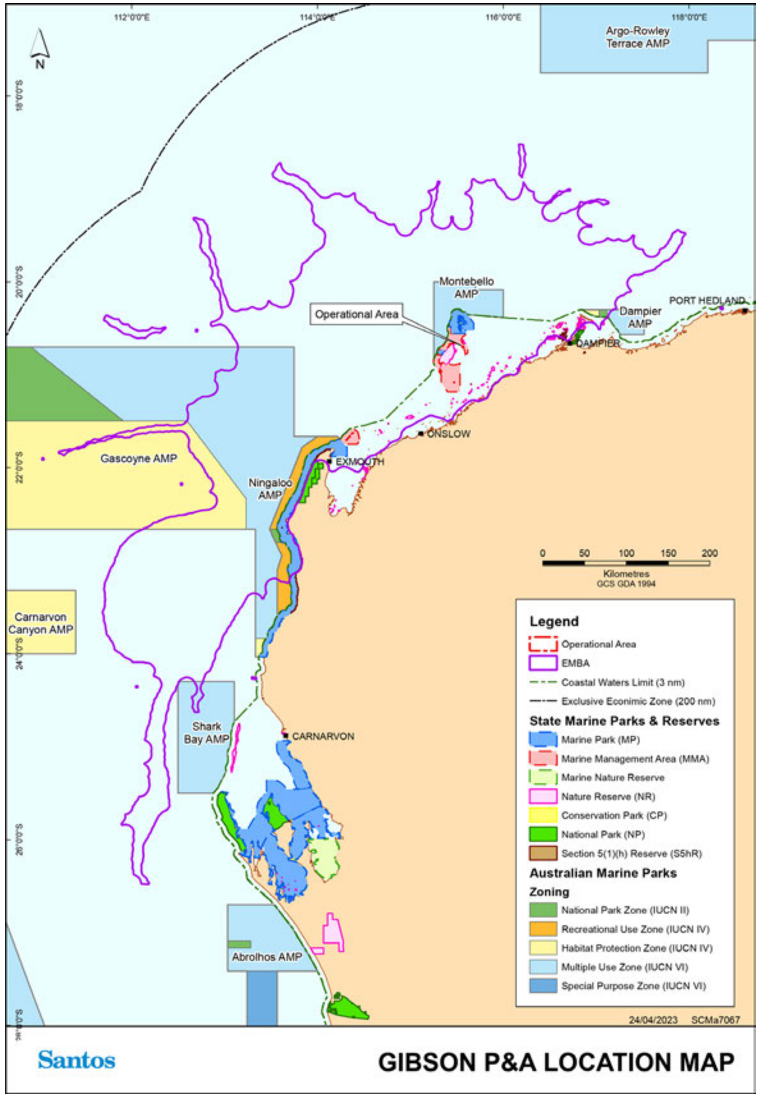
HJV – Simpson P&A



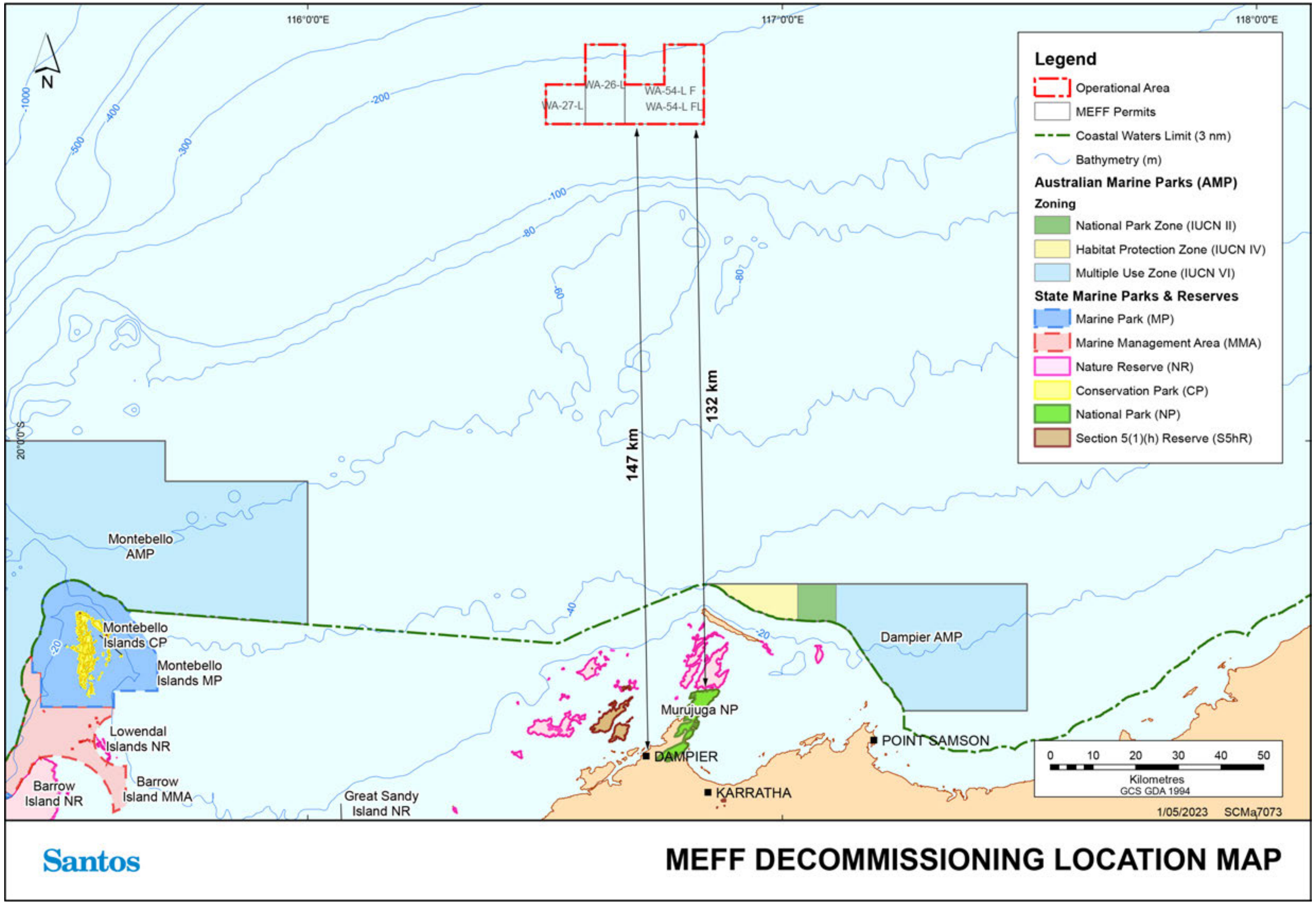


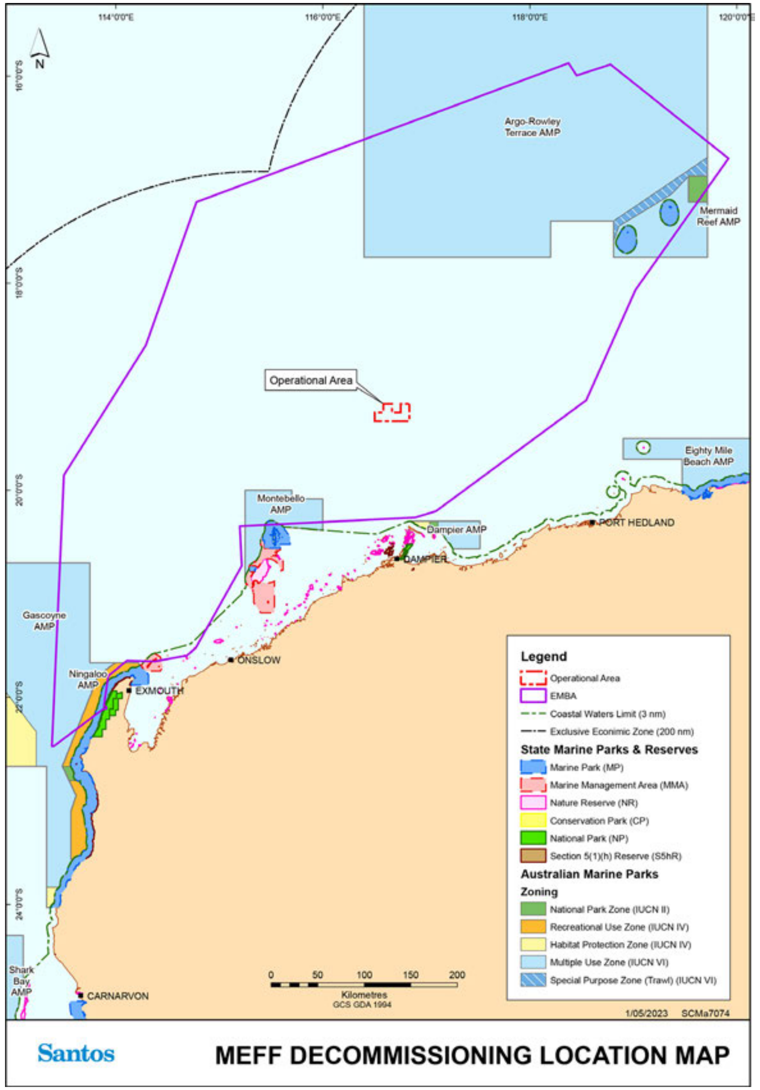
HJV – Gibson P&A



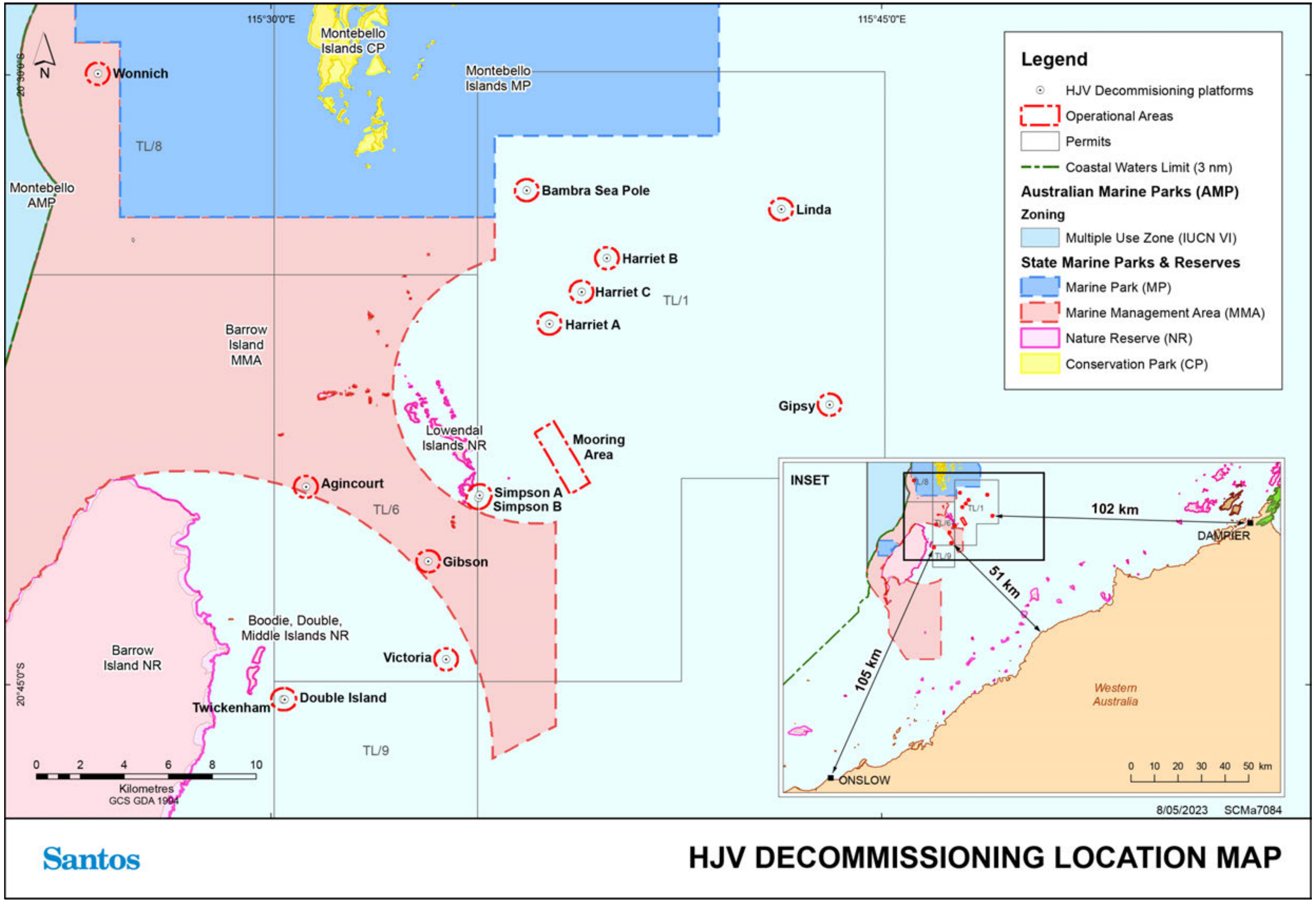


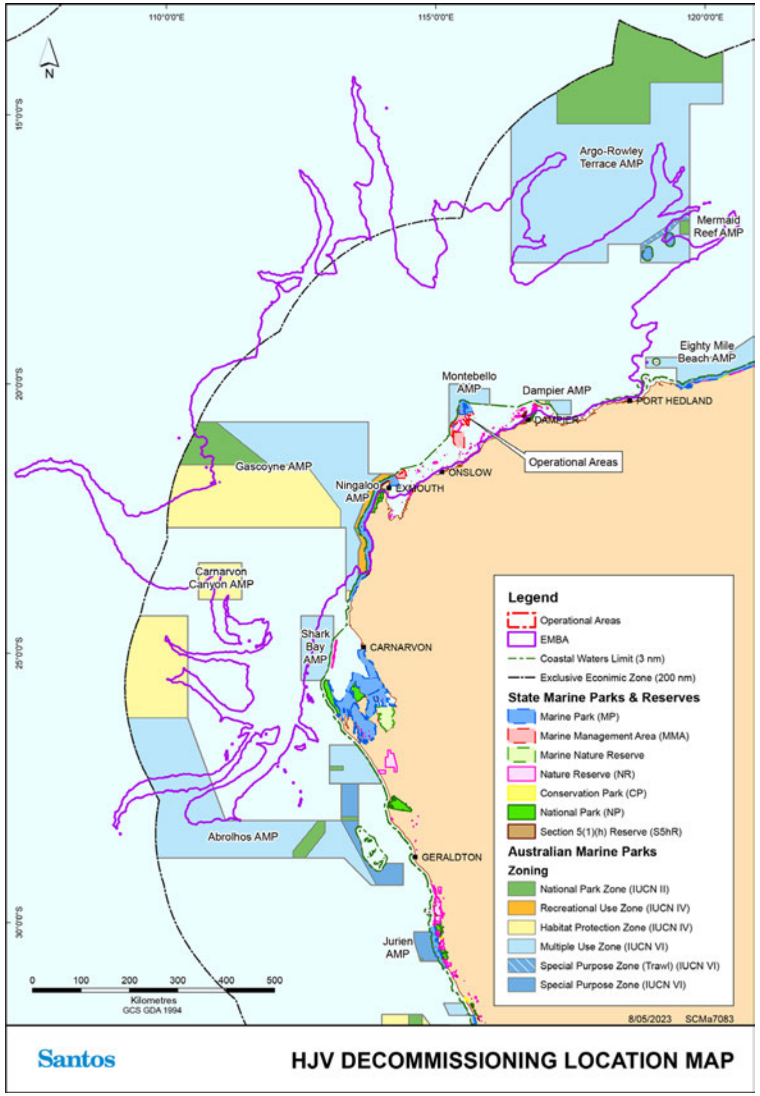
MEFF Decommissioning



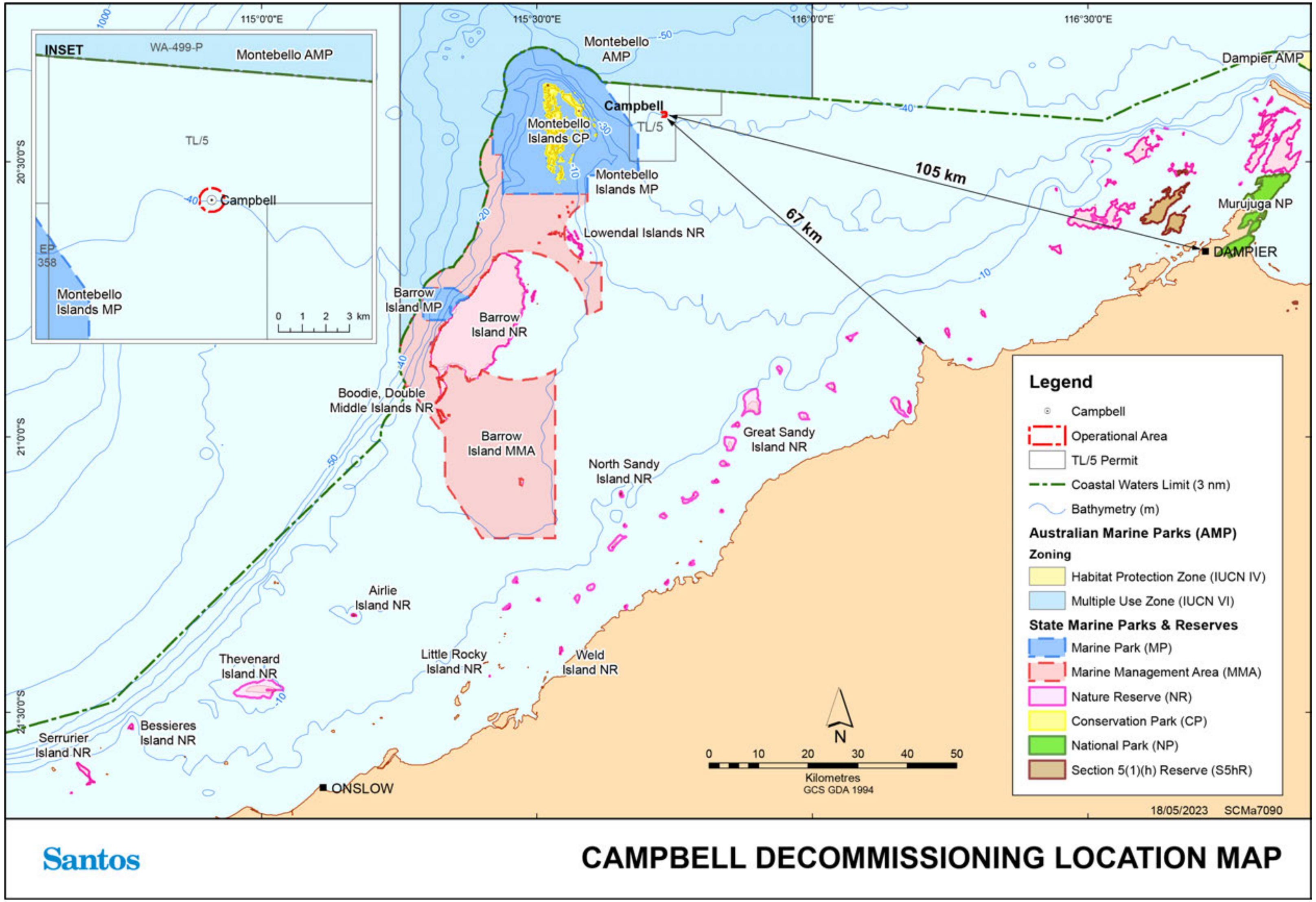


HJV Decommissioning

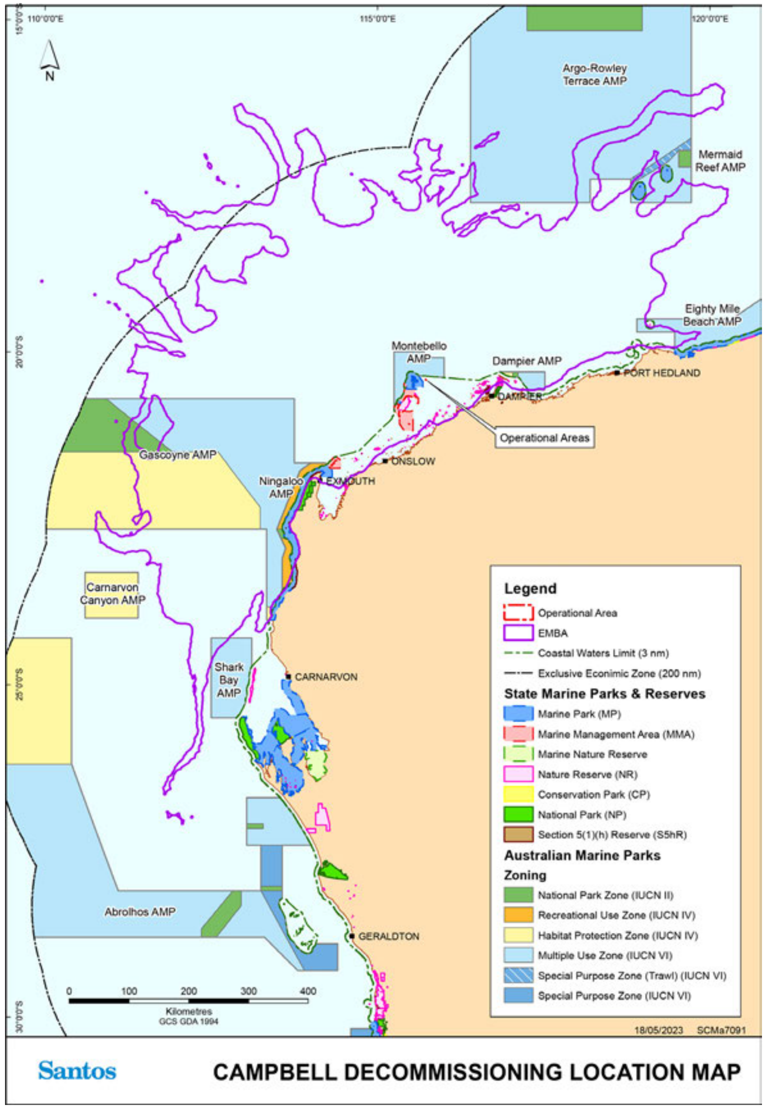




Campbell



INSET
WA-499-P
Montebello AMP
TL/5
Campbell
EP 358
Montebello Islands MP
0 1 2 3 km
115°0'0"E
115°30'0"E
116°0'0"E
116°30'0"E
20°30'0"S
21°0'0"S
21°30'0"S
Montebello AMP
Dampier AMP
Campbell
TL/5
Montebello Islands CP
Montebello Islands MP
Lowendal Islands NR
105 km
67 km
Murujuga NP
DAMPIER
Barrow Island MP
Barrow Island NR
Boodie, Double Middle Islands NR
Barrow Island MMA
North Sandy Island NR
Great Sandy Island NR
Airlie Island NR
Thevenard Island NR
Little Rocky Island NR
Weld Island NR
Bessieres Island NR
Serrurier Island NR
ONSLOW
Legend
Campbell
Operational Area
TL/5 Permit
Coastal Waters Limit (3 nm)
Bathymetry (m)
Australian Marine Parks (AMP)
Zoning
Habitat Protection Zone (IUCN IV)
Multiple Use Zone (IUCN VI)
State Marine Parks & Reserves
Marine Park (MP)
Marine Management Area (MMA)
Nature Reserve (NR)
Conservation Park (CP)
National Park (NP)
Section 5(1)(h) Reserve (S5hR)
N
0 10 20 30 40 50
Kilometres
GCS GDA 1994
18/05/2023 SCMa7090
Santos
CAMPBELL DECOMMISSIONING LOCATION MAP



N
Argo-Rowley Terrace AMP
Mermaid Reef AMP
Eighty Mile Beach AMP
Montebello AMP
Dampier AMP
PORT HEDLAND
DAMPIER
Operational Areas
ONSLOW
Gascoyne AMP
Ningaloo AMP
EXMOUTH
Carnarvon Canyon AMP
Shark Bay AMP
CARNARVON
Abrolhos AMP
GERALDTON
Legend
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Nature Reserve (NR)
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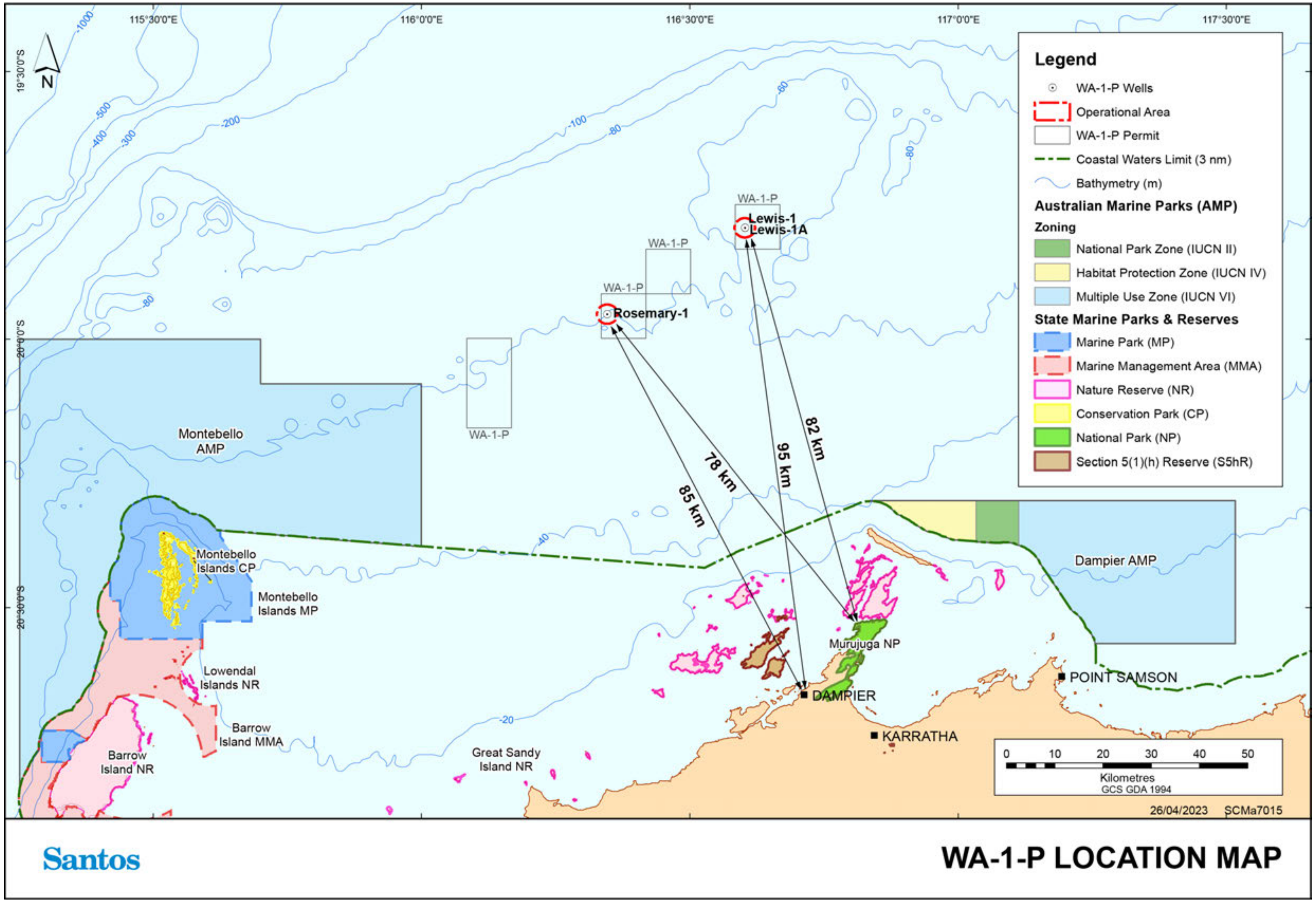
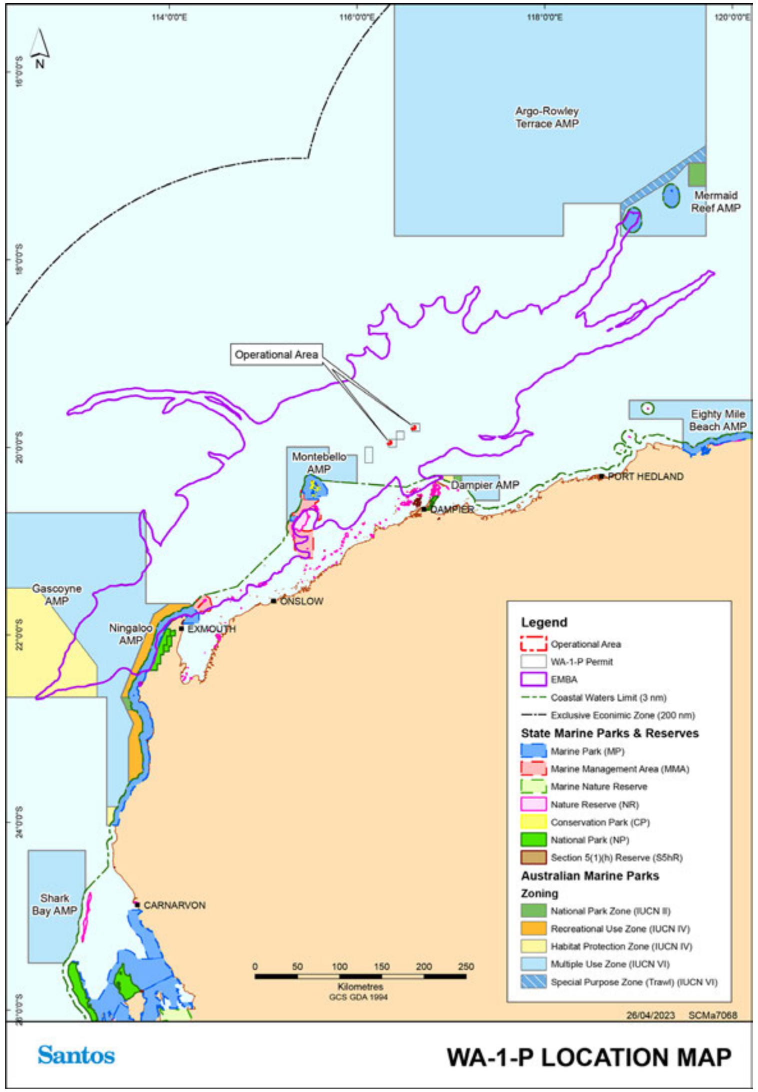
Recreational Use Zone (IUCN IV)
Habitat Protection Zone (IUCN IV)
Multiple Use Zone (IUCN VI)
Special Purpose Zone (Trawl) (IUCN VI)
Special Purpose Zone (IUCN VI)
0 100 200 300 400
Kilometres
GCS GDA 1994
18/05/2023 SCMa7091
Santos
CAMPBELL DECOMMISSIONING LOCATION MAP

WA-1-P

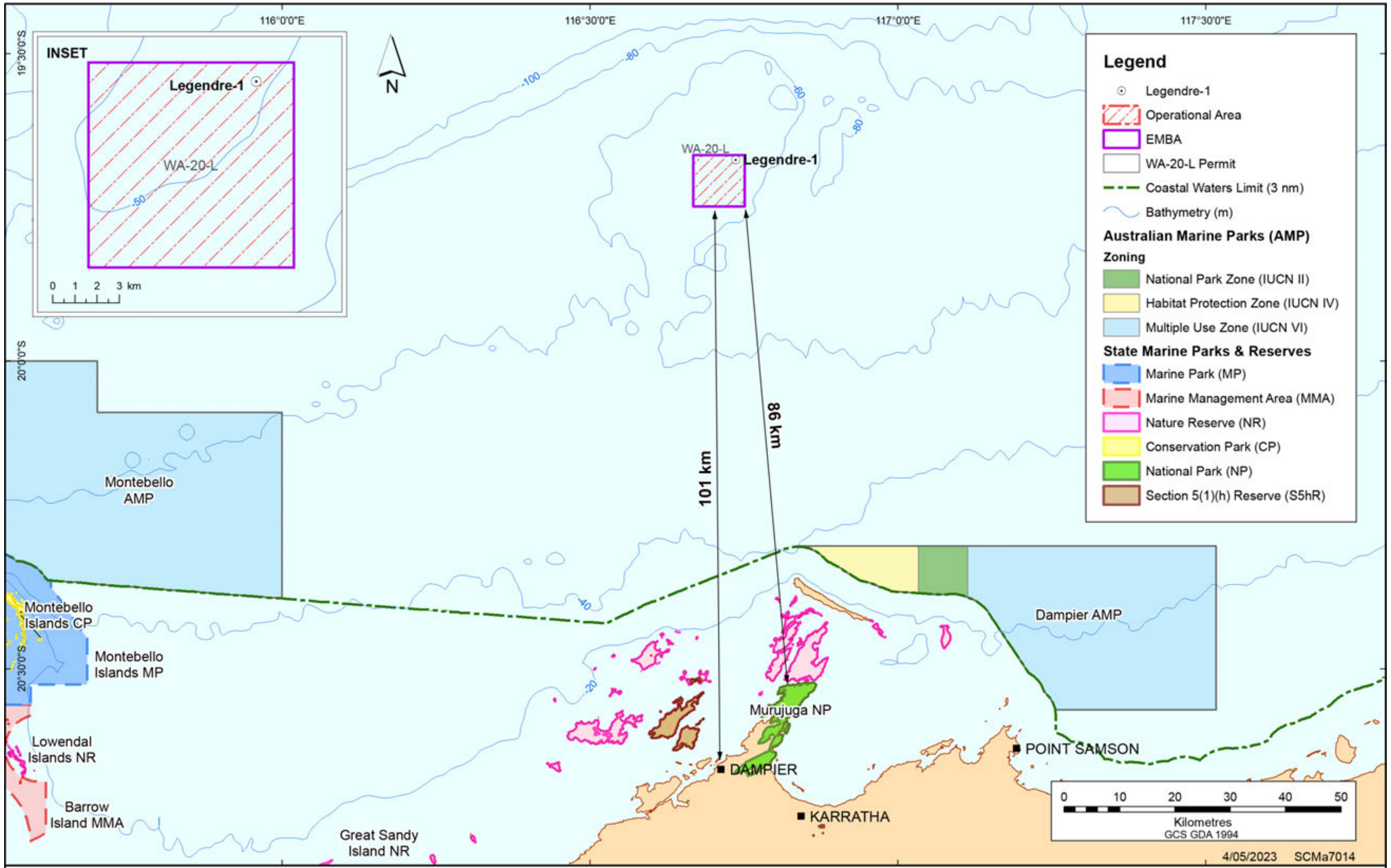


115°30'0"E
116°0'0"E
116°30'0"E
117°0'0"E
117°30'0"E
19°30'0"S
20°0'0"S
20°30'0"S
N
Legend
WA-1-P Wells
Operational Area
WA-1-P Permit
Coastal Waters Limit (3 nm)
Bathymetry (m)
Australian Marine Parks (AMP)
Zoning
National Park Zone (IUCN II)
Habitat Protection Zone (IUCN IV)
Multiple Use Zone (IUCN VI)
State Marine Parks & Reserves
Marine Park (MP)
Marine Management Area (MMA)
Nature Reserve (NR)
Conservation Park (CP)
National Park (NP)
Section 5(1)(h) Reserve (S5hR)
WA-1-P
Lewis-1
Lewis-1A
Rosemary-1
85 km
78 km
95 km
82 km
Montebello AMP
Montebello Islands CP
Montebello Islands MP
Lowendal Islands NR
Barrow Island MMA
Barrow Island NR
Great Sandy Island NR
Murujuga NP
DAMPIER
KARRATHA
POINT SAMSON
Dampier AMP
0 10 20 30 40 50
Kilometres
GCS GDA 1994
26/04/2023 SCMa7015
Santos
WA-1-P LOCATION MAP



114°0'0"E
116°0'0"E
118°0'0"E
120°0'0"E
N
Argo-Rowley Terrace AMP
Mermaid Reef AMP
Operational Area
Eighty Mile Beach AMP
Montebello AMP
Dampier AMP
DAMPIER
PORT HEDLAND
Gascoyne AMP
Ningaloo AMP
EXMOUTH
ONSLOW
Shark Bay AMP
CARNARVON
Legend
Operational Area
WA-1-P Permit
EMBA
Coastal Waters Limit (3 nm)
Exclusive Econimic Zone (200 nm)
State Marine Parks & Reserves
Marine Park (MP)
Marine Management Area (MMA)
Marine Nature Reserve
Nature Reserve (NR)
Conservation Park (CP)
National Park (NP)
Section 5(1)(h) Reserve (S5hR)
Australian Marine Parks
Zoning
National Park Zone (IUCN II)
Recreational Use Zone (IUCN IV)
Habitat Protection Zone (IUCN IV)
Multiple Use Zone (IUCN VI)
Special Purpose Zone (Trawl) (IUCN VI)
0 50 100 150 200 250
Kilometres
GCS GDA 1994
26/04/2023 SCMa7068
Santos
WA-1-P LOCATION MAP

WA-20-L



Santos

LEGENDRE-1 WELL LOCATION MAP

Santos

Spar Halyard Infill Project Environment Plan

Information for Relevant Persons

Activity Overview

Santos is planning to drill a development well, called Halyard 2, in Commonwealth waters commencing at the earliest in Q2 2024. Installation and pre-commissioning activities will also be undertaken to support future production through Santos' Varanus Island facilities.

The Operational Area for the Halyard 2 well is approximately 45 km from the nearest coastline (Barrow Island), and approximately 114 km north of Onslow, Western Australia (see **Figure 1**).

The expected durations are 50 days to drill and complete the well and 25 days for the installation and pre-commisioning activities.

The expected duration is a forecast and is subject to change based on vessel availability, adverse weather conditions or technical/equipment issues that may arise during operations.

Consultation & Feedback

All petroleum activities in Commonwealth waters must have an Environment Plan (EP) accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) before any activities can take place.

Under Commonwealth Environmental Regulations, Santos is required to consult with relevant persons about proposed activities when preparing an EP. A relevant person includes authorities, persons or organisations whose functions, interests or activities may be affected by the proposed activity.

You might 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, 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 you may be a relevant person, please contact us by **26 June 2022** to allow Santos time to initiate consultation with you, so you can tell us how you would like to be consulted throughout this process or if you need additional information.

Details on how to contact us are included in the **Providing Feedback** section of this information sheet.

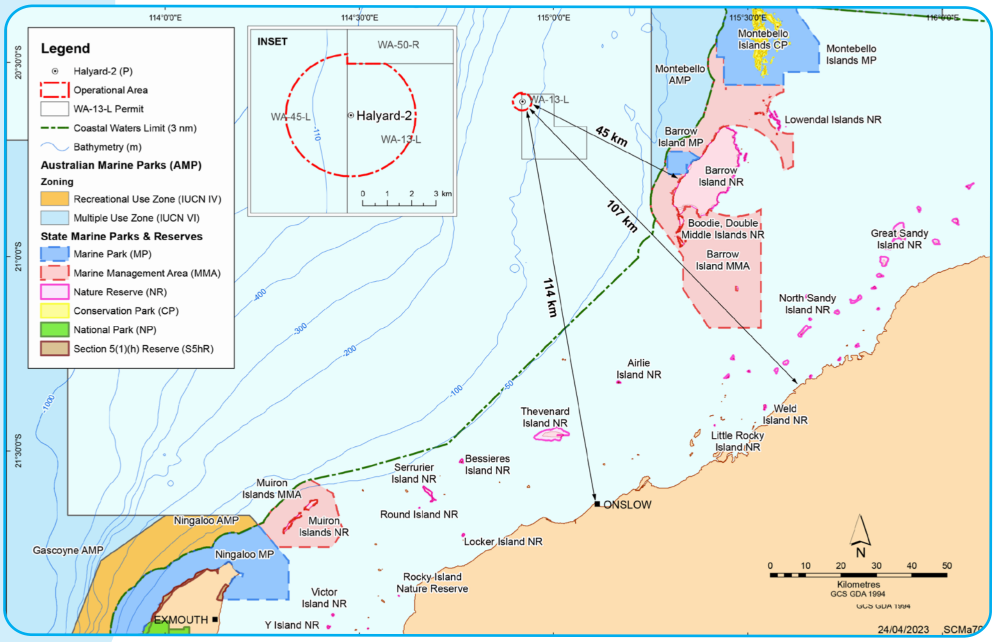


Figure 1. Spar Halyard activity location.

Activity Description

ACTIVITY DETAILS	
Location	Approximately 114 km north of Onslow, Western Australia.
Timing	The activity may occur any time between Q1 2024 and the end of 2025.
Duration	Expected duration of 75 days, comprising: + Drilling and completion - 50 days + Subsea installation and pre-commissioning - 25 days The expected duration is a forecast and is subject to change based on vessel availability, adverse weather conditions or technical/equipment issues that may arise during operations.
Water depth	Approximately 100 m to 130 m.
Planned activities	**Drilling (Halyard 2 well):** + Optional pre-mobilisation survey and pre-lay of moorings before moving the Semi-submersible mobile offshore drilling unit (MODU) to the operational area + Towing the MODU to the operational area and deploying moorings or connecting to pre-laid moorings + Install riser and blowout preventer (BOP) + Prepare and drill the well + Suspend well ready for commissioning **Installation (Halyard 2 well infrastructure):** + Seabed surveys (e.g., metrology, as-built survey) + Shut-in Halyard 1 well + Install subsea equipment and pressure test
Vessels	+ Semi-submersible MODU + Installation support vessel (ISV) + Up to four support vessels for activities such as anchor handling, MODU towing, transportation of equipment and consumables, bunkering etc.
Aircraft	Helicopters will be used for crew changes, critical equipment supply and emergency response. Helicopter flights will occur several times per week on average during the Spar-Halyard Infill Project.
Description of the natural environment	The Operational Area is flat and featureless, predominantly sand with a proportion of silt and clay.
Exclusion zone	A 500 m radius Petroleum Safety Zone (PSZ) exclusion zone will be in place around the MODU for the duration of the activity. The exclusion zone will remain around the well until eventual field decommissioning.
Operational Area	A 2,500 m radius Operational Area will be in place around the Halyard 2 well location during drilling activities. Other marine users are permitted to enter the Operational Area but should take care for safety reasons.
Petroleum permits	+ WA-13-L (Halyard 2 well and Operational Area) + WA-45-L (Operational Area only)

ACTIVITY COORDINATES	Latitude (GDA94)	Longitude (GDA94)
Halyard 2 Wellhead Coordinates	20° 36’ 04.06” S	114° 55’ 09.33” E

Activity Purpose and Approvals

Santos has a long history of exploration, development and operations in the Northern Carnarvon Basin, with the drilling of the Halyard 2 development well supporting potential future gas production via Santos' Varanus Island Hub facilities.

The Varanus Island Hub is the base of Santos' Western Australian energy portfolio and has been in operation since 1986. Located 75km offshore northwest Australia, Varanus Island is surrounded by a network of offshore fixed production platforms which feed gas, oil and condensate into the island's facilities for processing, storage and export to market.

Gas produced at this facility is transported via pipeline to shore for connection into the Dampier to Bunbury Natural Gas Pipeline for supply to Western Australian gas customers.

Santos will use a semi-submersible Mobile Offshore Drilling Unit (MODU) to drill the Halyard 2 well.

Semi-submersible MODUs are typically used in deeper waters where the rig floats on the ocean surface and can be moored using anchors deployed from the rig or use onboard propulsion systems to maintain the rig's position at the drilling location.

Installation of subsea infrastructure will also be undertaken to support future production to Santos' existing facilities.

An addendum to the Varanus Island Hub Operations EP is being prepared for planned activities, under which all activity impacts and risks are proposed to be managed to a level as low as reasonably practicable and acceptable over the life of the activity.

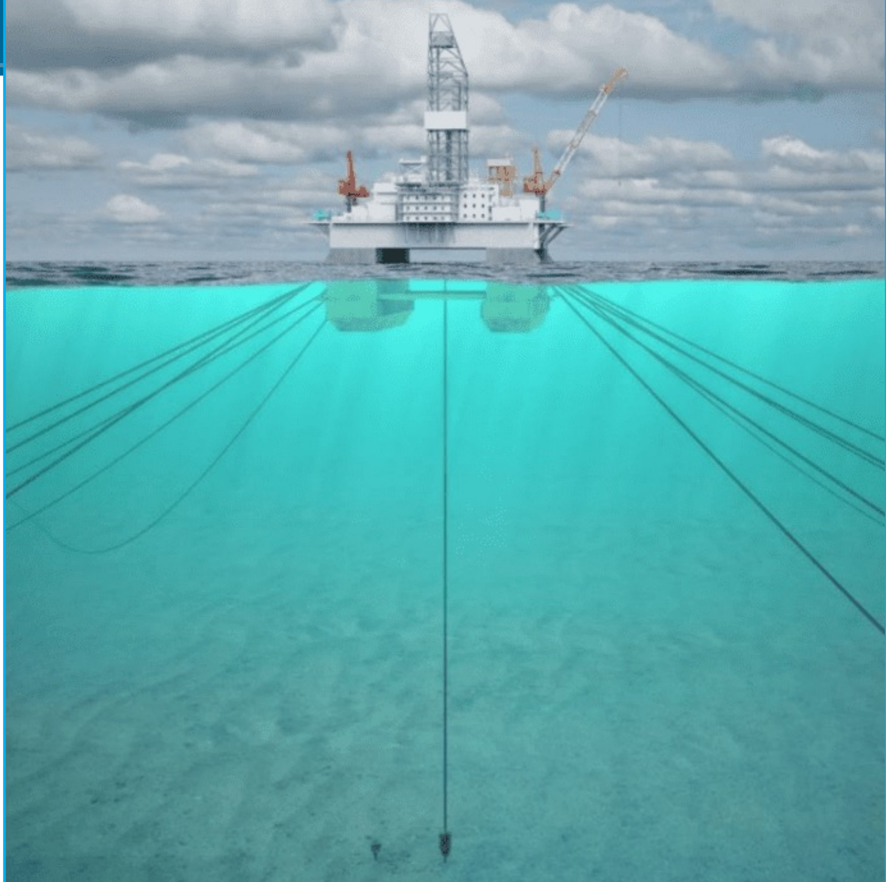


Figure 2. *A graphical representation of a semisubmersible MODU.*

The addendum to the EP will be submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for acceptance in accordance with the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth)*.

Santos may also undertake the activities described in the accepted Varanus Island Hub Operations EP in addition to the Spar-Halyard Infill Project activities. Santos has previously consulted with relevant persons regarding these activities, which include:

+ Operation of the John Brookes field infrastructure.
+ Operation of the Greater East Spar subsea infrastructure.
+ Operational activities, such as platform visits, inspections, maintenance and repair.
+ Associated vessel operations.
+ Eventual decommissioning of Santos' property after the end of the productive life.

Refer to the **Varanus Island Hub Operations EP** on NOPSEMA's website for further information.

Defining the Environment Area for Proposed Activities

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 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 outer boundary of worst-case spill resulting from a loss of well control during drilling. The EMBA for proposed drilling and installation activities is illustrated in **Figure 2**.

Oil spill EMBAs are defined by overlaying a great number (usually hundreds) of individual, computer simulated, hypothetical oil 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 EMBA represents the largest possible spatial extent that could be contacted by the worst-case spill events modelled, an actual spill event is more accurately represented by a single simulation run, resulting in a smaller spatial extent in the event of an actual 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 Environment Plans.

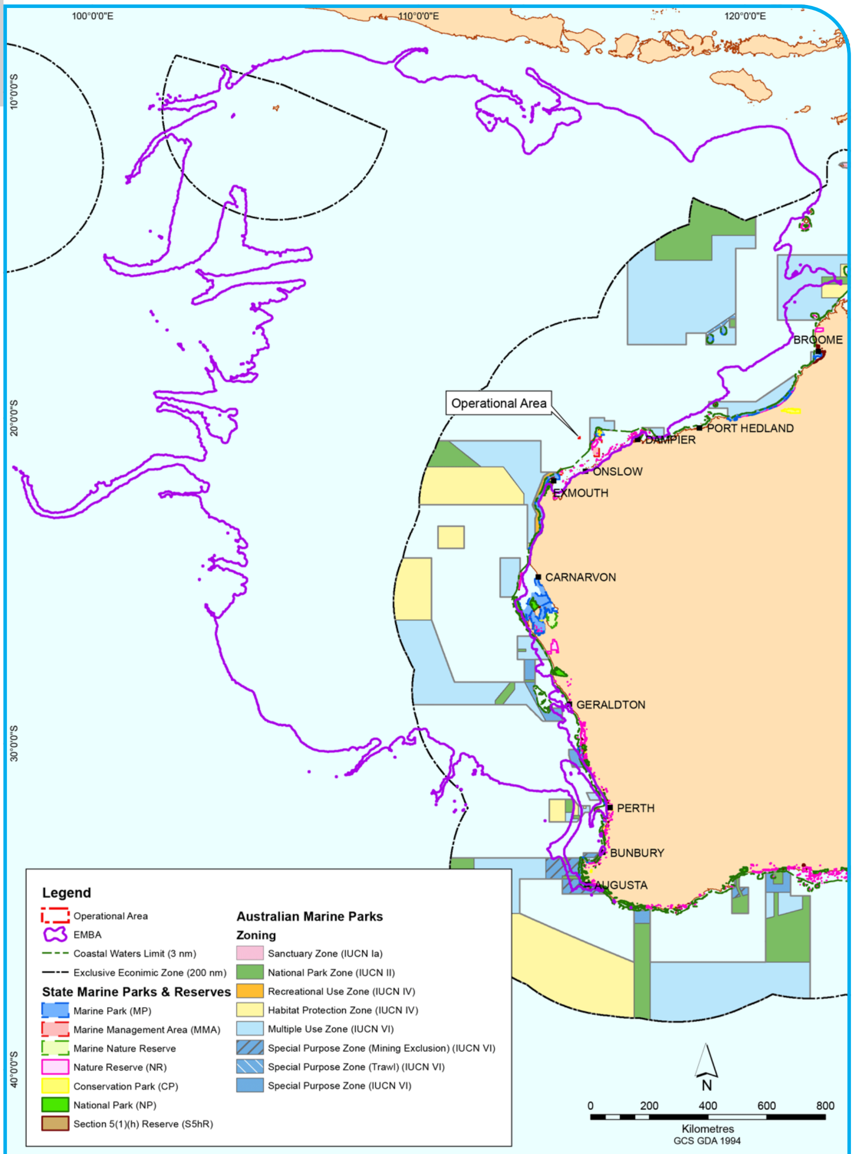


Figure 3. *Activity location map with EMBA*

TABLE 1 ENVIRONMENT AREA FOR PROPOSED ACTIVITIES

ENVIRONMENT AREA
Operational Area The area in which the MODU and support vessels will operate.
Environment that May Be Affected The spatial extent of activity impacts (e.g., facility presence, light, noise) and risk (e.g., hydrocarbon spill).

Environmental, Social, Economic and Cultural Features

We have undertaken a review of publicly available information to identify environmental, social, economic and cultural features that may be affected by activity impacts and risks, which are summarised in **Table 2**. These aspects will be risk-assessed within the EP on a case-by-case basis.

TABLE 2
ENVIRONMENTAL, SOCIAL, ECONOMIC AND CULTURAL FEATURES

FEATURES	DESCRIPTION	OPERATIONAL AREA	EMBA	PUBLIC INFORMATION REVIEW
Aboriginal Heritage	Registered Aboriginal heritage sites protected under the: + *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* + *WA Aboriginal Heritage Act 2021*	No	Yes	Barrow Island, Montebello Islands, Exmouth, Ningaloo Reef and the adjacent foreshores have a long history of occupancy by Indigenous communities.
Cultural Heritage	Registered cultural sites under the: + *Underwater Cultural Heritage Act 2018*	No	Yes	No known sites of shipwrecks, sunken aircraft or Aboriginal and Torres Strait Islander Underwater Cultural Heritage have been identified within the Operational Area. The nearest shipwreck, an unidentified probable wreck in Bandicoot Bay, is approximately 53 km southeast of the Operational Area.
Defence	Designated defence activity areas	Yes	Yes	Defence activities may take place within the Operational Area. The Operational Area is within a Defence Practice Area.
Fishing	Commercial fishing	Yes	Yes	A number of Commonwealth and State fisheries overlap the EMBA, of which some are active in the Operational Area.
	Indigenous, subsistence or customary fishing	No	Yes	Traditional Australian Indigenous fishing activities are generally concentrated within 3 NM of the Northern Territory / Western Australian coastline.
	Recreational and charter boat fishing	No	Yes	No interaction with recreational or charter boat fishers is anticipated in the Operational Area given the remoteness of the activity location. Recreational and charter boat fishing occurs within the EMBA.

Oil and Gas Operations	Petroleum operations	No	Yes	Petroleum exploration and production activities are undertaken within the EMBA. The Operational Area overlaps Santos operated infrastructure associated with the Varanus Island Hub.
Protected Areas (nearest Commonwealth and State marine parks)	Montebello Marine Park (Commonwealth)	No	Yes	The Montebello Marine Park is approximately 32 km east of the Operational Area.
	Barrow Island Marine Management Area (State)	No	Yes	The Barrow Island Marine Management Area is approximately 40 km east of the Operational Area.
Shipping	Shipping fairway	No	Yes	The Operational Area does not overlap any shipping fairways, although vessel traffic may be encountered as commercial vessels transit around Barrow Island and the Montebello Islands.
Telecommunications	Subsea telecommunications cables	No	Yes	The Darwin-Jakarta-Singapore Cable connects facilities onshore at Port Hedland, to Darwin, Christmas Island, Indonesia and Singapore and is more than 100 km north of the Operational Area.
Tourism	Tourism operations	No	Yes	Remoteness of the Operational Area and water depth limits opportunities for tourism. Tourism occurs within the EMBA.
Towns / communities	Onslow	No	Yes	Onslow is the nearest community and is approximately 114 km south of the Operational Area.
	Karratha	No	Yes	Karratha is the nearest city and is approximately 200 km southeast of the Operational Area.

Activity Impacts and Risk Management

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 with the Environment Plan on a case-by-case basis.

TABLE 3
ACTIVITY IMPACT AND RISK MANAGEMENT

ACTIVITY IMPACTS (DRILLING AND INSTALLATION OF HALYARD 2 SUBSEA INFRASTRUCTURE)

Acoustic disturbance to marine fauna

Description of activity impacts

Noise emissions from:

+ Flaring.
+ Helicopter operations.
+ MODU operations.
+ ROV operations.
+ Vessel operations.

Elevated underwater noise has the potential to change marine fauna behaviour such as attraction, avoidance and disorientation. The sensitivity of fauna to elevated noise levels varies depending on individual response.

Compliance with the following key management measures

+ Santos procedures for interacting with marine fauna.

Atmospheric emissions

Description of activity impacts

Atmospheric emissions will result from:

+ MODU operations.
+ Vessel operations.

Hydrocarbon combustion may result in a temporary, localised reduction of air quality in the environment immediately surrounding the discharge point during the activity. Non-GHG emissions, (NOX and SOX), can lead to a reduction in local air quality.

Compliance with the following key management measures

+ International Convention for the Prevention of Pollution from Ships (MARPOL) International Air Certificate.
+ Santos bulk solid transfer procedure.
+ Fuel oil quality compliant with MARPOL standard for fuel oil quality.
+ Santos Marine Assurance Standard.
+ MARPOL ozone-depleting substance handling procedures.
+ Vessel preventative maintenance systems.
+ Waste incineration compliant with MARPOL waste incineration standard.
+ Santos well test procedures.

Drilling discharges

Description of activity impacts

Drilling discharges include drilling muds, which will be water-based for this activity. Drilling discharges from the MODU will have a localised impact on water quality, sediment quality and benthic habitats.

Compliance with the following key management measures

+ Santos chemical selection procedure.
+ Cuttings management system.
+ Santos inventory control process.
+ Santos well test procedures.

Light emissions

Description of activity impacts

Light emissions will result from:

+ MODU operations.
+ Vessel operations.

Continuous lighting in the same location for an extended period may result in potential changes in behaviour, such as attraction, avoidance and disorientation, of marine fauna. Sources of light emissions typically used in the offshore petroleum industry are from operational lighting and flaring during well clean-up.

Compliance with the following key management measures

+ National Light Pollution Guidelines.

Operational discharges

Description of activity impacts

Planned discharges of:

+ Bilge water.
+ Boiler blowdown water.
+ Cooling water.
+ Deck drainage.
+ Desalination brine.
+ Putrescible waste.
+ Sewage and greywater.

Planned discharges associated with the activity will be small and intermittent, with volumes dependent on a range of variables. Operational discharges from vessels may create a localised and temporary reduction in marine water quality.

Compliance with the following key management measures

+ Deck cleaning and product selection.
+ Flushing spools and collections prior to disconnections.
+ Chemical management procedures.
+ Oily water treatment system compliant with MARPOL oily water treatment standard.
+ Santos product and chemical selection.
+ Sewage management compliant with MARPOL sewage management standard.
+ Santos waste management procedures.
+ Poppetted valves on subsea connections to reduce releases of fluids during flying lead and umbilical connections and disconnections.

Physical presence and interaction with other marine users

Description of activity impacts

Interaction with other marine users may occur as a result of vessel or helicopter activities. For commercial fishing licence holders, the level of interaction could lead to temporary displacement to fishing grounds. The presence of vessels could pose a navigational hazard and a collision risk.

Compliance with the following key management measures

+ Anchors are marked with surface buoys when MODU is not connected.
+ Santos marine assurance standard.
+ Maritime Notices.
+ MODU identification system.
+ Convention on the International Regulations for Preventing Collisions at Sea, 1972 /Marine Orders on navigational lighting.
+ Petroleum safety zone (exclusion zone).
+ Santos consultation activities for EP development and during the life of the EP.
+ Marine Orders on seafarer certification.
+ Support vessel on standby.

Seabed disturbance

Description of activity impacts

MODU, anchors, moorings and Halyard 2 subsea infrastructure. Seabed disturbance could result in localised removal of epifauna or decreases in the abundance and diversity of local infauna.

Compliance with the following key management measures

+ Santos vessel and MODU station keeping.
+ All equipment installed on the seabed designed such that it can be fully removed.

ACTIVITY RISKS

Accidental introduction of invasive marine species (IMS)

Description of activity risks

IMS may occur due to biofouling on vessels, discharge of high-risk ballast water and cross-contamination between vessels. IMS have the potential to cause significant loss of function for an environment or habitat.

Compliance with the following key management measures

+ Implementation of the management controls in the Santos Invasive Marine Species Management Plan.
+ International Convention on the Control of Harmful Anti-fouling Systems on Ships.

Unplanned hazardous and non-hazardous discharges

Description of activity risks

Potential release of chemicals and other non-hydrocarbon liquids may occur from:

+ MODU and support vessel operations.
+ Transferring, storing or using bulk products.
+ Mechanical failure of equipment.
+ Handling and storage spills and leaks.
+ Hose or hose connection failure or leak.
+ Lifting – dropped objects damaging liquid containers.

Liquids or chemicals released into the marine environment may lead to contamination of the water column in the vicinity of the release.

Compliance with the following key management measures

+ NOPSEMA accepted MODU safety case.
+ Oil pollution emergency plan.
+ Santos chemical selection procedure.
+ Santos Drilling and Completions Management Process.
+ Dropped object prevention procedures.
+ General chemical management procedures.
+ Hazardous chemical management procedures.
+ International Maritime Dangerous Goods Code.
+ ROV inspection and maintenance procedures.
+ Vessel preventative maintenance systems.
+ Well test procedures.

Unplanned interaction with marine fauna

Description of activity risks

Potential interaction with marine fauna may occur as a result of:

+ MODU operations.
+ Vessel operations.
+ Helicopter operations.

Marine fauna in surface waters would be most at risk from vessel collision.

Compliance with the following key management measures

+ Procedure for interacting with marine fauna.
+ Monitoring of surrounding marine environment by support vessel(s).

Unplanned hydrocarbon spill resulting from a vessel collision

Description of activity risks

A worst-case marine diesel spill for the proposed activity is a vessel collision resulting in the rupture of a fuel tank.

Compliance with the following key management measures

+ NOPSEMA accepted Oil Pollution Emergency Plan (OPEP).
+ Marine diesel fuel used for vessels.
+ MODU and support vessel spill response plans.
+ Refuelling and chemical transfer procedure.
+ Vessel Planned Maintenance System (PMS) to maintain vessel DP, engines and machinery.

Unplanned minor hydrocarbon release

Description of activity risks

A minor hydrocarbon release may occur as a result of:

+ ROV failure.
+ Loss of primary containment.
+ Pipework failure or rupture, hydraulic hose failure..
+ Lifting – dropped objects damaging diesel infrastructure.
+ The likelihood that a minor hydrocarbon release may occur is unlikely.

Compliance with the following key management measures

+ Dropped object prevention procedures.
+ Hazardous chemical management procedures.
+ Santos chemical selection procedure.
+ General chemical management procedures.
+ International Maritime Dangerous Goods Code.
+ ROV inspection and maintenance procedures.
+ NOPSEMA accepted Oil Spill Emergency Plan (OPEP).
+ Santos well test procedures.
+ MODU and support vessel(s) spill response plans.

Unplanned hydrocarbon spill resulting from a loss of well control

Description of activity risks

A worst-case credible oil spill scenario for the proposed activity is a loss of well control during drilling.

Compliance with the following key management measures

+ NOPSEMA accepted OPEP.
+ Drilling and Completions Management Process, including well integrity standards and NOPSEMA accepted Well Operations Management Plan (WOMP).
+ Isolation methodology designed and assessed by suitable qualified engineers, and isolation implemented as designed.
+ Marine assurance standard.
+ MODU and support vessel spill response plans including predrilling source control plan.

Unplanned release of solid objects

Description of activity risks	Key management measures
Potential release of solid objects such as: + Equipment and materials, such as hard hats, tools, or infrastructure parts. + Hazardous solid wastes, such as batteries, fluorescent tubes, and aerosol cans. + Non-hazardous solid wastes, such as paper and packaging. Solid objects, equipment and other items lost at sea could lead to disturbance of benthic habitats in the area where the object has been dropped.	+ Bulk solid transfer procedure. + Santos chemical selection procedure. + Dropped object prevention procedures. + General chemical management procedures. + Hazardous chemical management procedures. + International Maritime Dangerous Goods Code. + Waste (Garbage) Management Plan. + Dropped object study to determine risk and controls.

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 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.

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 first-hand feedback on commercial and recreational fishing, tourism and local community activities and interests.

Providing feedback

If you consider you may be a relevant person, please contact us by **26 June 2023** to allow Santos time 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 or if you need additional information.

Feedback provided by relevant persons will be considered in an addendum to the **Varanus Island Hub Operations Environment Plan (EP)** and through the life of the activity. Feedback from relevant persons will be 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.

E: offshore.consultation@santos.com

T: 1800 267 600

www.santos.com/offshoreconsultation

Santos

Spar Halyard Infill Project Environment Plan

Information for Relevant Persons

Activity Overview

Santos is planning to drill a development well, called Halyard 2, in Commonwealth waters commencing at the earliest in Q2 2024. Installation and pre-commissioning activities will also be undertaken to support future production through Santos' Varanus Island facilities.

The Operational Area for the Halyard 2 well is approximately 45 km from the nearest coastline (Barrow Island), and approximately 114 km north of Onslow, Western Australia (see **Figure 1**).

The expected durations are 50 days to drill and complete the well and 25 days for the installation and pre-commisioning activities.

The expected duration is a forecast and is subject to change based on vessel availability, adverse weather conditions or technical/equipment issues that may arise during operations.

Consultation & Feedback

All petroleum activities in Commonwealth waters must have an Environment Plan (EP) accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) before any activities can take place.

Under Commonwealth Environmental Regulations, Santos is required to consult with relevant persons about proposed activities when preparing an EP. A relevant person includes authorities, persons or organisations whose functions, interests or activities may be affected by the proposed activity.

You might 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, 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.

Santos is now consulting with relevant persons for activities proposed to be managed under an addendum to the Varanus Island Hub Operations Environment Plan. If you consider you may be a relevant person, please contact us as soon as possible if you require any further information or if you think you are not on our consultation list.

We are asking for relevant persons to provide feedback by **26 July 2023**.

Details on how to contact us are included in the **Providing Feedback** section of this information sheet.

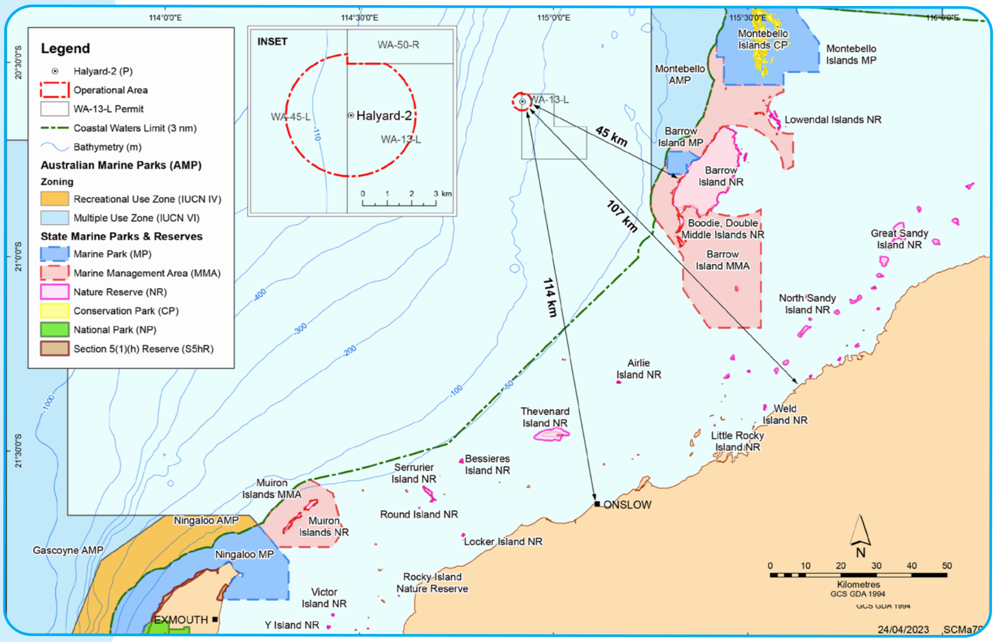


Figure 1. Spar Halyard activity location.

Activity Description

ACTIVITY DETAILS	
Location	Approximately 114 km north of Onslow, Western Australia.
Timing	The activity may occur any time between Q1 2024 and the end of 2025.
Duration	Expected duration of 75 days, comprising: + Drilling and completion - 50 days + Subsea installation and pre-commissioning - 25 days The expected duration is a forecast and is subject to change based on vessel availability, adverse weather conditions or technical/equipment issues that may arise during operations.
Water depth	Approximately 100 m to 130 m.
Planned activities	**Drilling (Halyard 2 well):** + Optional pre-mobilisation survey and pre-lay of moorings before moving the Semi-submersible mobile offshore drilling unit (MODU) to the operational area + Towing the MODU to the operational area and deploying moorings or connecting to pre-laid moorings + Install riser and blowout preventer (BOP) + Prepare and drill the well + Suspend well ready for commissioning **Installation (Halyard 2 well infrastructure):** + Seabed surveys (e.g., metrology, as-built survey) + Shut-in Halyard 1 well + Install subsea equipment and pressure test
Vessels	+ Semi-submersible MODU + Installation support vessel (ISV) + Up to four support vessels for activities such as anchor handling, MODU towing, transportation of equipment and consumables, bunkering etc.
Aircraft	Helicopters will be used for crew changes, critical equipment supply and emergency response. Helicopter flights will occur several times per week on average during the Spar-Halyard Infill Project.
Description of the natural environment	The Operational Area is flat and featureless, predominantly sand with a proportion of silt and clay.
Exclusion zone	A 500 m radius Petroleum Safety Zone (PSZ) exclusion zone will be in place around the MODU for the duration of the activity. The exclusion zone will remain around the well until eventual field decommissioning.
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Petroleum permits	+ WA-13-L (Halyard 2 well and Operational Area) + WA-45-L (Operational Area only)

ACTIVITY COORDINATES	Latitude (GDA94)	Longitude (GDA94)
Halyard 2 Wellhead Coordinates	20° 36’ 04.06” S	114° 55’ 09.33” E

Activity Purpose and Approvals

Santos has a long history of exploration, development and operations in the Northern Carnarvon Basin, with the drilling of the Halyard 2 development well supporting potential future gas production via Santos' Varanus Island Hub facilities.

The Varanus Island Hub is the base of Santos' Western Australian energy portfolio and has been in operation since 1986. Located 75km offshore northwest Australia, Varanus Island is surrounded by a network of offshore fixed production platforms which feed gas, oil and condensate into the island's facilities for processing, storage and export to market.

Gas produced at this facility is transported via pipeline to shore for connection into the Dampier to Bunbury Natural Gas Pipeline for supply to Western Australian gas customers.

Santos will use a semi-submersible Mobile Offshore Drilling Unit (MODU) to drill the Halyard 2 well.

Semi-submersible MODUs are typically used in deeper waters where the rig floats on the ocean surface and can be moored using anchors deployed from the rig or use onboard propulsion systems to maintain the rig's position at the drilling location.

Installation of subsea infrastructure will also be undertaken to support future production to Santos' existing facilities.

An addendum to the Varanus Island Hub Operations EP is being prepared for planned activities, under which all activity impacts and risks are proposed to be managed to a level as low as reasonably practicable and acceptable over the life of the activity.

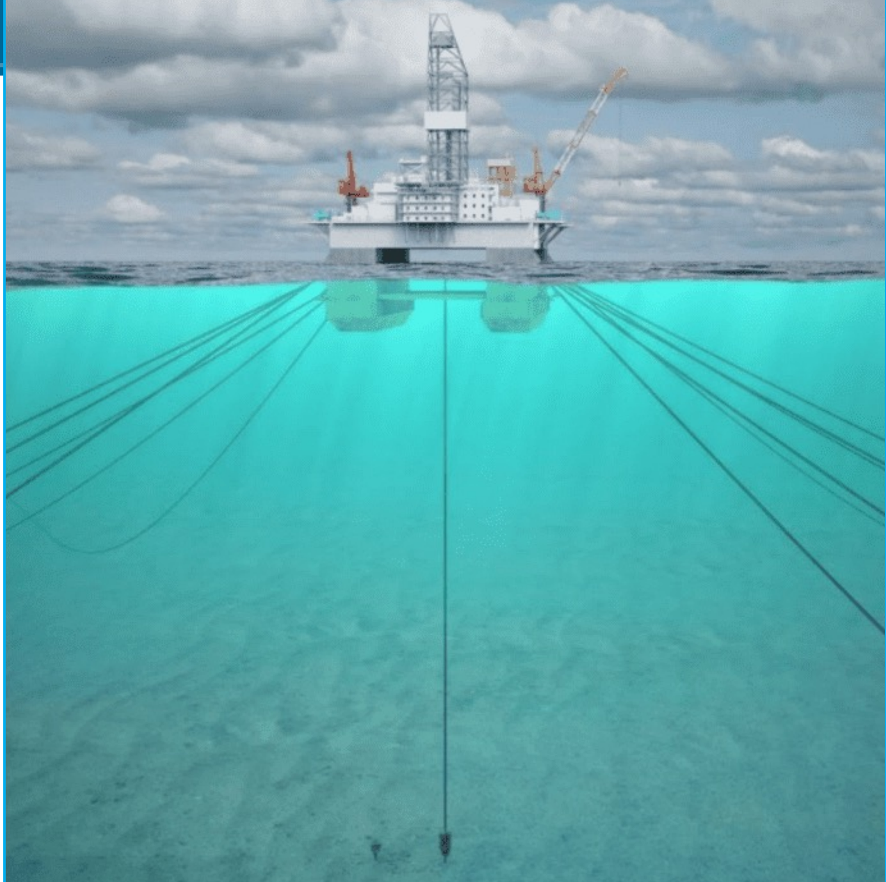

Figure 2. *A graphical representation of a semisubmersible MODU.*

The addendum to the EP will be submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for acceptance in accordance with the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).*

Santos may also undertake the activities described in the accepted Varanus Island Hub Operations EP in addition to the Spar-Halyard Infill Project activities. Santos has previously consulted with relevant persons regarding these activities, which include:

+ Operation of the John Brookes field infrastructure.
+ Operation of the Greater East Spar subsea infrastructure.
+ Operational activities, such as platform visits, inspections, maintenance and repair.
+ Associated vessel operations.
+ Eventual decommissioning of Santos' property after the end of the productive life.

Refer to the **Varanus Island Hub Operations EP** on NOPSEMA's website for further information.

Defining the Environment Area for Proposed Activities

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 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 outer boundary of worst-case spill resulting from a loss of well control during drilling. The EMBA for proposed drilling and installation activities is illustrated in **Figure 2**.

Oil spill EMBAs are defined by overlaying a great number (usually hundreds) of individual, computer simulated, hypothetical oil 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 EMBA represents the largest possible spatial extent that could be contacted by the worst-case spill events modelled, an actual spill event is more accurately represented by a single simulation run, resulting in a smaller spatial extent in the event of an actual 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 Environment Plans.

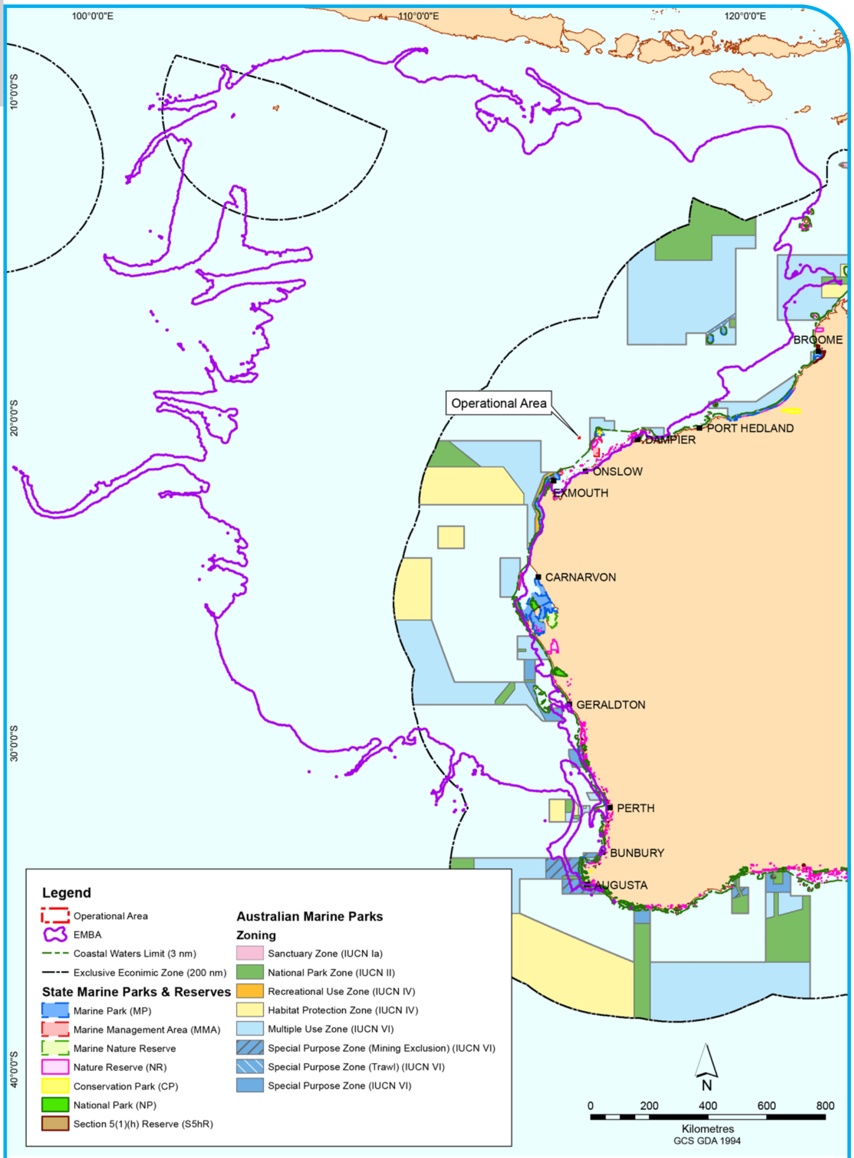

Figure 3. *Activity location map with EMBA*

TABLE 1
ENVIRONMENT AREA FOR PROPOSED ACTIVITIES

ENVIRONMENT AREA
Operational Area The area in which the MODU and support vessels will operate.
Environment that May Be Affected The spatial extent of activity impacts (e.g., facility presence, light, noise) and risk (e.g., hydrocarbon spill).

Environmental, Social, Economic and Cultural Features

We have undertaken a review of publicly available information to identify environmental, social, economic and cultural features that may be affected by activity impacts and risks, which are summarised in **Table 2**. These aspects will be risk-assessed within the EP on a case-by-case basis.

TABLE 2
ENVIRONMENTAL, SOCIAL, ECONOMIC AND CULTURAL FEATURES

FEATURES	DESCRIPTION	OPERATIONAL AREA	EMBA	PUBLIC INFORMATION REVIEW
Aboriginal Heritage	Registered Aboriginal heritage sites protected under the: + *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* + *WA Aboriginal Heritage Act 2021*	No	Yes	Barrow Island, Montebello Islands, Exmouth, Ningaloo Reef and the adjacent foreshores have a long history of occupancy by Indigenous communities.
Cultural Heritage	Registered cultural sites under the: + *Underwater Cultural Heritage Act 2018*	No	Yes	No known sites of shipwrecks, sunken aircraft or Aboriginal and Torres Strait Islander Underwater Cultural Heritage have been identified within the Operational Area. The nearest shipwreck, an unidentified probable wreck in Bandicoot Bay, is approximately 53 km southeast of the Operational Area.
Defence	Designated defence activity areas	Yes	Yes	Defence activities may take place within the Operational Area. The Operational Area is within a Defence Practice Area.
Fishing	Commercial fishing	Yes	Yes	A number of Commonwealth and State fisheries overlap the EMBA, of which some are active in the Operational Area.
	Indigenous, subsistence or customary fishing	No	Yes	Traditional Australian Indigenous fishing activities are generally concentrated within 3 NM of the Northern Territory / Western Australian coastline.
	Recreational and charter boat fishing	No	Yes	No interaction with recreational or charter boat fishers is anticipated in the Operational Area given the remoteness of the activity location. Recreational and charter boat fishing occurs within the EMBA.

Oil and Gas Operations	Petroleum operations	No	Yes	Petroleum exploration and production activities are undertaken within the EMBA. The Operational Area overlaps Santos operated infrastructure associated with the Varanus Island Hub.
Protected Areas (nearest Commonwealth and State marine parks)	Montebello Marine Park (Commonwealth)	No	Yes	The Montebello Marine Park is approximately 32 km east of the Operational Area.
	Barrow Island Marine Management Area (State)	No	Yes	The Barrow Island Marine Management Area is approximately 40 km east of the Operational Area.
Shipping	Shipping fairway	No	Yes	The Operational Area does not overlap any shipping fairways, although vessel traffic may be encountered as commercial vessels transit around Barrow Island and the Montebello Islands.
Telecommunications	Subsea telecommunications cables	No	Yes	The Darwin-Jakarta-Singapore Cable connects facilities onshore at Port Hedland, to Darwin, Christmas Island, Indonesia and Singapore and is more than 100 km north of the Operational Area.
Tourism	Tourism operations	No	Yes	Remoteness of the Operational Area and water depth limits opportunities for tourism. Tourism occurs within the EMBA.
Towns / communities	Onslow	No	Yes	Onslow is the nearest community and is approximately 114 km south of the Operational Area.
	Karratha	No	Yes	Karratha is the nearest city and is approximately 200 km southeast of the Operational Area.

Activity Impacts and Risk Management

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 with the Environment Plan on a case-by-case basis.

TABLE 3
ACTIVITY IMPACT AND RISK MANAGEMENT

ACTIVITY IMPACTS (DRILLING AND INSTALLATION OF HALYARD 2 SUBSEA INFRASTRUCTURE)

Acoustic disturbance to marine fauna

Description of activity impacts

Noise emissions from:

+ Flaring.
+ Helicopter operations.
+ MODU operations.
+ ROV operations.
+ Vessel operations.

Elevated underwater noise has the potential to change marine fauna behaviour such as attraction, avoidance and disorientation. The sensitivity of fauna to elevated noise levels varies depending on individual response.

Compliance with the following key management measures

+ Santos procedures for interacting with marine fauna.

Atmospheric emissions

Description of activity impacts

Atmospheric emissions will result from:

+ MODU operations.
+ Vessel operations.

Hydrocarbon combustion may result in a temporary, localised reduction of air quality in the environment immediately surrounding the discharge point during the activity. Non-GHG emissions, (NOX and SOX), can lead to a reduction in local air quality.

Compliance with the following key management measures

+ International Convention for the Prevention of Pollution from Ships (MARPOL) International Air Certificate.
+ Santos bulk solid transfer procedure.
+ Fuel oil quality compliant with MARPOL standard for fuel oil quality.
+ Santos Marine Assurance Standard.
+ MARPOL ozone-depleting substance handling procedures.
+ Vessel preventative maintenance systems.
+ Waste incineration compliant with MARPOL waste incineration standard.
+ Santos well test procedures.

Drilling discharges

Description of activity impacts

Drilling discharges include drilling muds, which will be water-based for this activity. Drilling discharges from the MODU will have a localised impact on water quality, sediment quality and benthic habitats.

Compliance with the following key management measures

+ Santos chemical selection procedure.
+ Cuttings management system.
+ Santos inventory control process.
+ Santos well test procedures.

Light emissions

Description of activity impacts

Light emissions will result from:

+ MODU operations.
+ Vessel operations.

Continuous lighting in the same location for an extended period may result in potential changes in behaviour, such as attraction, avoidance and disorientation, of marine fauna. Sources of light emissions typically used in the offshore petroleum industry are from operational lighting and flaring during well clean-up.

Compliance with the following key management measures

+ National Light Pollution Guidelines.

Operational discharges

Description of activity impacts

Planned discharges of:

+ Bilge water.
+ Boiler blowdown water.
+ Cooling water.
+ Deck drainage.
+ Desalination brine.
+ Putrescible waste.
+ Sewage and greywater.

Planned discharges associated with the activity will be small and intermittent, with volumes dependent on a range of variables. Operational discharges from vessels may create a localised and temporary reduction in marine water quality.

Compliance with the following key management measures

+ Deck cleaning and product selection.
+ Flushing spools and collections prior to disconnections.
+ Chemical management procedures.
+ Oily water treatment system compliant with MARPOL oily water treatment standard.
+ Santos product and chemical selection.
+ Sewage management compliant with MARPOL sewage management standard.
+ Santos waste management procedures.
+ Poppetted valves on subsea connections to reduce releases of fluids during flying lead and umbilical connections and disconnections.

Physical presence and interaction with other marine users

Description of activity impacts

Interaction with other marine users may occur as a result of vessel or helicopter activities. For commercial fishing licence holders, the level of interaction could lead to temporary displacement to fishing grounds. The presence of vessels could pose a navigational hazard and a collision risk.

Compliance with the following key management measures

+ Anchors are marked with surface buoys when MODU is not connected.
+ Santos marine assurance standard.
+ Maritime Notices.
+ MODU identification system.
+ Convention on the International Regulations for Preventing Collisions at Sea, 1972 /Marine Orders on navigational lighting.
+ Petroleum safety zone (exclusion zone).
+ Santos consultation activities for EP development and during the life of the EP.
+ Marine Orders on seafarer certification.
+ Support vessel on standby.

Seabed disturbance

Description of activity impacts

MODU, anchors, moorings and Halyard 2 subsea infrastructure. Seabed disturbance could result in localised removal of epifauna or decreases in the abundance and diversity of local infauna.

Compliance with the following key management measures

+ Santos vessel and MODU station keeping.
+ All equipment installed on the seabed designed such that it can be fully removed.

ACTIVITY RISKS

Accidental introduction of invasive marine species (IMS)

Description of activity risks

IMS may occur due to biofouling on vessels, discharge of high-risk ballast water and cross-contamination between vessels. IMS have the potential to cause significant loss of function for an environment or habitat.

Compliance with the following key management measures

+ Implementation of the management controls in the Santos Invasive Marine Species Management Plan.
+ International Convention on the Control of Harmful Anti-fouling Systems on Ships.

Unplanned hazardous and non-hazardous discharges

Description of activity risks

Potential release of chemicals and other non-hydrocarbon liquids may occur from:

+ MODU and support vessel operations.
+ Transferring, storing or using bulk products.
+ Mechanical failure of equipment.
+ Handling and storage spills and leaks.
+ Hose or hose connection failure or leak.
+ Lifting – dropped objects damaging liquid containers.

Liquids or chemicals released into the marine environment may lead to contamination of the water column in the vicinity of the release.

Compliance with the following key management measures

+ NOPSEMA accepted MODU safety case.
+ Oil pollution emergency plan.
+ Santos chemical selection procedure.
+ Santos Drilling and Completions Management Process.
+ Dropped object prevention procedures.
+ General chemical management procedures.
+ Hazardous chemical management procedures.
+ International Maritime Dangerous Goods Code.
+ ROV inspection and maintenance procedures.
+ Vessel preventative maintenance systems.
+ Well test procedures.

Unplanned interaction with marine fauna

Description of activity risks

Potential interaction with marine fauna may occur as a result of:

+ MODU operations.
+ Vessel operations.
+ Helicopter operations.

Marine fauna in surface waters would be most at risk from vessel collision.

Compliance with the following key management measures

+ Procedure for interacting with marine fauna.
+ Monitoring of surrounding marine environment by support vessel(s).

Unplanned hydrocarbon spill resulting from a vessel collision

Description of activity risks

A worst-case marine diesel spill for the proposed activity is a vessel collision resulting in the rupture of a fuel tank.

Compliance with the following key management measures

+ NOPSEMA accepted Oil Pollution Emergency Plan (OPEP).
+ Marine diesel fuel used for vessels.
+ MODU and support vessel spill response plans.
+ Refuelling and chemical transfer procedure.
+ Vessel Planned Maintenance System (PMS) to maintain vessel DP, engines and machinery.

Unplanned minor hydrocarbon release

Description of activity risks

A minor hydrocarbon release may occur as a result of:

+ ROV failure.
+ Loss of primary containment.
+ Pipework failure or rupture, hydraulic hose failure..
+ Lifting – dropped objects damaging diesel infrastructure.
+ The likelihood that a minor hydrocarbon release may occur is unlikely.

Compliance with the following key management measures

+ Dropped object prevention procedures.
+ Hazardous chemical management procedures.
+ Santos chemical selection procedure.
+ General chemical management procedures.
+ International Maritime Dangerous Goods Code.
+ ROV inspection and maintenance procedures.
+ NOPSEMA accepted Oil Spill Emergency Plan (OPEP).
+ Santos well test procedures.
+ MODU and support vessel(s) spill response plans.

Unplanned hydrocarbon spill resulting from a loss of well control

Description of activity risks

A worst-case credible oil spill scenario for the proposed activity is a loss of well control during drilling.

Compliance with the following key management measures

+ NOPSEMA accepted OPEP.
+ Drilling and Completions Management Process, including well integrity standards and NOPSEMA accepted Well Operations Management Plan (WOMP).
+ Isolation methodology designed and assessed by suitable qualified engineers, and isolation implemented as designed.
+ Marine assurance standard.
+ MODU and support vessel spill response plans including predrilling source control plan.

Unplanned release of solid objects

Description of activity risks	Key management measures
Potential release of solid objects such as: + Equipment and materials, such as hard hats, tools, or infrastructure parts. + Hazardous solid wastes, such as batteries, fluorescent tubes, and aerosol cans. + Non-hazardous solid wastes, such as paper and packaging. Solid objects, equipment and other items lost at sea could lead to disturbance of benthic habitats in the area where the object has been dropped.	+ Bulk solid transfer procedure. + Santos chemical selection procedure. + Dropped object prevention procedures. + General chemical management procedures. + Hazardous chemical management procedures. + International Maritime Dangerous Goods Code. + Waste (Garbage) Management Plan. + Dropped object study to determine risk and controls.

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 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.

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 first-hand feedback on commercial and recreational fishing, tourism and local community activities and interests.

Providing feedback

If you consider you may be a relevant person, please contact us as soon as possible if you require any further information or if you think you are not on our consultation list.

We are asking for relevant persons to provide feedback by **26 July 2023**.

Feedback provided by relevant persons will be considered in an addendum to the **Varanus Island Hub Operations Environment Plan (EP)** and through the life of the activity. Feedback from relevant persons will be 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.

Santos

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Appendix G 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	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.

Consequence Level		I	II	III	IV	V	VI
				significant population decline.			
	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[6]; habitat within a protected area; habitats that include benthic primary producers[7]and/ or epi-fauna[8]	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;	No or negligible impact on protected area values;	Detectable but insignificant impact on one of more of	Significant impact on one of more of	Major long term effect on one of more	Extensive loss of one or more of protected area's values;	Complete loss of one or more of protected

[6] *As defined by the Department of Agriculture, Water and Environment (DaWE)*
[7] *Benthic photosynthetic organisms such as seagrass, algae, hard corals and mangroves*
[8] *Fauna attached to the substrate including sponges, soft corals and crinoids.*

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Consequence Level		I	II	III	IV	V	VI
	Commonwealth/ National Heritage Areas; Land/ Marine Conservation Reserves.	No decline in species population within protected area; No or negligible alteration, modification, obscuring or diminishing of protected area values.*	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*	protected area's values; Significant decrease in population within protected area; Significant alteration, modification, obscuring or diminishing of protected area values.	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 species population contained within protected area.	area's values with no recovery; Complete loss of species population contained within protected area with no recovery.
	Socio-economic receptors Includes: fisheries (commercial and recreational); tourism; oil and gas; defence; commercial shipping.	No or negligible loss of value of the local industry; No or negligible reduction in key natural features or populations supporting the activity.	Detectable but insignificant short-term loss of value of the local industry. Detectable but insignificant reduction in key natural features or population supporting the local activity.	Significant loss of value of the local industry; Significant medium term reduction of key natural features or populations supporting the local activity.	Major long-term loss of value of the local industry and threat to viability. Major reduction of key natural features or populations supporting the local activity.	Shutdown of local industry or widespread major damage to regional industry; Extensive loss of key natural features or populations supporting the local industry.	Permanent shutdown of local or regional industry; Permanent loss of key natural features or populations supporting the local or regional industry.

Appendix H Spill Modelling Results

Appendix G1: Stochastic Spill Modelling Results for:

surface release of condensate from John Brookes wellheads

subsea release of condensate from subsea pipeline

subsea release of condensate from wellheads

Appendix G2: High Environmental Value Consequence Summary

Appendix H1: Stochastic Spill Modelling Results

Modelling results for surface release of condensate from John Brookes Wellheads

Receptor	Receptor Type	Minimum Time to Contact (Hours)							Maximum hydrocarbon concentration							Max. Oil Ashore (m3)	Max. Length of Oiled Shoreline (km)		
		Moderate Exposure Values			High Exposure Values				Moderate Exposure Values			High Exposure Values							
		Shoreline accumulation (100 g/m2)	Surface hydrocarbons (10 g/m2)	Dissolved aromatics (50 ppb)	Entrained hydrocarbons (100 ppb)	Shoreline accumulation (1,000 g/m2)	Surface hydrocarbons (25 g/m2)	Dissolved aromatics (400 ppb)	Shoreline accumulation (100 g/m2)	Surface hydrocarbons (10 g/m2) *	Dissolved aromatics (50 ppb)	Entrained hydrocarbons (100 ppb)	Shoreline accumulation (1,000 g/m^2)	Surface hydrocarbons (25 g/m^2) *	Dissolved aromatics (400 ppb)	Shoreline accumulation	Shoreline accumulation (100 g/m^2)		
Barrow Island	Emergent	105	NC	C	230	NC	NC	C	711	NC	E	1077	NC	NC	414	20	61	Barrow Island	Emergent
Muiron Islands	Emergent	568	NC	C	122	NC	NC	NC	144	NC	199	169	NC	NC	NC	3	9	Muiron Islands	Emergent
Ningaloo Coast North	Emergent	129	NC	C	105	NC	NC	NC	966	NC	321	823	NC	NC	NC	14	65	Ningaloo Coast North	Emergent
Lowendal Islands	Shoreline	NA	NC	C	363	NA	NC	NC	NA	NC	52	515	NA	NC	NC	NA	NC	Lowendal Islands	Shoreline
Montebello Islands	Emergent	171	NC	C	106	413	NC	NC	E	NC	146	1198	1543	NC	NC	33	43	Montebello Islands	Emergent
Barrow-Montebello Surrounds*	Intertidal	NA	NC	C	58	NC	NC	C	579	NC	E	1216	NC	NC	412	NA	NA	Barrow-Montebello Surrounds*	Intertidal
Montebello AMP	AMP	NA	NC	C	18	NA	NC	C	NA	NC	E	2574	NA	NC	583	NA	NA	Montebello AMP	AMP
Offshore Ningaloo	AMP	NA	1396	C	16	NA	NC	C	NA	NC	E	4434	NA	NC	1238	NA	NA	Offshore Ningaloo	AMP
Outer Ningaloo	AMP	NA	NC	C	92	NA	NC	C	NA	NC	E	1089	NA	NC	429	NA	NA	Outer Ningaloo	AMP

Receptor	Receptor Type	Minimum Time to Contact (Hours)							Maximum hydrocarbon concentration							Max. Oil Ashore (m3)	Max. Length of Oiled Shoreline (km)			
		Moderate Exposure Values			High Exposure Values				Moderate Exposure Values			High Exposure Values								
		Shoreline accumulation (100 g/m2)	Surface hydrocarbons (10 g/m2)	Dissolved aromatics (50 ppb)	Entrained hydrocarbons (100 ppb)	Shoreline accumulation (1,000 g/m2)	Surface hydrocarbons (25 g/m2)	Dissolved aromatics (400 ppb)	Shoreline accumulation (100 g/m2)	Surface hydrocarbons (10 g/m2) *	Dissolved aromatics (50 ppb)	Entrained hydrocarbons (100 ppb)	Shoreline accumulation (1,000 g/m^2)	Surface hydrocarbons (25 g/m^2) *	Dissolved aromatics (400 ppb)	Shoreline accumulation	Shoreline accumulation (100 g/m^2)			
Coast North																		Coast North		
Outer NW Ningaloo	AMP	NA	NC	C	64	NA	NC	C	NA	NC	E	2766	NA	NC	412	NA	NA	Outer NW Ningaloo	AMP	
Southern Islands Coast	Emergent	1245	NC	C	550	NC	NC	NC	E	NC	187	400	NC	NC	NC	8	37	Southern Islands Coast	Emergent	
Rankin Bank	Submerged	NA	NC	C	354	NA	NC	NC	NA	NC	63	287	NA	NC	NC	NA	NA	Rankin Bank	Submerged	
Thevenard Island	Emergent	NC	NC	NC	1261	NC	NC	NC	NC	NC	NC	268	NC	NC	NC	2	7	Thevenard Island	Emergent	
Glomar Shoals	Emergent	NA	NC	NC	1108	NA	NC	NC	NA	NC	NC	206	NA	NC	NC	NA	NA	Glomar Shoals	Emergent	
Middle Islands Coast	Emergent	NC	NC	NC	676	NC	NC	NC	NC	NC	NC	170	NC	NC	NC	NC	14	Middle Islands Coast	Emergent	
Abrolhos West	Submerged	NA	NC	NC	2149	NA	NC	NC	NA	NC	NC	121	NA	NC	NC	NA	<1	Abrolhos West	Submerged	
Offshore Abrolhos – Perth North	Submerged	NA	NC	NC	2467	NA	NC	NC	NA	NC	NC	112	NA	NC	NC	NA	<1	Offshore Abrolhos – Perth North	Submerged	
Offshore Abrolhos – NW	Submerged	NA	NC	C	356	NA	NC	NC	NA	NC	109	313	NA	NC	NC	NA	<1	Offshore Abrolhos – NW	Submerged	

Receptor	Receptor Type	Minimum Time to Contact (Hours)							Maximum hydrocarbon concentration							Max. Oil Ashore (m3)	Max. Length of Oiled Shoreline (km)		
		Moderate Exposure Values			High Exposure Values				Moderate Exposure Values			High Exposure Values							
		Shoreline accumulation (100 g/m2)	Surface hydrocarbons (10 g/m2)	Dissolved aromatics (50 ppb)	Entrained hydrocarbons (100 ppb)	Shoreline accumulation (1,000 g/m2)	Surface hydrocarbons (25 g/m2)	Dissolved aromatics (400 ppb)	Shoreline accumulation (100 g/m2)	Surface hydrocarbons (10 g/m2) *	Dissolved aromatics (50 ppb)	Entrained hydrocarbons (100 ppb)	Shoreline accumulation (1,000 g/m^2)	Surface hydrocarbons (25 g/m^2) *	Dissolved aromatics (400 ppb)	Shoreline accumulation	Shoreline accumulation (100 g/m^2)		
Outer Abrolhos Islands – Shoals	Submerged	NA	NC	NC	2078	NA	NC	NC	NA	NC	NC	186	NA	NC	NC	NA	<1	Outer Abrolhos Islands – Shoals	Submerged
Rowley Shoals surrounds	Submerged	NA	NC	NC	2796	NA	NC	NC	NA	NC	NC	115	NA	NC	NC	NA	<1	Rowley Shoals surrounds	Submerged

E = Exceeded

C = Contacted at threshold (timeframe and maximum concentration not specified in modelling)

NC = No contact

** This receptor is only emergent at lowest astronomical tide therefore accumulation is considered temporary only under these tidal conditions.*

Modelling results for subsea release of condensate from subsea pipeline

Receptor	Receptor Type	Minimum Time to Contact (Hours)							Maximum Hydrocarbon Concentration							Max. Oil Ashore (m^3)	Max. Length of Oiled 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 aromatics (50 ppb)	Entrained hydrocarbons (100 ppb)	Shoreline accumulation (1,000 g/m^2)	Surface hydrocarbons (25 g/m^2)	Dissolved aromatics (400 ppb)	Shoreline accumulation (100 g/m^2)	Surface hydrocarbons (10 g/m^2)*	Dissolved aromatics (50 ppb)	Entrained hydrocarbons (100 ppb)	Shoreline accumulation (1,000 g/m^2)	Surface hydrocarbons (25 g/m^2)*	Dissolved aromatics (400 ppb)	Shoreline accumulation	Shoreline accumulation (100 g/m^2)
Lowendal Islands	Shoreline	19	7	C	4	NC	8	NC	860	C	292	714	NC	NC	NC	6	4
Montebello Islands	Emergent	16	NC	C	19	NC	NC	NC	764	NC	396	618	NC	NC	NC	11	37
Barrow-Montebello Surrounds*	Emergent	NC	1	C	2	NC	1	C	NC	C	E	2010	NA	NC	978	NC	NC
Montebello MP	State MP	22	1	C	2	NC	1	C	NC	C	E	2394	NA	NC	1181	NC	NC
Barrow Island	Emergent	16	3	C	3	NC	NC	C	E	C	E	803	1110	NC	719	20	44
Muiron Islands	Emergent	NC	NC	NC	294	NC	NC	NC	NC	NC	NC	145	NC	NC	NC	NC	NC
Ningaloo Coast North	Emergent	NC	NC	C	332	NC	NC	NC	NC	NC	91	153	NC	NC	NC	NC	NC
Offshore Ningaloo	AMP	NC	NC	C	149	NC	NC	NC	NC	NC	238	156	NC	NC	NC	NC	NC
Outer Ningaloo Coast North	AMP	NC	NC	C	NC	NC	NC	NC	NC	NC	106	NC	NC	NC	NC	NC	NC
Outer NW Ningaloo	AMP	NC	NC	C	341	NC	NC	NC	NC	NC	107	104	NC	NC	NC	NC	NC
Southern Islands Coast	Coast	NC	NC	C	462	NC	NC	NC	NC	NC	61	186	NC	NC	NC	NC	NC
Thevenard Island	Emergent	NC	NC	NC	196	NC	NC	NC	NC	NC	NC	241	NC	NC	NC	NC	NC

E = Exceeded

C= Contacted at threshold (timeframe and maximum concentration not specified in modelling)

NC = No contact

** This receptor is only emergent at lowest astronomical tide therefore accumulation is considered temporary only under these tidal conditions.*

Appendix H2: High Environmental Consequence Summary

Receptor (Hotspot) Name	HEV Ranking	Values	Oil Spill Modelling Parameter NC = No Contact		Subsea	Surface	Consequence Category	Consequence Ranking	Final
Outer Ningaloo Coast North (submerged)	1	Habitats The Ningaloo Reef itself and its juxtaposition with coastal terraces, limestone plains, reef sediments. The contact of the reef by entrained oil may reduce the aesthetic appeal and diminish these values. Marine mammals Seasonal aggregations of whale sharks, manta rays, sea turtles and rays. Whale sharks Mar-Jul. Loggerhead turtles. Green turtles Dec-Mar. Low density hawksbill turtles. Pygmy blue whale feeding. Socio-economic and heritage values Very significant for recreational fishing, game fishing and charter boat tourism. Protected Areas. World Heritage Areas. Australian Marine Park.	Probability of contact by floating oil at 10 g/m²	(%)	NC	NC	Threatened/ migratory fauna Physical environment/ habitat Protected areas Socio-economic receptors	II II II II	II
			Minimum time to contact by floating oil 10 g/m²	Time (days)	NC	NC			
			Maximum accumulated oil ashore >100 g/m²	m³	NC	NC			
			Maximum accumulated concentration >100 g/m²	g/m²	NC	NC			
			Maximum length of shoreline oiled (>100 g/m²)	(km)	NC	NC			
			Maximum concentration of entrained oil >100 ppb	(ppb)	526	821			
			Maximum concentration of dissolved hydrocarbon >50 ppb	(ppb)	245	121			
Muiron Islands (emergent)	2	The Muiron Islands are part of the Ningaloo World Heritage Area. Physical habitats Coral reefs – Soft coral communities dominate the reefs on the western side of the Muiron Islands whilst	Probability of contact by floating oil at 10 g/m²	(%)	NC	NC	Threatened/ Migratory Fauna Physical Environment/ Habitat Protected Areas Socio-economic Receptors	IV IV IV III	IV
			Minimum time to contact by floating oil 10 g/m²	Time (days)	NC	NC			

Receptor (Hotspot) Name	HEV Ranking	Values	Oil Spill Modelling Parameter NC = No Contact		Subsea	Surface	Consequence Category	Consequence Ranking	Final
		habitats on the eastern side of the Muiron Islands are more sheltered, consisting of sandy beaches and shallow lagoons with diverse soft and hard coral communities (Cassata & Collins, 2008). The northern boundary substrate can be described as a combination of sand covered limestone pavement (Quadrant Energy, 2016) Seagrasses – Identified on the eastern side of the Muiron Islands. Macroalgae – Seagrass and macroalgal habitats are present within the NWS region including Muiron Islands (eastern side). Sandy beaches – The western shores comprise sandy beaches sloping away to the shelf backed by low dunes. Marine fauna Invertebrates – Not identified within the area although noted in the deeper offshore environment or the more protected environment of the nearby Exmouth Gulf (refer Ningaloo Coast hotspot). Fish and sharks – Shark aggregations are seasonally reported and manta rays are commonly found in the area. Seabirds – Significant bird breeding. Several BIAs for reproduction, foraging and resting include the Muiron Islands.	Maximum accumulated oil ashore >100 g/m²	m³	18	9			
			Maximum accumulated concentration >100 g/m²	g/m²	478	209			
			Maximum length of shoreline oiled (>100 g/m²)	(km)	5	3			
			Maximum concentration of entrained oil >100 ppb	(ppb)	289	480			
			Maximum concentration of dissolved hydrocarbon >50 ppb	(ppb)	174	69			

Receptor (Hotspot) Name	HEV Ranking	Values	Oil Spill Modelling Parameter NC = No Contact		Subsea	Surface	Consequence Category	Consequence Ranking	Final
		There are five known rookeries as well isolated rookeries on the Muiron and Sunday Islands. Marine reptiles: turtles – Provides important aggregation and nesting areas for turtle populations, including the loggerhead (Caretta caretta) and green (Chelonia mydas). The North West Cape and Muiron Islands are major nesting sites for loggerhead turtles, with approximately 400 and 600 females nesting annually on the Ningaloo Coast (particularly, North West Cape area) and Muiron Islands respectively (DEP, 2001). The Recovery Plan for Marine Turtles in Australia (2003) 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. The Muiron Islands are minor nesting sites for flatback and hawksbill turtles (DEC, 2009a). Marine mammals – Seasonal aggregations of whale sharks, manta rays, sea turtles and rays. Whale sharks Mar-Jul. Pygmy blue whale feeding. Protected areas The Ningaloo Coast World Heritage Area (WHA) also includes the Muiron Islands as having outstanding universal value for the Ningaloo Coast							

Receptor (Hotspot) Name	HEV Ranking	Values	Oil Spill Modelling Parameter NC = No Contact		Subsea	Surface	Consequence Category	Consequence Ranking	Final
		(Refer to Ningaloo Coast hotspot). The Ningaloo Coast WHA includes Muiron Island Marine Management Area (including the Muiron Islands) category IA – Sanctuary Zone (islands) and II – Marine National Park Zone. Socio-economic and heritage values Significant for recreational fishing and charter boat tourism. Social amenities and other tourism such as commercial dive charters. The unclassified waters of the Muiron Islands Marine Management area are also open to commercial fishing in accordance with the Fish Resources Management Act 1994. The Management Plan for the Ningaloo Marine Park and Muiron Islands Marine Management Area (2005 to 2015) identifies that the area has significant indigenous heritage value associated with historical and current use but the linkage appears to be directly related to the Ningaloo Reef and the adjacent foreshore as opposed to the Muiron Islands,							
Ningaloo Coast North	2	Habitats	Probability of contact by floating oil at 10 g/m²	(%)	NC	NC	Threatened/Migratory Fauna	IV IV	IV

Receptor (Hotspot) Name	HEV Ranking	Values	Oil Spill Modelling Parameter NC = No Contact		Subsea	Surface	Consequence Category	Consequence Ranking	Final
(emergent)		Contains part of the largest fringing reef in Australia. Lagoonal, intertidal and subtidal coral communities. Nine species of seagrass + macroalgae beds. Mangrove bay – Significant for mangroves. Yardie Creek – Significant mangroves and tidal creek. Marine mammals Seasonal aggregations of whale sharks, manta rays, sea turtles and rays. Whale sharks Mar-Jul. Loggerhead turtles. Green turtles Dec-Mar. Low density hawksbill turtles. Pygmy blue whale feeding. Seabirds 33 species of seabirds and avifauna. Main breeding areas at Mangrove Bay, Mangrove Point, Point Maud, the Mildura Wreck Site and Fraser Island. Protected areas Includes 13 out of the 18 sanctuary zones under the state MP. World Heritage Areas – Exmouth Peninsula Karst System is an official value of the National Heritage Area. Socio-economic and heritage values Tourism. Recreational fishing – fishing and charter boat tourism.	Minimum time to contact by floating oil 10 g/m²	Time (days)	NC	NC	Physical Environment/ Habitat Protected Areas Socio-Economic Receptors	IV II	
			Maximum accumulated oil ashore >100 g/m²	m3	54	23			
			Maximum accumulated concentration >100 g/m²	g/m²	517	179			
			Maximum length of shoreline oiled (>100 g/m²)	(km)	16	6			
			Maximum concentration of entrained oil >100 ppb	(ppb)	373	581			
			Maximum concentration of dissolved hydrocarbon >50 ppb	(ppb)	119	55			

Receptor (Hotspot) Name	HEV Ranking	Values	Oil Spill Modelling Parameter NC = No Contact		Subsea	Surface	Consequence Category	Consequence Ranking	Final
Barrow-Montebello Surrounds (intertidal)	3	Habitats Coral reefs habitat. Seabirds Migratory birds. Turtles Internesting. Whales Humpback/pygmy blue whale migration. Socio-economic Significant for recreational fishing and charter boat tourism.	Probability of contact by floating oil at 10 g/m²	(%)	NC	NC	Threatened/ migratory fauna Physical environment/ habitat Protected areas Socio-economic receptors	III II II II Fauna consequence allocated III due to turtle nesting	III
			Minimum time to contact by floating oil 10 g/m²	Time (days)	NC	NC			
			Maximum accumulated oil ashore >100 g/m²	m3	NC	NC			
			Maximum accumulated concentration >100 g/m²	g/m²	NC	NC			
			Maximum length of shoreline oiled (>100 g/m²)	(km)	NC	NC			
			Maximum concentration of entrained oil >100 ppb	(ppb)	308	494			
			Maximum concentration of dissolved hydrocarbon >50 ppb	(ppb)	456	254			
Montebello Islands (emergent)	3	Habitats Reefs – coral spawning: Mar & Oct. Algae (40%). Mangroves (considered globally unique as they are offshore). Fish habitat. Intertidal sand flat communities. Turtles Loggerhead and green (significant rookery), hawksbill,	Probability of contact by floating oil at 10 g/m²	(%)	NC	NC	Threatened/ migratory fauna Physical environment/ habitat Protected areas Socio-economic receptors	IV IV IV III	IV
			Minimum time to contact by floating oil 10 g/m²	Time (days)	NC	NC			
			Maximum accumulated oil ashore >100 g/m²	m3	33	13			
			Maximum accumulated concentration >100 g/m²	g/m²	342	165			

Receptor (Hotspot) Name	HEV Ranking	Values	Oil Spill Modelling Parameter NC = No Contact		Subsea	Surface	Consequence Category	Consequence Ranking	Final
		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. 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)	Maximum length of shoreline oiled (>100 g/m²)	(km)	11	3			
			Maximum concentration of entrained oil >100 ppb	(ppb)	203	286			
			Maximum concentration of dissolved hydrocarbon >50 ppb	(ppb)	446	249			
Lowendal Islands (emergent)	3	Habitats Important shallow lagoons with seagrass for dugongs. Deep-water benthic (soft sediment) habitats.	Probability of contact by floating oil at 10 g/m²	(%)	NC	NC	Threatened/ migratory fauna Physical environment/ habitat Protected areas	IV IV IV III	IV
			Minimum time to contact by floating oil 10 g/m²	Time (days)	NC	NC			

Receptor (Hotspot) Name	HEV Ranking	Values	Oil Spill Modelling Parameter NC = No Contact		Subsea	Surface	Consequence Category	Consequence Ranking	Final
		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 Oct-Jan. Significant flatback rookery, nesting season for flatback turtles, peaks in Dec-Jan with subsequent peak hatchling emergence in Feb-Mar. Seabirds Approximately 89 species of avifauna, 12 to 14 species of migratory and threatened seabirds. Marine mammals 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	Maximum accumulated oil ashore >100 g/m²	m3	8	3	Socio-economic receptors		
			Maximum accumulated concentration >100 g/m²	g/m²	182	74			
			Maximum length of shoreline oiled (>100 g/m²)	(km)	2	NC			
			Maximum concentration of entrained oil >100 ppb	(ppb)	83	117			
			Maximum concentration of dissolved hydrocarbon >50 ppb	(ppb)	38	24			

Receptor (Hotspot) Name	HEV Ranking	Values	Oil Spill Modelling Parameter NC = No Contact		Subsea	Surface	Consequence Category	Consequence Ranking	Final
		Social amenities and other tourism, very significant for recreational fishing and charter boat tourism.							
Barrow Island (emergent)	3	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, 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	Probability of contact by floating oil at 10 g/m²	(%)	NC	NC	Threatened/ migratory fauna Physical environment/ habitat Protected areas Socio-economic receptors	IV IV IV III	IV
			Minimum time to contact by floating oil 10 g/m²	Time (days)	NC	NC			
			Maximum accumulated oil ashore >100 g/m²	m^3	17	7			
			Maximum accumulated concentration >100 g/m²	g/m²	243	130			
			Maximum length of shoreline oiled (>100 g/m²)	(km)	6	2			
			Maximum concentration of entrained oil >100 ppb	(ppb)	235	405			
			Maximum concentration of dissolved hydrocarbon >50 ppb	(ppb)	314	118			

Receptor (Hotspot) Name	HEV Ranking	Values	Oil Spill Modelling Parameter NC = No Contact		Subsea	Surface	Consequence Category	Consequence Ranking	Final
		Island Nature Reserve (south-southeast island). Double island important bird nesting (shearwaters, sea eagles). Whales Pygmy blue whale northern migration (Apr to Aug). 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).							
Outer NW Ningaloo (submerged)	3	Physical habitats Coral reef. Seagrasses. Macroalgal beds. Non-coral benthic habitats. high and unique sponge biodiversity. Marine fauna Invertebrates. Cetacean migration. Finfish and rays Whale sharks – migratory and aggregation site. Manta rays aggregation. 500 finfish species recorded. Birds	Probability of contact by floating oil at 10 g/m²	(%)	NC	NC	Threatened/ migratory fauna Physical environment/ habitat Protected areas Socio-economic receptors	II II II II	II
			Minimum time to contact by floating oil 10 g/m²	Time (days)	NC	NC			
			Maximum accumulated oil ashore >100 g/m²	m^3	NC	NC			
			Maximum accumulated concentration >100 g/m²	g/m²	NC	NC			
			Maximum length of shoreline oiled (>100 g/m²)	(km)	NC	NC			
			Maximum concentration of	(ppb)	499	779			

Receptor (Hotspot) Name	HEV Ranking	Values	Oil Spill Modelling Parameter NC = No Contact		Subsea	Surface	Consequence Category	Consequence Ranking	Final
		33 species seabirds and avifauna present (13 resident and 20 migratory). 13 JAMBA/CAMBA species. Marine mammals 13 species of toothed whale and dolphin and seven species of baleen whale. Protected area Key ecological feature (Commonwealth waters adjacent to Ningaloo Reef) and Continental Slope Demersal Fish Communities. Socio-economic and heritage values Sanctuary zones under state MP. National Heritage Place. Shipwrecks important as diving sites.	entrained oil >100 ppb						
			Maximum concentration of dissolved hydrocarbon >50 ppb	(ppb)	246	124			
Ningaloo Coast South (emergent)	3	Refer Outer NW Ningaloo and Ningaloo Coast North.	Probability of contact by floating oil at 10 g/m²	(%)	NC	NC	Threatened/ migratory fauna Physical environment/ habitat Protected areas Socio-economic receptors	III III III II	III
			Minimum time to contact by floating oil 10 g/m²	Time (days)	NC	NC			
			Maximum accumulated oil ashore >100 g/m²	m3	9	5			
			Maximum accumulated concentration >100 g/m²	g/m²	10	20			
			Maximum length of shoreline oiled (>100 g/m²)	(km)	NC	NC			

Receptor (Hotspot) Name	HEV Ranking	Values	Oil Spill Modelling Parameter NC = No Contact		Subsea	Surface	Consequence Category	Consequence Ranking	Final
			Maximum concentration of entrained oil >100 ppb	(ppb)	32	45			
			Maximum concentration of dissolved hydrocarbon >50 ppb	(ppb)	2	2			