

Stag Field Environment Plan Permit WA-15-L

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Please refer to the Jadestone Energy MIS for the latest revision.

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14A	01/03/18	J. Williams	MOC 2018-005. Replace references to Marine Logistics Procedure with Stag Marine Facility Operating Manual
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Acronyms and Abbreviations

Abbreviation	Description
AFFF	Aqueous Film Forming Foam
AFZ	Australian Fishing Zone
AHV	Anchor handling vehicle
ALARP	as low as reasonably practicable
AMP	Australian Marine Parks
AMSA	Australian Maritime Safety Authority
API	American Petroleum Institute
APPEA	Australian Petroleum Production and Exploration Association
AQIS	Australian Quarantine and Inspection Service
AUV	Autonomous underwater vehicle
BCF	Bioconcentration Factor
BOP	Blowout preventer
Bq/g	Becquerel per gram
CAA	Civil aviation authority
CALM	Catenary Anchor Leg Mooring
CCTV	Closed circuit television
CGFU	Compact gas floatation unit
CHARM	Chemical Hazard and Risk Management
CMMS	Computerised Maintenance Management System
CP	Cathodic Prevention
CPF	Central Production Facility
CPI	Corrugated plate interceptor
DA	Designated Authority
DCCEEW	Department of Climate Change, Energy, the Environment and Water (Previously DAWE)
DAWE	Department for Agriculture, Water and Environment (previously DoEE)
DBCA	Department of Biodiversity, Conservation and Attractions
DPAW	Department of Parks and Wildlife (now DBCA)
DEC	Department of Environment and Conservation (now DBCA)
DIIS	Department of Industry, Innovation and Science
DMIRS	Department of Mines, Industry Regulation and Safety (previously Department of Mines and Petroleum, DMP)
DoC	Document of Compliance
DOEE	Department of the Environment and Energy (now DAWE)
DoF	Department of Fisheries (now DPIRD)

Abbreviation	Description
DP	Dynamically Positioned
DPIRD	Department of Primary Industries and Regional Development (previously Department of Fisheries)
DSMS	Diving safety management system
DSV	Diving support vessel
DSWEPaC	Department of Sustainability, Environment, Water, Population and Communities (now DAWE)
dwt	Dry weight tonnes
EEZ	Economic Exclusion Zone
EH&S	Environmental Health & Safety
EMBA	Environment that may be affected
EP	Environment Plan
EP Act	Environmental Protection Act 1986
EPA	Environmental Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
ESD	Emergency Shut-Down system
ESP	Electric Submersible Pump
GFU	Gas floatation unit
HLO	Helicopter landing officer
HVAC	Heating ventilation air conditioning (system)
HWU	Hydraulic Workover Unit
ICAO	International civil aviation organisation
IMO	International Maritime Organisation
IMS	Invasive Marine Species
IMR	Integrity, maintenance and repair
IWC	International Whaling Commission
KEFs	Key Ecological Features
Kl	Kilolitre
Ksm ³	Thousand Standard Cubic Metres
LAT	Lowest astronomical tide
LC50	Lethal concentration of a compound at which 50% of test species dies within a specified time frame
MAOP	Maximum Allowable Operating Pressure
MCR	Marine Conservation Reserve
mg/L	Milligrams per litre
MMA	Marine Management Area
mmscfd	Million Standard Cubic Feet per Day

Abbreviation	Description
MOPU	Mobile offshore production unit
MPRA	Marine Parks Reserves Authority
MSDS	Material safety data sheet
NCB	North Coast Bioregion
NDT	Non-Destructive Testing
NEBA	Net Environmental Benefit Assessment
NES	National Environmental Significance
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NORM	Naturally Occurring Radioactive Materials
NSF	Northern Shark Fishery
NWS	North-West Shelf
NWSTF	North-West Slope Trawl Fishery
OCIMF	Oil Companies International Marine Forum
OCNS	Offshore Chemical Notification Scheme
ODS	Ozone Depleting Substances
OGP	Oil and gas producers (association)
OIM	Offshore Installation Manager
OIW	Oil-in-water
OPGGGS (E) Regs	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
OPGGGS Act	Offshore Petroleum and Greenhouse Gas Storage Act 2006
OPMF	Onslow Prawn Managed Fishery
OSCP	Oil Spill Contingency Plan
PAH	Polycyclic aromatic hydrocarbons
PLEM	Pipeline end manifold
ppm	parts per million
PRS	Production Reporting System
PTS	Permanent Threshold Shift
PW	Produced water
RO	Reverse Osmosis Plant
ROV	Remote Operated Vehicle
SBFTF	Southern Bluefin Tuna Fishery
SCM	Subsea control module
SRB	Sulphur Reducing Bacteria
SSS	Side-Scan sonar
SSWI	Ship Specific Work Instructions

Abbreviation	Description
STP	Sewage Treatment Plant
SWL	Safe Working Load
TPH	Total petroleum hydrocarbons
TTS	Temporary Threshold Shift
VBSA	Vessel based support activity
WA	Western Australia
WAF	Water accommodated fraction
WOMP	Well Operations Management Plan
WSTF	Western Skipjack Tuna Fishery
WTBF	Western Tuna and Billfish Fishery

ENVIRONMENT PLAN SUMMARY

This Stag Field Environment Plan Permit WA-15-L Summary has been prepared from material provided in this Environment Plan (EP) and associated Oil Pollution Emergency Plan (OPEP). The summary consists of the following as required by Regulation 11(4):

EP Summary material requirement	Relevant section of EP containing EP Summary material
The location of the activity	Section 1.2
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 7
The control measures for the activity	Section 6 and 7
The arrangements for ongoing monitoring of the titleholders' environmental performance	Section 8.3
Response arrangements in the oil pollution emergency plan	Section 8.5 and Oil Pollution Emergency Plan
Consultation already undertaken and plans for ongoing consultation	Section 4
Details of the titleholders nominated liaison person for the activity	Section 1.5

1. OVERVIEW OF THE ACTIVITY

1.1 Introduction

Jadestone Energy (Australia) Pty Ltd ('Jadestone') is the operator and titleholder of the Stag Field Production and Export Facility (Stag Facility). The facility is located in permit area WA-15-L, approximately 60 km northwest of Dampier in approximately 49 m water depth (**Figure 1-1**). Oil is currently produced from the Stag Reservoir, via production wells, and seawater and production water are injected via injection wells.

The Stag Facility, shown in **Figure 1-1** and **Figure 1-2** includes:

- A fixed Central Production Facility (CPF), producing and processing oil from a number of wells.
- A single 2 km long carbon steel export oil pipeline on the northeast side of the CPF connecting to a Catenary Anchor Leg Mooring (CALM) buoy via a flexible submarine hose (underbuoy hose).
- A third-party tanker receives oil through a flexible offtake hose from the CALM buoy. Once loading is complete, the tanker departs the field for delivery of cargo to market. No offtake activity from the third-party tanker occurs in field.
- Water injection flowlines and wells to assist reservoir fluid recovery.
- Support/ supply vessels, work vessels and tugboats/ static tow vessels supporting third-party tanker movement, facility logistics, maintenance and provisioning; and
- Helicopter support.

Oil is loaded continuously to the third-party tanker at a production rate of up to 5,000 bbl/d. The CPF has been in production since 1998 with only minor modifications carried out during this time.

Stag oil is a medium crude (API 19) with a very low proportion of volatile compounds due to microbial degradation within the reservoir.

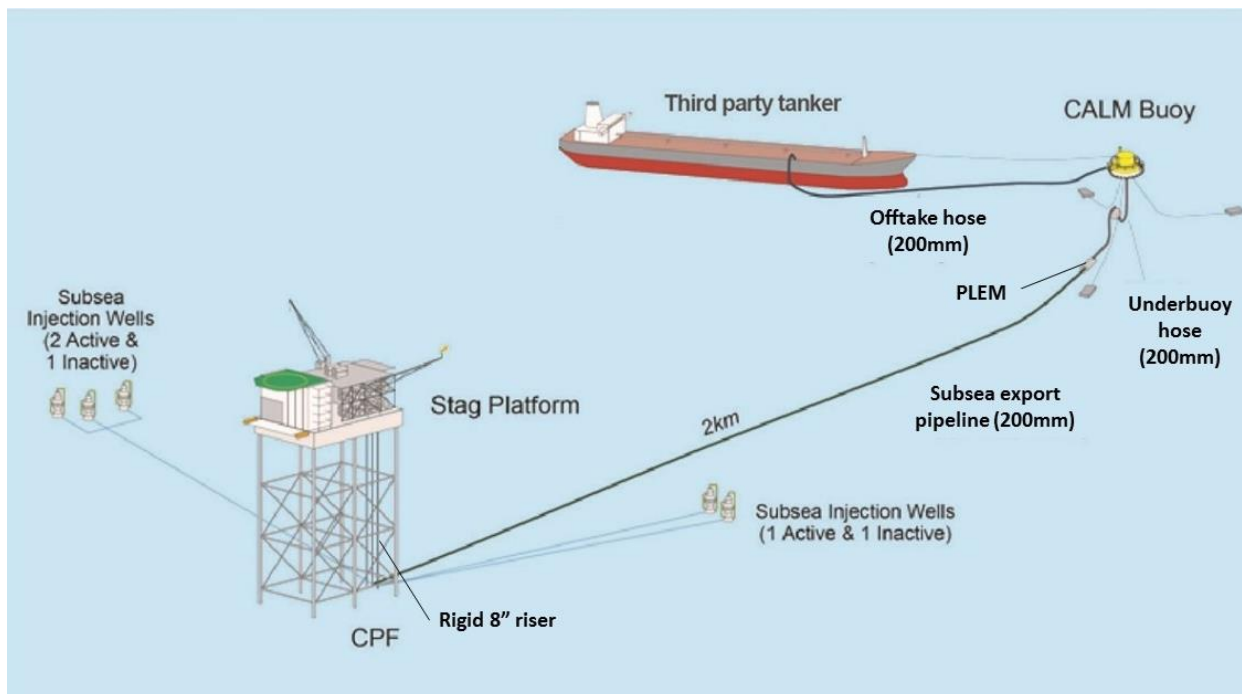


Figure 1-1: Schematic of the Stag Facility (not to scale)



Figure 1-2: Aerial view of Stag Facility

1.2 Scope

The scope of this EP covers the following activities associated with the Stag Facility:

- Routine production and well intervention.
- Crude oil loading activities to the third-party tanker.
- Routine inspection, maintenance and repair (IMR) of the CPF, subsea export pipeline, wells and associated subsea infrastructure (including use of remotely operated vehicle (ROV) and diving activities); and
- Non-routine and unplanned activities and incidents associated with the above.

The infrastructure covered by this EP includes the following as located within the defined Operational Area:

- Stag CPF.
- Pipelines and hoses.
- Subsea infrastructure tied back to the Stag CPF (including wells, wellheads, manifolds, risers, flowlines, etc.).
- CALM buoy.
- Support vessels assisting with activities defined above within the defined Operational Area; and
- Helicopter activity within the Operational Area.

This EP applies to activities undertaken within the Operational Area only as defined in the description of the activity (**Section 1.7**).

Activities that are not covered in this EP include third-party offtake tankers, nearby shipping activity, drilling or intervention activities undertaken by a mobile offshore drilling unit (MODU), or decommissioning. Vessels associated with Stag Operations when outside the Operational Area adhere to all applicable maritime regulations, and Commonwealth and State environmental management obligations, as relevant.

Activities proposed within the Operational Area outside the scope of this EP will be the subject of a separate EP or a revision.

1.3 Objective

This Environment Plan (EP) has been prepared in accordance with the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Environment Regulations) under the Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGs Act) and as administered by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA). Table 1-1 provides EP section references against the requirements of the OPGGS (E) Regulations.

The objectives of this EP are to ensure that:

- All operational activities associated with the Stag Facility are planned and conducted in accordance with Jadestone’s Environmental Management Policy.
- Potential adverse environmental impacts and risks associated with the proposed activities, during both routine and non-routine operations, are continuously reduced to as low as reasonably practicable (ALARP) and of acceptable levels; and
- That the environmental performance outcomes (EPO) and environmental performance standards (EPS) outlined in this EP are met.

This EP contains the environmental impact assessment for Stag Facility operations. The assessment aims to systematically identify and assess the potential environmental impacts associated with operational activity and to stipulate mitigation measures to avoid and/ or reduce any adverse impacts to the marine environment to ALARP and acceptable levels. The implementation of the EPOs specified within this document will provide Jadestone with the required level of assurance that the activities are being managed in an environmentally responsible manner.

This EP is written to allow for the continuation of production at the Stag Facility for a period of five (5) years from the date of its acceptance by NOPSEMA.

Table 1-1: Requirements of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 and EP Summary

Reg	Requirement	Section
13(1) 11(4)(a)(i) 11(4)(a)(iii)	<p><i>Description of the activity</i></p> <p>The environment plan must contain a comprehensive description of the activity including the following:</p> <ul style="list-style-type: none"> the location or locations of the activity. general details of the construction and layout of any facility or other structure. an outline of the operational details of the activity (for example, seismic surveys, exploration drilling or production) and proposed timetables. any additional information relevant to consideration of environmental impacts and risks of the activity. 	1.7
13(2) 11(4)(a)(ii)	<p><i>Description of the environment</i></p> <p>The environment plan must:</p>	3

Reg	Requirement	Section
	describe the existing environment that may be affected by the activity, as well as any relevant cultural, social and economic aspects of the environment that may be affected; and include details of the particular relevant values and sensitivities (if any) of that environment.	
13(3) 11(4)(a)(iv)	<i>Description of environmental impacts and risks</i> The environment plan must include: details of the environmental impacts and risks for the activity; and an evaluation of all the impacts and risks.	6, 7
13(3a)	For the avoidance of doubt, the evaluation mentioned in paragraph (3)(b) must evaluate all the significant impacts and risks arising directly or indirectly from: a) all operations of the activity, including construction; and b) potential emergency conditions, whether resulting from accident or any other reason.	6, 7
13(4) 11(4)(a)(v)	<i>Environmental performance objectives and standards</i> The environment plan must include environmental performance objectives, environmental performance standards and measurement criteria that: address legislative and other controls that manage environmental features of the activity; and define the objectives, and set the standards, against which performance by the operator in protecting the environment is to be measured; and include measurement criteria for determining whether the objectives and standards have been met.	6, 7
13(5)	Requirements: The environment plan must describe the requirements that: a) apply to the activity; and b) are relevant to the environmental management of the activity	6, 7
14(1)	The environment plan must contain an implementation strategy for the activity in accordance with this regulation.	8
14(2) 11(4)(a)(vi)	The implementation strategy must include measures to ensure that the environmental performance objectives and standards in the environment plan are met.	8
14(3)	The implementation strategy must identify the specific systems, practices and procedures to be used to ensure that the environmental impacts and risks of the activity are continuously reduced to (ALARP) and that the environmental performance objectives and standards in the environment plan are met.	8
14(4)	The implementation strategy must establish a clear chain of command, setting out the roles and responsibilities of personnel in relation to the implementation, management and review of the environment plan.	8
14(5)	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 and has the appropriate competencies and training.	8
14(6)	The implementation strategy must provide for the monitoring, audit, management of non-conformance and review of the operator's environmental performance and the implementation strategy.	8
14(7)	The implementation strategy must provide for the maintenance of a quantitative record of emissions and discharges (whether occurring during normal operations or otherwise) to the air, marine, seabed and sub-seabed environment, that is accurate and can be monitored and audited against the environmental performance standards and measurement criteria.	8
14(8) 11(4)(a)(vii)	The implementation strategy must contain an oil pollution emergency plan and provide for the maintenance of the plan.	OPEP
14(8AA)	The oil pollution emergency plan must:	OPEP

Reg	Requirement	Section
	a) be kept up-to-date; and b) include emergency response arrangements.	
14(8A)	The response arrangements in the oil spill contingency plan must be tested: when they are introduced; and when they are significantly amended; and not later than 12 months after the most recent test; and for a new location for the activity that is added to the environment plan after the response arrangements have been tested and before the next test is conducted — when the location is added to the plan; and for a facility or other structure that becomes operational after the response arrangements have been tested and before the next test is conducted — when the facility or structure becomes operational.	OPEP
14(9) 11(4)(a)(viii)	The implementation strategy must provide for appropriate consultation with: relevant authorities of the Commonwealth, a State or territory; and other relevant interested persons or organisations	8
14(10)	The implementation strategy must comply with the Act, the regulations and any other environmental legislation applying to the activity.	8
15	The environment plan must include arrangements for: recording, monitoring and reporting information about the activity (including information required to be recorded under the Act, the regulations and any other environmental legislation applying to the activity) sufficient to enable the Regulator to determine whether the environmental performance objectives and standards in the environment plan are met; and reporting to the Regulator at intervals agreed with the Regulator, but not less often than annually.	8
15(1) 11(4)(a)(ix)	The environment plan must include the details for the titleholder and nominated liaison person	1.5
16 11(4)(a)(viii)	The environment plan must contain the following: a statement of the operator's corporate environmental policy;	1.6
	a report on all consultations between the operator and relevant authorities, interested persons and organisations in the course of developing the environment plan;	4
	details of all reportable incidents in relation to the proposed activity.	9

1.4 Stag Facility Location

The Stag Facility is located on the North-West Shelf (NWS) off Western Australia (WA), approximately 60 km north-west of Dampier (Table 1-2, Figure 1-3).

Table 1-2: Distances from Stag Facility to Key Regional Features

Regional Feature	Distance from Stag CPF
Dampier Archipelago	32 km (17.3 Nm)
Closest Montebello Island	75 km (40.5 Nm)
Varanus Island	82 km (44.3 Nm)
Barrow Island	96 km (51.8 Nm)
Glomar Shoals	100 km (54 Nm)

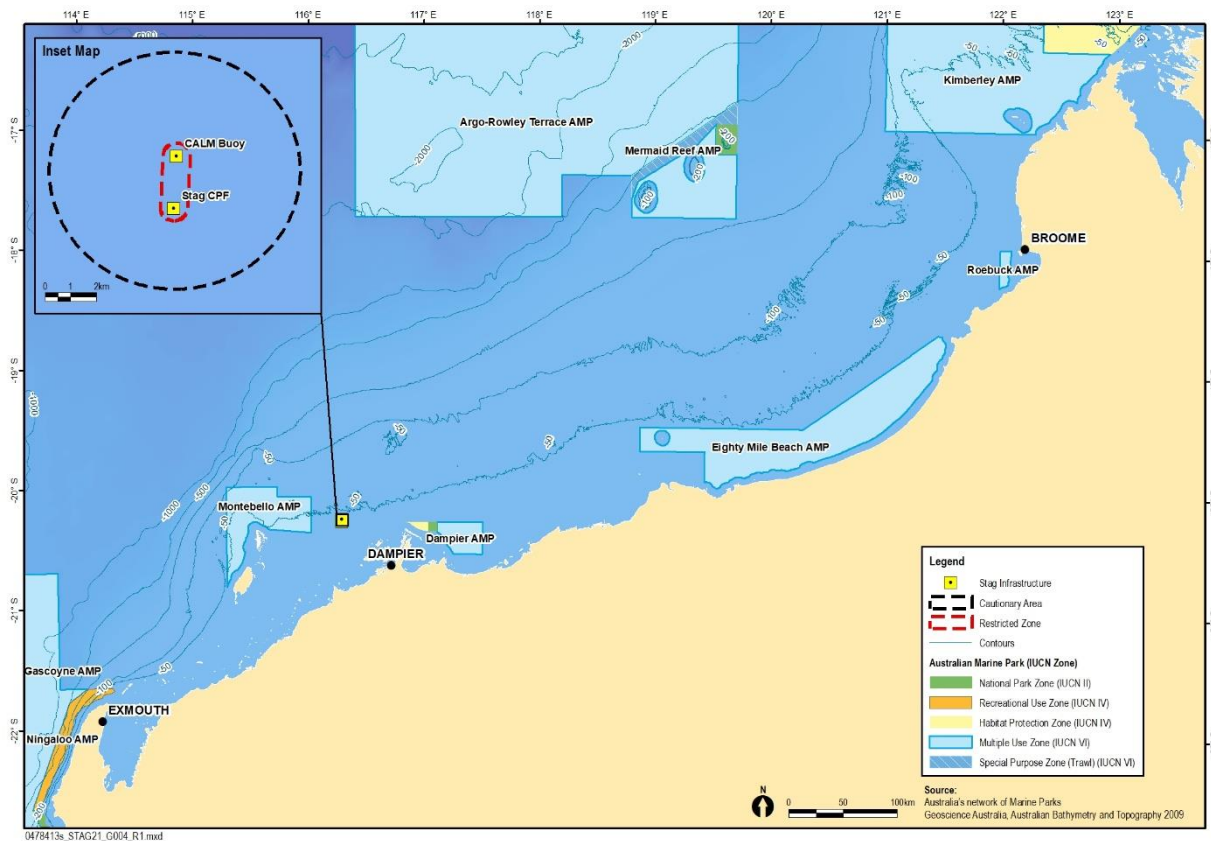


Figure 1-3: Location of the Stag Field

The CPF is located above the original Stag-6H well. The subsea export pipeline runs due north from the north-west side of the CPF to the CALM buoy. The CALM buoy is located in a water depth of approximately 49 m below lowest astronomical tide (LAT), approximately 2 km to the north of the Stag CPF (Table 1-3).

Table 1-3: Stag CPF and the CALM Buoy Coordinates

Facility	Latitude	Longitude
Stag CPF	20° 17.5' South	116° 16.433' East
CALM Buoy	20° 16.395' South	116° 16.492' East

Water injection flowlines run 1,100 m off the north-eastern corner of the CPF where they connect to two sub-surface wellheads. A further three sub-surface water injection wellheads are located approximately 3 km west of the facility (**Figure 1-1**).

1.4.1 Restricted Zones and Cautionary Areas

A cautionary area is charted for Stag field facilities, a circle of 2.5 NM (approx. 5 km) radius around the facilities, with the centre located 1.4 km due north of the CPF. In addition, there is an exclusion zone of 500 m radius around the CPF, CALM buoy (and moorings) and pipeline. Vessels operating within this exclusion zone must not exceed a speed of five (5) knots.

1.4.2 Operational Area

The Operational Area is defined as the area within the 500 m radius Restricted Zone that extends around the CPF, subsea export pipeline, and CALM buoy.

1.5 Operator and Titleholder Details

Jadestone is engaged in exploration, appraisal and pre-development activities in Southeast Asia, with a portfolio of 10 exploration and pre-development assets. Jadestone is an active operator within the region and the Company's principal focus is on assets in Australia, Indonesia, Vietnam and the Philippines.

Jadestone is firmly committed to being a responsible corporate citizen. The company places safety, environmental and social responsibility considerations at the core of its business and operational decision-making.

Jadestone's Australian office is located at:

The Atrium Building, Level 2, 168 St Georges Terrace
Perth, Western Australia, 6000.
ACN 613 671 819

Jadestone's contact for the Stag Facility is:

Neil Colyer, Operations Manager
Phone: +61 8 9486 6600
Email: NColyer@jadestone-energy.com

In the event contact details for Jadestone or the liaison contact change within the timeframe of this EP, the Regulator, the National Offshore Petroleum Safety and Environment Management Authority (NOPSEMA) will be advised of the updated details.

1.6 HSE Policy

Protecting the environment, valuing cultural heritage and maintaining open stakeholder communication are an integral part of Jadestone's business approach. This is reflected in Jadestone's Health Safety and Environmental (HSE) Policy (**Figure 1-4**) and this EP.

HEALTH, SAFETY & ENVIRONMENT POLICY



Respect



Integrity



Safety



Results-oriented



Sustainability



Passion

PHILOSOPHY

Jadestone's philosophy is to ensure that health, safety and environmental protection is intrinsic to, and embedded within, our operating activities. The business focusses on those things that deliver top performance and value optimisation while eliminating waste. A focus on HSE performance provides a safe and rewarding work environment for Jadestone employees, and the achievement of sustainable business activities in the local and global communities where they work.

EXECUTION

Within the HSE Policy, Jadestone has committed to:

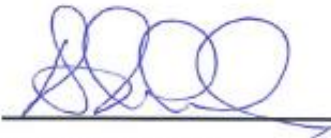
- Promote a strong HSE culture through visible leadership and an engaged, competent workforce aligned with Jadestone's Shared Values
- Assess all risks and manage them to as low as reasonably practicable
- Maintain an ever-improving HSE management system through setting and monitoring performance targets to achieve our aims within a framework of continuous improvement
- Take all necessary actions to prevent incidents, with an aspiration of targeting zero. Investigate and apply learnings
- Encourage and promote the ownership of HSE performance by all employees and contractors
- Ensure all contractor companies working with us have a management system that either equals or exceeds Jadestone's own management system
- Manage and maintain plant, equipment and machinery to achieve required performance, safety and integrity
- Openly monitor, evaluate and report HSE performance, and communicate to all relevant stakeholders, and
- Comply with all regulatory requirements as an absolute minimum.

RESPONSIBILITY

Everyone who is engaged to work for Jadestone shall be familiar with this policy and its contents.

Everyone must take responsibility for ensuring their own safety, the safety of those around them, and the protection of the environment, by following Jadestone's policies and procedures. That includes taking all necessary precautions and immediately acting upon and reporting any HSE concerns they may have.

Everyone has the right to stop the job and a responsibility to intervene in work fronts or activities if they feel there is a risk to themselves, their workmates or to the environment.



A. Paul Blakeley OBE
President & Chief Executive Officer

April 2020

Figure 1-4: Jadestone Energy (Australia) Pty Ltd HSE Policy (April 2020)

1.7 Legislative Framework

The activity is located within the Commonwealth Petroleum Jurisdiction Boundary and therefore regulated under Commonwealth legislation; primary under the OPGGS Act and the OPGGS(E) Regulations. In accordance with Regulation 13(4) of the OPGGS(E) Regulations, this section describes the Commonwealth legislation, international agreements and other relevant guidelines and codes of practice to the activity. In the unlikely event of an unplanned hydrocarbon release that migrates into state waters, Western Australia (WA) or Northern Territory (NT) legislation will be triggered. Applicable Commonwealth and state legislation are listed in Appendix A.

Jadestone shall have regard to all matters pertaining to the below by ensuring that activities are managed to ALARP and acceptable levels through a robust evaluation process and the implementation of identified control measures and mitigation as identified in this EP.

1.7.1 International Legislation

Australia is signatory to numerous international conventions and agreements that obligate the Commonwealth government to prevent pollution and protect specified habitats, flora and fauna. Those which are relevant to the operation of the Stag Facility are detailed in Appendix A.

1.7.2 Commonwealth Legislation

All activities conducted during the operation of the Stag Facility will comply with legislative requirements established under relevant Commonwealth legislation, and in line with applicable best practice guidelines and management procedures. These are further detailed in Appendix A.

1.7.3 Ecologically Sustainable Development

Australia has developed a National Strategy for Ecologically Sustainable Development (ESD) (available at <https://www.environment.gov.au/about-us/esd/publications/national-esd-strategy-part1>), which identifies four principles and ways to apply them to a range of industry sectors and issues such as climate change, biodiversity conservation, urban development, employment, and economic activity, diversity and resilience. OPGGS(E) Regulation 3 states that any petroleum activity carried out in an offshore area is carried out in a manner consistent with the principles of ESD as set out in section 3A of the EPBC Act. These are listed below:

- a. Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations
- 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
- c. 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
- d. The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making, and
- e. Improved valuation, pricing and incentive mechanisms should be promoted.

Jadestone Energy has incorporated the principles of ESD into the decision-making framework described in **Section 5** and in the development of control measures and environmental performance outcomes (EPO) proposed in Sections 6 and 7. Jadestone Energy believes that the commitments made within this EP demonstrate that the environmental management of the activity will be conducted in accordance with the principles of ESD.

Australia is signatory to several international environmental protection agreements and conventions which are relevant to the region, including for the protection of wetlands and environmental values. Australia is also a signatory to several international conventions of potential relevance to the activity, including:

- Australia-Indonesia Memorandum of Understanding regarding the Operations of Indonesian Traditional Fishermen in Areas of the Australian Fishing Zone (AFZ) and Continental Shelf – 1974 (Memorandum of Understanding Box);
- Convention on the Conservation of Migratory Species of Wild Animals 1979 (Bonn Convention);
- International Convention on Oil Pollution Preparedness, Response and Co-operation 1990;
- Protocol to International Convention on the Prevention of Marine Pollution by Dumping of Waste and Other Matter 1996;
- Marine Pollution - International Convention for the Prevention of Pollution from Ships (MARPOL); and
- United Nations Convention on the Law of the Sea 1982.

1.8 This Environment Plan

The Stag Facility Five Year Operations Environment Plan (this EP hereafter) has been prepared in accordance with the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS(E) Regulations) under the Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGS Act) and as administered by NOPSEMA.

The objectives of this EP are to ensure that:

- All activities associated with the Activity are planned and conducted in accordance with Jadestone Energy's Health, Safety and Environmental (HSE) Policy (**Figure 1-4**);
- Potential adverse environmental impacts and risks associated with the proposed activities, during both routine and non-routine operations, are continually reduced to as low as reasonably practicable (ALARP) and of acceptable levels; and
- That the environmental performance outcomes (EPO) and environmental performance standards (EPS) outlined in this EP are met.

This EP contains the environmental impact assessment for the activity. The assessment aims to systematically identify and assess the potential environmental impacts and risks associated with the activity and to stipulate mitigation measures to avoid and/or reduce any adverse impacts to the marine environment to ALARP and acceptable levels. The implementation of the EPOs specified within this document will provide Jadestone Energy with the required level of assurance that the activities are being managed in an environmentally responsible manner.

NOPSEMA's Guidance Note for Environment Plan Content Requirements (GN-1344; Rev 4, April 2019) was referred to in the preparation of this EP.

2. DESCRIPTION OF THE ACTIVITY

Provided herein is a description of the activities, equipment and operations that Jadestone has responsibility for at the Stag Field. For noting, activities and equipment precluded from this EP are described in **Section 2.2**.

2.1 Facility Layout and Description

The CPF is a fixed oil production platform. It comprises a jacket, which is secured to the seabed by six drilled and grouted piles, a hull, which is supported on tubular legs, a process module and an accommodation module. The platform has accommodation, offices, medical and mess facilities for a maximum overnight manning level of 58 personnel onboard.

The platform has a helideck and a boat landing area.

Produced oil from the CPF is exported via an 8", 2 km rigid steel oil subsea export pipeline to a pipeline end manifold (PLEM) and then an 85 m long flexible submarine hose (underbuoy hose) to the CALM buoy. A flexible 200 mm offtake hose connects the CALM buoy to a third-party tanker.

There is associated gas production, which is used as fuel for the boiler and process blanketing with the excess being flared. Water and oil are separated throughout the process and directed to the produced water package for treatment prior to discharge or injection.

2.1.1 Central Processing Facility

The CPF stands approximately 20 m above sea level in a water depth of approximately 49 m LAT. The maximum topsides area is approximately 37 m x 57 m (2,109 m²). The structure, including topsides and piles, weighs approximately 6,500 tonnes.

The CPF is located over a pre-installed mudline template as a guide and supports 12 well slots; in addition, five subsea water injection wells. Two subsea water injection wells are located approximately 1,100 m off the north-eastern corner of the facility, with the other three being located approximately 3,200 m west of the facility.

The topsides equipment includes the following process activities:

- Separation and processing of produced oil, gas and water;
- Produced water treatment and disposal offshore;
- Sand separation;
- Seawater treatment and pumping for water injection wells; and
- Gas flaring.

The topsides also include the following utilities:

- Power generation and distribution;
- Potable and utility water;
- Utility and instrument air;
- Heating, Ventilation and Air Conditioning (HVAC) system; and
- Hydraulic Workover Unit (HWU) for well operations.

The CPF has a helideck and a boat landing area. Helicopter is the normal means of transport for personnel (refer Section 3.2.14). The CPF is serviced by a single crane, with a boom length adequate to reach all required laydown areas (refer Section 3.2.11) located on a pedestal on the west side of the process module.

2.1.2 Wells and Subsea Infrastructure

The scope of this EP includes all subsea infrastructure associated with production and water injection, including:

- Trees/ wells;
- Manifolds;
- Rigid spools;
- Flexible flowlines;
- Electric submersible pumps; and
- Chemical injection system.

Hydrocarbons from the reservoir are pumped to the topside manifolds via the wells for processing at the CPF. The production wells are completed with electric submersible pumps (ESP). Provision has been made for the downhole injection of chemicals beneath the pump intake, including demulsifier, scale inhibitor and corrosion inhibitor.

Water injection is required to maintain bottom hole pressure and to aid recovery.

The current estimated end of field life for Stag is 2035. The current wells in use on title are expected to produce until end of field life and therefore a firm date for cessation of production is not currently available. Noting that on the CPF are 12 slots for platform wells, over time wells are abandoned as they water out and the slots are required for infill drilling from the same slot. Therefore, the maximum number of platform wells active at any one time is 12. There are also five subsea water injection wells with wellheads, two of these are inactive. At the end of field life, all wells shall be abandoned.

The wells authorised by title WA-15-L (or previous titles and within current title boundary) are provided in the table below, along with their status, type and other relevant information.

Table 2-1: Status of wells within WA-15-L

Well	Type	Status	Maintenance and monitoring
Antler 1, Centaur 1, Roebuck 1, Stag 1, Stag 16, Stag 2, Stag 22, Stag 3, Stag 34, Stag 35, Stag 4, Stag 41, Stag 42, Stag 5, Stag 7, Stag 8	Exploration/ Appraisal	Abandoned with wellhead removed and conductor / casing strings cut below the mudline.	N/a – no maintenance required as no wellhead in place
Stag-12H, Stag-15H, Stag-21H, Stag-25H, Stag-36H, Stag-37H, Stag-43H, Stag-45H, Stag-48H	CPF	Active Production well	Wells are maintained and monitored in accordance with the accepted WOMP (GF-50-PLN-W-00001) Stag 50H and 51H drilled in Q4 2022

Well	Type	Status	Maintenance and monitoring
Stag 49H, Stag 50H, Stag 51H,			
Stag-29H	Subsea	Inactive Injection well with wellhead and tree in situ. Stag 29H no longer has flowline attached (re-purposed on adjacent well)	Wells are maintained and monitored in accordance with the accepted WOMP (GF-50-PLN-W-00001 Revision 3) as they may be required for use again during the field life.
Stag-17H Stag-18H, Stag-32H, Stag-40H	Subsea	Active Injection well with wellhead and tree in situ	Wells are maintained and monitored in accordance with the accepted WOMP (GF-50-PLN-W-00001 Revision 3)

2.1.3 Subsea Export Pipeline

The Stag 8" oil subsea export pipeline is a single 200 mm carbon steel pipeline that runs approximately 2 km from the Stag CPF to the Stag PLEM. A flexible underbuoy hose of 300 mm diameter connects the PLEM to the CALM Buoy.

The pipeline was installed in 1998 and was subject to a design life extension in 2013, extending the service life by 10 years to 2023, a further design life extension will be completed to allow for the service life beyond 2023 to 2035 through a planned re-living project. The pipeline has been designed and constructed to all necessary Australian and International standards.

The primary means of stabilising the pipeline is self-weight by the application of concrete weight coating along its length. Remotely operated vehicle/ autonomous underwater vehicle (ROV/ AUV) (refer **Section 2.2.15**) surveys are undertaken of the pipeline to identify possible span exceedance or buckling.

The subsea property described here as the subsea export pipeline (that is, property starting at the CPF and terminated at the PLEM) is operated under pipeline license WA-6-PL. For information in relation to the WA-6-PL instrument, refer to [Pipeline Licence WA-6-PL \(nopta.gov.au\)](http://nopta.gov.au).

2.1.4 CALM Buoy

The Stag CALM buoy is located approximately 2 km to the north of the CPF and is linked by the subsea export pipeline and the PLEM. Oil from the subsea export pipeline passes through the CALM buoy product piping, swivel and valve isolation system, and into the floating offtake hose and the third-party tanker.

The product swivel ensures that a leak free, rotational connection is achieved between the buoy product piping and the offtake hose.

The buoy consists of six watertight compartments and is constructed so that in the event of damage and flooding of one compartment, it remains stable.

It is moored by a six-chain catenary anchor system which is secured by means of gravity anchors covered by rock berms. It is designed for securing third-party tankers up to 150,000 dry weight tonnes (DWT).

Access to the buoy for maintenance and servicing is via a boat landing.

2.1.5 Third-party tanker

The tanker is operated by a third-party contracted to Jadestone and operates under International Safety Management (ISM) code. The tanker while in field, is moored to the CALM buoy and receives oil continuously from the CPF.

The following operations are carried out on or by the third-party tanker:

- Connection and disconnection from the CALM Buoy;
- Crude oil loading operations;
- Maintenance operations as per planned maintenance system for third party tanker; and
- Accommodation facilities for up to 30 persons.

Arrangements for the arrival, connection and disconnection of the third-party tanker are described in Jadestone's Stag Marine Tanker Operations Manual (GF-00-MN-H-00037) which is provided to the Vessel Operator during the contract pre-award engagement.

Oil passes from the CALM buoy into the third-party tanker via a 200 mm (8") diameter, up to approximately 220 m long offtake hose of double carcass construction with built-in flotation. The tanker is double-hulled and stores crude in cargo tanks.

The third-party tanker will use low sulphur heavy fuel oil or Stag crude oil as a fuel supply for its engines.

2.2 Operations and Process Description

Primary operations at the Stag CPF entail production and maintenance activities including:

- Production including water reinjection;
- Operational and emergency flaring of excess gas through flare systems;
- Processing and discharge of produced water within discharge limits;
- Processing and discharge of drainage/ oily waters;
- Produced sand handling;
- Loading of crude oil onto the third-party tanker; and
- Inspection, Maintenance and Repair (IMR) activities (topsides and subsea) including well operations, plant modification and diving/ ROV operations.

Supporting activities associated with the facility operations include:

- Utility systems such as lighting, heating, ventilation and air conditioning, water systems, power generation, safety system, and accommodation facilities;
- Collection, treatment and disposal of sewage;
- Support vessel operations;
- Lifting operations; and
- Helicopter operations for transporting personnel and urgent freight.

For noting, installation of new subsea equipment or the tie-in of new production or water injection wells is not covered by this EP.

2.2.1 Production

Production includes hydrocarbon recovery from the reservoir via subsea wells and equipment, topside separation and processing of fluids. Profitable production is expected to be achievable at the Stag Facility for another 5 to 10 years.

Oil is exported to the third-party tanker. Gas is utilised for steam generation in the boiler. Water is processed and is then either reinjected, discharged overboard or sent to the third-party tanker for storage.

Crude oil production

Oil is currently produced from twelve production wells and supported by seawater injected into dedicated injection wells.

Due to the low pressure of the reservoir, the wells are sub-hydrostatic and electric submersible pumps have been installed in the wells to draw reservoir fluids to the surface. Water injection is required to maintain reservoir pressure and to control the movement of oil within the reservoir to maximise its recovery. Seawater for water injection is pumped through coarse and fine filtration systems and de-aerated before it is pumped under high pressure into the water injection wells.

Reservoir fluids from the wells are typically delivered into two parallel production headers and then two first stage product separators that split the well production into oil, gas and water streams. Oil is split from water and gas in the first stage separators, then heated and further treated to remove entrained water during the second stage. Oil polishing takes place in the electrostatic coalescer prior to export to the third-party tanker. Hot crude ready for export is cooled by heat exchangers and pumped to the oil export system. Crude oil is flowed from the export line and stored waiting to be conditioned and used as fuel in the main power generators.

Produced sand

Produced sand from the Stag Reservoir consists of fine sand and glauconite containing traces of oil and some heavy metals. In normal operation, suspended solids in the separators are carried by process water to Hydrocyclones removing solids greater than 20 µm from the water stream to the solids handling system for further processing. Larger particulates not carried through by the produced water stream accumulate in the separators requiring regular sparging. Solids are discharged into bulk bags (~1.7 t) ready to ship to shore for disposal and liquids discharged to the slops tanks for recycled processing.

At the conclusion of the solids removal, some fine solids and oil may remain in the wash water and these are then tested before being pumped into deep water injectors 17H and 18H where they are returned to the reservoir.

Produced sands are not discharged to the marine environment.

2.2.2 Flaring

Gas that is excess to the fuel requirements for heating in the production process and excess blanket gas from the gas flotation unit, is burned as a continuous release through a flare system present on the CPF. Approximately 20% of the gas produced (current average flare rate of 300 sm³/h) is used as fuel for equipment with the balance (80%) being flared.

The flare tip is supported on a 30 m boom attached to the side of the process module and is mounted to discharge vertically.

The gas flared on the CPF is primarily composed of methane and combustion releases carbon dioxide, carbon particles and water (**Table 2-2**).

Table 2-2: Composition of flaring gas

Element	Percentage
CH ₄	96.08%
H ₂ O	3.02%
N ₂	0.67%
CO ₂	0.16%
C ₂ H ₆	0.07%

The flare system will accept the continuous release of:

- First stage separator gas in excess of fuel gas system demand;
- Off gas from the second stage separator;
- Excess blanket gas from the corrugated plate interceptors (CPIs); and
- Purge gas.

The flare system will also accept the intermittent release of gas from:

- Relief valves;
- Relief valve bypass vents;
- Flow-line vents;
- Blowdown valves; and
- Systems being prepared for maintenance.

The flare system is designed to handle a continuous flaring rate which may range between 0.3 and 10 million standard cubic feet per day (mmscfd); the flare typically operates at approximately 0.3 mmscfd. In addition, the flare system can accommodate an instantaneous flaring rate of 15 mmscfd.

2.2.3 Processing and Discharge of Produced Water

Production fluids from the reservoir arrive in a multi-phase state at the CPF where produced water is separated from the crude oil and treated. Provided below is a description of the stages of treatment of the original production fluid stream that results in the produced water discharge leaving the CPF.

The water flowing from the CPIs may be injected with an emulsion breaker and a polyelectrolyte before entering the Gas Flotation Unit (GFU), V203. The GFU is maintained under a fuel gas blanket at 100 kPag.

Cyclone turbine aerators within the flotation unit cause the entrainment of gas into the water. The gas bubbles preferentially attract the oil particles in the water stream which are floated to the surface where they coagulate / coalesce and are skimmed from the water surface. The skimmed oil is drained into the Recovered Oil Vessel together with the oil from the CPIs and directed to the Flare knock out drum V-310 for reprocessing.

The clarified water, which has a residual oil content of less than 30 mg/l, flows to the environment via a pipe that discharges 0.5 m above mean sea level. The flow of clarified water is controlled by the water level in the Gas Flotation Unit.

Clarified water quality is continuously monitored by an in-line oil-in-water (OIW) analyser AITP 2031. The monitor is integrated into the DCS to provide a continuous record of water quality and to alarm should water quality specifications be exceeded. Off-specification water will be redirected to the Open Hazardous Drain Slop Tank T 412 or when full through crossover valve to T411.

A continuous produced water stream is discharged overboard at the CPF at a rate of approximately 7,520 m³/d with an average oil-in-water (OIW) concentration of not greater than 15 mg/L over any 24-hour period.

Further information on produced water discharges made from the CPF is presented in Section 7.4.

On occasions, produced water is off-spec and is not able to be discharged overboard from the CPF. In these circumstances, the facility may either inboard the water to tanks on the CPF or push forward the water to the third party-tanker. If the water is inboarded on the facility, this water may later be cycled through the production process and cleaned to a quality that is then able to be discharged overboard at the CPF. If the water has been pushed forward to the third-party tanker, the water will remain in the tanker while it is on location at the CALM buoy and will not be discharged in field. Any water received by the third-party tanker during push forwards will be disposed of at the cargo receiving facility.

2.2.4 Drainage Systems

The Stag CPF drainage system collects hydrocarbon-based and other liquid wastes (rain and wash water etc.) from all areas across the facility via open (hazardous and non-hazardous) or closed drains.

Open drains

The Stag CPF open drains system consists of two separate collection systems, the hazardous open drain system and the non-hazardous open drain system. Hazardous areas and non-hazardous area drains are completely segregated to prevent ingress of hydrocarbons into a non-hazardous area via the drains system.

The hazardous open drains system is designed to remove and collect oily water from hazardous areas, such as wash down water and spillage of liquids on decks, detergents, equipment drip trays or bunded areas. Collected fluids are routed to two slops storage tanks with a total capacity of 250 m³. All drains into the tanks are via standpipes into a water trap which prevents any back flow of oil/ gas. Liquids are recovered and processed through the second stage of the production separation system and treated prior to discharge.

Drainage from the helicopter landing deck is allowed to drain directly overboard.

The non-hazardous open drains system collects rainwater, wash down water and spillage of liquids from decks located in non-hazardous areas of the facility.

Closed drains

The closed drain system collects liquids from:

- Normally pressurised and hazardous equipment prior to maintenance;
- Flare drum liquids;
- Produced water degasser;
- Operational drainage from the oil separators;
- Liquid sampling draining from the oil separators; and
- Level bridle drains.

The closed drains system is combined with the flare system and consists of a flare knockout / closed drain drum and transfer pumps. The hydrocarbon liquid drained from the process equipment is drained by gravity flow to the flare / closed drains drum via drain headers. Under normal operations the liquids in the closed drains drum are pumped back under level control to the process upstream of the oil heaters.

2.2.5 Inspection, Maintenance and Repair Activities

IMR is undertaken at planned intervals to maintain performance, reliability and prevent deterioration or failure of equipment and ensure safe and reliable operation of the facility. IMR activities (including corrosion

control; refer **Section 2.2.6**) are scheduled through BASSnet and generally involve up to four campaigns per year and is conducted on all operating assets included suspended infrastructure at appropriate frequencies.

IMR activities include maintenance of the topside equipment and structural components of the CPF, all subsea infrastructure and crude oil transfer facilities (CALM buoy, transfer hose and associated appurtenances). This may include activities such as cycling of valves, pressure and leak testing, lubrication of rotating equipment, and cleaning and painting activities for corrosion protection.

Maintenance is managed using the BASSnet Computerised Maintenance Management System (CMMS) and enables:

- The ability to analyse equipment for better maintenance regimes, design changes or replacement;
- The ability to schedule and plan timely removal of infrastructure in a safe and environmentally responsible manner;
- Timely preventative maintenance schedules;
- Improved control over maintenance expenditures;
- Automatic parts ordering and inventory control;
- Reduction of inventory costs and improved stores accountability; and
- Improved utilisation of labour.

Preventative maintenance is incorporated into the CMMS and includes:

- All routine inspections;
- All statutory inspections; and
- All maintenance carried out on a usage basis such as machine running hours.

Inspection of subsea infrastructure is the process of physical verification and assessment of components to detect changes to its as-built state. Inspections are planned to occur at planned intervals in accordance with the Subsea Inspection Strategy (JS-16-PR-U-00001) (**Table 3-2**) and techniques may include general visual inspections (GVI), cathodic protection (CP) surveys using ROV, side-scan sonar (SSS) using the vessel’s transducer or autonomous underwater vehicle (AUV), and wall thickness measurements using ROV-deployable tools. Other inspections may be triggered by environmental effects, such as cyclone or earthquake, by JSE or external parties’ activities, by significant anomalies reported at any time, or by inspection results that exceed defined limits.

Table 2-3: Summary of planned inspections and frequency

Item	Inspection Type	Frequency ¹	Comment
CPF	CP	1 Yr	Drop-cell survey of jacket & all attachments
CPF members, caissons and conductors	GVI	3 yr	Every component
CPF jacket members	Flooded Member Detection (FMD)	6 yr	50% of members, including low fatigue members

¹ As outlined in the Subsea Inspection Strategy (JS-16-PR-U-00001) which may be revised as required resulting in changes in frequency and inspection types

Item	Inspection Type	Frequency ¹	Comment
Underbuoy Hose	GVI & Contact Cathodic Potential Measurement (CCP)	2.5 yr.	With Buoy & Mooring Class inspection
Buoy turret and moorings	In-water survey (IWS) ²	2.5 yr.	Oversight by Classification Society
Rigid pipelines	WT Mapping	10 yr.	At identified corrosion risk locations
Rigid pipelines/ flowlines, static flexibles & umbilicals	Acoustic	6 yr.	Alternating with GVI
	GVI	6 yr.	Alternating with GVI
Pipeline flanges & PLETs/PLEMs	GVI & CCP	3 yr.	N/a
Rigid risers & spools	GVI & CCP	3 yr.	GVI full coverage, CP on flanges & outer clamps
Stag wells	GVI & CCP	3 yr.	

Maintenance and repair activities may include corrective (e.g. repair of equipment) and non-routine maintenance, which may occur during shutdown periods. These activities are largely unplanned and interrupt production and so are not expected/ wanted more than once every few years. The only liquid discharges that may occur during maintenance and repair activities are cooling water that will discharge directly to the sea (refer **Section 7.5**) and freshwater associated with cooling circuits on the generators that will be discharged to the drainage system (refer **Section 7.5**).

Platform and diving frequencies are set 'as required' as per Subsea Inspection Strategy (JS-16-PR-U-00001) and are based on findings during ROV Surveys and planned maintenance requirements. Diving operations will be supported by a suitable Diving Support Vessel (DSV) operating in DP mode or anchored in the field.

The underbuoy hose change out is conducted in accordance with the Stag Marine Facility Operating Manual (GF-90-MN-G-00038). The process of change out includes clearing the line of oil followed by a flush with seawater to the third-party tanker where the water is processed through the slops system. Discharges are thus as per slops discharge (refer **Section 7.4**).

Subsea integrity and maintenance activities carried out by Jadestone include the CPF, subsea export pipeline, CALM buoy (and mooring chains) and underbuoy hoses. The activities are undertaken and managed in accordance with CALM buoy – Operation and Maintenance Manual (GF-10-MN-G-00186), Jadestone's Subsea Inspection Strategy (JS-16-PR-U-00001) (summarised in Appendix D Stag Safety Critical Elements Performance Standards Report (GA-70-REP-F-00007) and Subsea Flexible Hose Maintenance Procedure (GF-

² As defined by Class requirements for marine assets

16-PR-L-00187). Other than discharges as per the underbuoy hose change out, there are no other discharges to the marine environment.

Wetblasting or grit blasting may be used to prepare structures or equipment prior to painting/ coating. Before commencing wet blasting or grit blasting, the work area is walled-in using sheeting that is taped down to create a fully contained work environment. Wastewater and particulate material (e.g. garnet if grit blasting, paint flakes and rust off old surface coatings) generated during the activity is managed within the work environment and is not discarded to the marine environment.

2.2.6 Integrity and Corrosion Control

Integrity and corrosion control work involves anode replacements on the various subsea pipelines and offshore facilities, cathodic protection monitoring, weld inspections, ultrasonic wall thickness testing, flooded member detection surveys, free span inspection of pipelines, coating inspection and repairs, protective leg wrap maintenance and installation, non-destructive testing (NDT) and general inspections and maintenance of subsea valves, Xmas trees and conductors, conductor guide centralisers and other subsea infrastructure. These activities can involve ROV/ AUV inspections or diver assisted surveys.

A program of ongoing fabric maintenance of the CPF is also undertaken as part of the Corrosion Management Strategy (JS-00-PR-N-00001). Prior to painting, the offshore structures are ultra high-pressure water or grit-blasted with garnet (a natural coastal sand product).

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

As part of the maintenance of these facilities, marine growth on the substructures is monitored using ROV and / or divers and if determined to be beyond the design imposed acceptable thickness it is periodically removed. This is usually undertaken by either water blasting or manual ROV, divers or bespoke automatic devices.

Inspections are scheduled to occur every three years, and replacement programs are planned on inspection findings. No discharges to the marine environment occur with planned replacement activities or inspections.

2.2.7 Utility Systems

Power generation

Main electrical power is supplied by three generator sets powered by Caterpillar diesel engines. Primary fuel for these engines is treated Stag crude oil however they can also run on diesel if required. Each machine is contained within its own enclosure, which provides weather protection, sound attenuation and fire protection.

Cooling water

Seawater is used as a heat exchange medium for the cooling of the three onboard power generators. The cooling water is drawn through a segregated cooling system and is therefore not contaminated by engine oils or other liquid discharges from the process. Average discharge rates are up to 108 m³/h for each of the generators. Discharge water is approximately 3°C above ambient marine waters and is discharged at hull level.

An industrial grade saltwater chlorinator is used to produce chlorinated water to dose the respective caisson and pumps utilising sea water to prevent the accumulation of marine growth throughout the system. More information on the discharges and process for cooling water are presented in **Section 7.5**.

Desalination brine discharges

The freshwater system is designed to produce, store and distribute fresh and potable water throughout the CPF. During normal operations, fresh and potable water is produced via a desalination process and results in a discharge of ~850 m³/d with elevated salinity (approximately 10% higher than the intake seawater), increase in temperature (between 27–39°C) and low concentrations of anti-scale chemicals. The seawater feed is taken from the main generator seawater cooling return line and further heated as required by steam supplied from the boiler.

Potable water may also be delivered by supply vessel during extended maintenance periods. A unique hose connection is provided to prevent cross contamination by inadvertent transfer of diesel from the supply vessel.

Storage is provided in a single Potable Water Tank, T960, of 215 m³ capacity located within the west side of the hull structure. The tank is fitted high and low level alarms and trips.

Heating Ventilation and Air Conditioning (HVAC) system

The purpose of the HVAC system is to:

- Purge enclosed designated areas of the accommodation and hull to maintain a non-hazardous classification and to prevent the entry of flammable gases;
- Provide conditioned air to manned areas to ensure a comfortable working and living environment;
- Provide controlled temperature in enclosed areas for the safe and efficient running of equipment; and
- Purge contaminated air from areas housing essential equipment before reoccupation (black start purging).

Two major air distribution systems are provided, one for the accommodation module and one for the hull. Each system has its own fans, ducting distribution system and fire dampers where required, but they share a common chilled water plant which supplies the cooling medium to both systems.

Facility lighting

The CPF is provided with lighting throughout the accommodation and process areas. In the event of a power failure, the system changes over to a low voltage emergency system.

Fuel gas

Gas produced from the process separators is used as fuel in the boiler and for process blanketing. The remaining gas is sent to flare.

2.2.8 Well Operations

Well operations outside of standard production operations conducted on the Stag CPF are planned and conducted in accordance with the Jadestone Drilling Management System (DMS) (JS-50-PR-W-00001) and include tasks from simple wellhead and tree maintenance, up to and including well completion, well interventions and workovers.

Well interventions and workovers are operations done on, within, or through the wellbore after the initial completion; and includes replacement of sub-surface safety valves and downhole pumps, wireline operations, and plug and abandonment / slot recovery activities.

Well operations on sub-pressured wells shall maintain a minimum of one well barrier envelope during the entire operation.

Planned well operations that may be undertaken on Stag include the following:

Wellhead and Tree Maintenance

Replacement of subsurface safety valves
 ESP replacement
 Zonal isolation
 Water shut off plug backs
 Setting and pulling of plugs, running drifts and other diagnostic runs
 Chemical injection, acid stimulation/injection
 Production logging of reservoir section for well performance assessment, or wireline evaluation logging of well
 Perforation and punching (mechanical and explosive)
 Removal and replacement of Tree and Wellhead components
 Tubing / Casing / Conductor milling, cutting, recovery
 Setting of downhole plugs / isolations (mechanical and / or cement)
 Annular cement squeeze
 Well Annulus diagnostics, fluid top up and bleed off
 Well Kill
 Well bore Clean-up
 Sand Clean-out
 Casing repair using straddle packer assemblies, expandable casing patches or installation / cementing of 194mm casing from surface to below failure

Work overs and interventions are undertaken on an as needs basis. Based on previous years' activities, approximately seven work overs/ interventions have been required per year. Based on historical activity, it is assumed that approximately 35 work overs/ interventions will be required over the lifetime of this EP.

During work overs and interventions, a dedicated workover crew, working day and night shifts undertakes the required well intervention activities. A brief description of each well intervention and workover activity as listed above is provided below. For noting, there are minimal discharges to the environment during cementing and section milling activities as the majority of the work is carried out on wells that are accessed on the topside of the platform.

Workover to replace ESP

Workovers and interventions are generally conducted utilising the Stag Hydraulic Workover Unit (HWU). The Stag HWU is operated under the procedures set out in the Stag Hydraulic Workover Unit Operations Manual (GA-18-MN-W-00221). This manual describes the operating and maintenance requirements of the HWU and details the policies and procedures specific to the unit.

The normal sequence of operations for an ESP workover is as follows:

- Well kill operations (injection of kill fluid (seawater treated with biocide) into well);
- Pull out of hole and lay down faulty completions;
- Casing integrity tests (if required); and
- Pick up and run in hole new completion.

Current Stag reservoir pressures range from approximately 1,380 kPa (200 psi) – 5,250 kPa (760 psi), equivalent to a 0.776 SG fluid gradient. Given Stag oil density is 0.893 SG, hydrostatic pressure of a full column of reservoir oil is greater than the maximum reservoir pressure, therefore the wellbore cannot hold a full column of fluid and cannot flow liquid to surface unassisted. With reservoir pressures being sub-normal, well kill operations are conducted using treated (biocide) sea water.

Casing integrity tests may be conducted if there is believed to be a well integrity issue with the 244 mm production casing. To test the casing integrity, a packer is run into the well on pipe to the selected test depth, set and the casing is pressure tested with seawater to a pre-determined pressure. The packer is then retrieved from the well and workover operations continue as programmed.

Wireline Interventions

Wireline interventions may be run as part of a workover program or as a separate, standalone operation.

Wireline operations include the running of electric tools into the well for conducting measurements. Measurements can include casing wall thickness, cement evaluation (behind casing), production logging (tools used to measure production properties of the well, for example fluid density, flowrate), formation logging (tools used to measure properties of the formation, for example rock density, resistivity, sonic properties), determining static fluid levels and setting of plugs to seal off the tubing or casing.

Wireline operations can be conducted with pressure containment equipment on live wells or on killed wells during workover operations.

Annulus Monitoring/ Treatment

Annulus monitoring is the measurement of pressure and fluid characteristics in the annuli of the well. This is a routine activity and completed as part of the well integrity management.

If pressures build up to unacceptable levels in the well annuli, annulus fluid will be bled off to the process so as to reduce the pressure. Samples of fluid will be taken so a determination as to the source of the pressure build-up can be identified.

Perforating

Perforating is an activity that may be undertaken to increase productivity (or injectivity) of the well. Small shaped explosive charges are conveyed into the well to a predetermined depth and detonated. The explosive charges blast a small hole through the casing and cement and into the formation to enable fluids to flow from the formation into the well.

Perforating guns can be deployed into the well as part of a wireline intervention, on coiled tubing or on pipe with the HWU.

Explosive charges to sever pipe or plasma cut pipe are included in this perforating activity. These operations are conducted if a string is stuck and needs to be freed from the well.

While perforating activities cause the release of sound energy, as the energy is released hundreds of metres downhole there is no transmission of sound energy to the marine environment. Therefore, no impact assessment of this planned activity appears in **Section 7** of the EP.

Water shut-off / zonal isolation

Water shut offs or zonal isolations are normally carried out by the HWU.

Depending on the location of the zone required to be shut-off will determine the tools and technique used to achieve the isolation. All shutoffs will be conducted utilising the deployment of mechanical barriers into the well, be it bridge plugs or straddle packers/ liners.

Sand clean out

During production, it is common for sand to be deposited and accumulate inside the horizontal sections of casing.

During workovers or interventions, this sand can impede access to the required section of the well. To gain access to the well, this sand has to be flushed away.

With reservoir pressures being sub-normal and the limited pumping capacity of the Stag HWU, it is impossible to lift the sand to surface. As a result, if sand clean-out is required, fluid is injected at surface and the sand is agitated at the build-up to flush it back into the reservoir.

Casing milling, cutting, recovery

During workover operations, or as part of abandonment preparation work, there may be a requirement to cut and recover casing or mill casing with downhole tools.

Casing cutting is achieved through the running of a casing cutting tool into the well. Metal blades on the casing cutter are activated by pumping through the tool. The tool is then rotated with the blades cutting the casing. After cutting the casing cutter is retrieved and the casing can then be recovered (pulled) back to surface.

Specialty milling fluids are used for section milling operations when on a closed system (casing cleaned and reservoir isolated from activity) with returns to surface to remove casing cuttings (swarf) from the well. On surface the swarf (metal filings) is removed from the milling fluid stream via magnets placed in the returns trough. This swarf is then placed into designated waste bins for disposal onshore. On completion of this activity the milling fluid is displaced out of the well with clean fluids (treated seawater). This milling fluid is discharged directly overboard at sea surface. The milling fluid generally consists of potassium chloride for formation inhibition and xanthan gum to provide viscosity to lift swarf, with traces of additives to assist with fluid longevity (biocide) and assist cutting (lubricity).

Well kill/ suspension

Well kill is the process of pumping fluid with a density greater than the produced fluid into the well to stop the well from flowing. This is done to control the well.

Current Stag reservoir pressures range from approximately 1,380 kPa (200 psi) – 5,250 kPa (760 psi), equivalent to a 0.776 SG fluid gradient. Given Stag oil density is 0.893 SG, hydrostatic pressure of a full column of reservoir oil is greater than the maximum reservoir pressure, therefore the wellbore cannot hold a full column of fluid and cannot flow liquid to surface unassisted. With reservoir pressures being sub-normal, well kill operations are conducted using treated (biocide) sea water.

Cementing Operations

Cementing operations may occur during repair or abandonment of well sections. Cementing operations involves pumping of cement downhole to a pre-determined location in the well. On placement of the cement surface equipment and the well above the target location are displaced to clean fluids (treated seawater) to ensure there is no excess cement that will cause blockages or future access once set. This excess cement is discharged directly overboard at sea surface.

Disposal of NORM tubing (onshore).

During workovers, the tubing is recovered from the well. During the production phase, naturally occurring radioactive materials (NORMs) may have been deposited on the walls of the tubing.

As tubing is recovered from the well it is tested for radioactivity. If found to be radioactive, the tubing is quarantined, shipped to shore and disposed of by the waste contractor in accordance with the necessary requirements for the disposal of such waste.

2.2.9 Plant Modification

Plant modification may entail the removal, replacement or installation of new equipment to either surface or subsea equipment. Plant modification may occur in response to operational changes or new technology. Such modifications may include removing pipework and process units or upgrading the various components and equipment on the platform, including the addition of new equipment.

When equipment becomes obsolete, or requires change due to wear, corrosion or age, it will be changed out for new, more modern/efficient replacements. Prior to change out, flushing of the section will be undertaken using water and nitrogen, with discharges managed through the closed drainage network, after which the section will be isolated and changed out.

No discharges to the marine environment are planned during modifications to plant and process equipment.

2.2.10 Waste Management

Jadestone's Waste Management Plan (JS-70-PR-I-00035) applies to activities in the Stag Field, which details the waste management practices during operation. The Waste Management Plan also addresses controlled waste management in accordance with the Environmental Protection (Controlled Waste) Regulations 2004. There are no planned discharges of solid wastes to the marine environment.

Non-Hazardous waste

Non-hazardous solid wastes include scrap metal, packaging, wood, cardboard, paper, empty containers and putrescible waste (food scraps) that will routinely be transferred onshore for recycling or disposal.

Non-hazardous wastes are segregated at source into recyclable and non-recyclable wastes and stored in marked containers for transport onshore to Dampier for recycling disposal.

Non-hazardous wastes produced on the Stag CPF that will be segregated to facilitate recycling include:

- Paper and cardboard;
- Mixed plastics;
- Aluminium cans;
- Wooden pallets; and
- Scrap metal.

All non-hazardous solid wastes will be returned to the mainland for disposal or recycling by back-loading onto a support vessel in closed containers (e.g. skips, wheelie bins, tanks or bulk-bags). Jadestone's waste management contractor will dispose of general wastes to an approved landfill facility or appropriate treatment/ recycling facilities for segregated wastes.

Hazardous waste

Hazardous wastes routinely generated include oil contaminated material (e.g. sorbents, filters and rags), spent chemicals and chemical containers, used engine oil, paint cans, hydraulic fluids, batteries, fluorescent tubes, cooking oils and medical wastes. NORM in the form of scale and sands may also be generated. Wet blasting, if performed, will generate a sludge waste comprising blasting medium (if used, i.e. garnet), rust and particles of old surface coatings (e.g. paint and epoxy). Oily waste material may also be generated as a result of oil spill response activities.

Hazardous wastes will be segregated at source and stored in clearly marked containers prior to transfer onshore to Jadestone's waste management contractor for recycling wherever practicable or disposal at a licensed waste disposal facility. Hazardous waste types to be segregated in accordance with the Waste Management Plan are:

- Aerosol cans (recyclable);
- Batteries (recyclable);
- Electronic waste (recyclable);
- Empty plastic / metal drums (recyclable);
- Flammable liquid wastes (non-recyclable);
- Fluorescent tubes (recyclable);

- Gas cylinders (recyclable);
- Glycol (non-recyclable);
- Hydrocarbon sludges (non-recyclable);
- Medical waste (non-recyclable);
- Produced sands (non-recyclable);
- Solid hazardous waste (non-recyclable); and
- Waste Oil (recyclable).

Handling and storage of waste chemicals will be in accordance with the relevant Safety Data Sheet (SDS).

As described in **Section 2.2.1** produced sands are generated on the Stag CPF from the Stag reservoir. The sands settle out in the separators where they are regularly flushed to the Stag sands solids washing and handling process. The dry sands are transported back to the mainland in ‘bulki bags’, each containing approximately 1.7 t of material.

A third-party assessment of NORM levels in Stag sands – Radiological Assessment of Washed Sands generated from the Stag Offshore Production Platform (GF-70-REP-F-00001) – indicated that the levels of NORM within Stag sands do not put them into the category of radioactive waste and that no special procedures/ guidelines are required for handling, transportation or disposal on the basis of their NORM activity.

Table 2-4: ²²⁶Ra and ²²⁸Ra Activity Within Stag CPF Produced Sands between 2015 and 2022

Sample Year	²²⁶ Ra (Bq/kg)	²²⁸ Ra (Bq/kg)
2015	127	155
2016	217	251
2017	188	189
2018	362	333
2019	305	377
2020	No samples due to COVID closing laboratories	No samples due to COVID closing laboratories
2021	349	608
2022	560	560

Third-party tanker and Support Vessels

For the third-party tanker and support vessels against which MARPOL Annex V and/or Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (Part IIIC)/ AMSA Marine Order 95 apply, wastes are contained, segregated, stored, labelled, processed and disposed of in accordance with a Garbage Management Plan, as specified in MARPOL Annex V or AMSA Marine Order 95. Waste may be incinerated onboard the third-party tanker.

2.2.11 Lifting Operations

The Stag Platform is equipped with a single Amclyde Model 20000 diesel-hydraulic pedestal crane, installed on the west side of the CPF. The crane pedestal is integral with the structure of the process module. The crane has a main hook, which was designed to be reeved with four or six lines, and an auxiliary hook with a single line, however, the main hook has been de-rated to four lines only due to the capacity of the crane pedestal. The maximum load of the crane is 26,309 kg.

The crane has an additional brake on the Whipline to facilitate personnel riding. The CPF also has monorails and pad eyes installed for use in lifting operations.

Lifting equipment and loose lifting gear are managed in BASSnet CMMS. All personnel involved in lifting operations are suitably competent and hold the relevant qualifications. The lifting operations are managed using the permit to work (PTW) system and follow the Lifting Operations Procedure (JS-90-PR-F-00036).

2.2.12 Export and Offtake Operations

Transfer of Stag crude oil from the CPF to the third-party offtake tanker passes through several pieces of infrastructure and equipment:

- A rigid 8" riser;
- Subsea export pipeline;
- Pipeline end manifold (PLEM);
- Flexible riser at the PLEM;
- The underbuoy hose up to the CALM buoy;
- From the CALM buoy the oil passes through a 200 mm (8"), up to approximately 220 m long, double carcass type floatation hose (the offtake hose). Within the offtake hose a marine breakaway coupling (MBC) is positioned between hose sections 5 and 6; and
- At the end of the offtake hose the oil passes through a manifold connection at the third-party offtake tanker.

The equipment described above is indicated in **Figure 1-1**.

Transfer of crude oil through the export and offtake infrastructure and equipment is usually gravity fed. This means that the height difference between the Stag CPF where the transfer of cargo commences, and the height at the tanker manifold are different (i.e. the CPF is higher than the tanker manifold) and allows the cargo to flow across the field from the CPF to the tanker. The gravity feed process does not involve a pump.

In the circumstance that transfer is impeded from the CPF to the tanker (e.g. in cooler months when the cargo is more viscous, or when the tanker is empty and the manifold is higher), an export pump may be used. The export pumps are fitted with minimum flow valves which automatically recirculates the oil around the pump to maintain the level in the production process on the CPF. The maximum discharge of the pumps can therefore only be the maximum production rate from the facility at the time (i.e. a maximum pumped rate of up to 5,000 bbl/d).

Periodically, once cargo loading is complete (approximately every three to four months) or during cyclone response (between the months of November to April inclusive each year), the third-party tanker will depart the field. During this period, either a replacement tanker will arrive, or the field will be shut in until a tanker arrives. In the event a third-party tanker is not in field, the offtake hose will remain shut in and connected to the CALM buoy.

Planned production shut ins / reduced production events will occur each year as required. Shutdowns are required for cyclone departure and reconnect of the tanker, as well as for planned maintenance programs of the CPF and subsea infrastructure. The field planning process manages the competing demands of the drivers to maintain a consistent frequency of shutdowns so operations remain consistent for the facility. The primary risk associated with shutdowns due to any of the drivers listed is damage to the electrical submersible pumps that are used downhole in production wells which can be materially affected during production shut ins or shutdown periods. Increasing the number of stops on the pumps increases the potential for pump failures during restart so when possible the intention is to reduce ESP speeds and produce into the crude fuel storage tank and utilise additional capacity within the Stag process when a third party tanker is not connected, in accordance with document Continuing Production During Tanker Changeover (GA-19-PR-P-00268).

Following reconnection of the third-party tanker, the underbuoy hose, offtake hose and CALM buoy connections will be leak tested to ensure integrity prior to recommencement of production and cargo

transfer to the third-party tanker. In the event integrity defects are identified during pre-cargo transfer testing, an appropriate repair plan is implemented.

Inspection and maintenance activities, as well as operation of the offtake equipment, is the responsibility of Jadestone. The offtake equipment described here is also described in the Facility Description of the Stag Development Safety Case (GA-70-REP-F-00003.02). As such, Jadestone is also the Operator registered with NOPSEMA and is responsible for the operation and maintenance of the equipment, as required by an Operator of a Facility under the OPGGS Act.

Planned inspection and maintenance activities undertaken as a minimum for the offtake equipment includes the following:

- A monthly visual inspection of the offtake hose;
- An annual pressure test of the offtake hose; and
- A five year replacement of the offtake hose (including the MBC situated within the hose).

2.2.13 Support Vessels

Supply/ support vessels provide support activities to the facility during operations, including transport materials, fuel and chemicals, for offloading and backload of equipment, waste and materials.

Support vessels may be used for survey activities, inspections, maintenance, static tow, and connect/disconnect activities, as required.

These vessels may also be used to provide oil spill response services in the case of an incident.

2.2.14 Helicopter Operations

Helicopter operations contracted for Stag Facility operations encompasses routine crew change and access to 24-hour medivac coverage. The helicopter hanger and passenger processing facilities are currently conducted out of the Karratha airport; however, the aircraft contract arrangements are reviewed on a regular basis and the contractor and heliport arrangements may be changed from time to time.

Helicopter contracting and technical and operational specification are referenced in accordance with OGP Aircraft Management Guidelines.

Aircraft operations and aviation passenger safety are administered by the CAA of Australia which issues guidelines for aircraft take-off and landing facilities.

The helideck on the facility is designed, illuminated, marked out and operated/audited in accordance with these guidelines:

- CAP 437: UK C.A.A. 8th Edition Jan 2018: Standards for Offshore Helicopter Landing Areas; and
- CAAP 92-4(0): Australian CASA – Guideline for the development and operation of off-shore Helicopter Landing Sites.

Selected core personnel on the facility are trained in helicopter operations and helideck procedures, enabling each of them to perform the duties of the helicopter landing officer (HLO) if required.

Wind speed and weather limitations for flights are defined by the aircraft operator and all aircraft operations are at the ultimate discretion of the pilot.

There are no helicopter refuelling facilities on Stag, and no planned helicopter operations on the third-party tanker.

2.2.15 Diving and ROV Operations

Diving operations (air diving or saturation diving) may be required at the Stag CPF and Stag CALM Buoy to conduct inspection and survey, maintenance and repair or intervention. A diving contractor with a NOPSEMA accepted Diving Safety Management System (DSMS) will be contracted to perform diving activities from a diving support vessel (DSV). No diving operations will be carried out from the Stag CPF.

ROV may be deployed from vessels to conduct surveys of infrastructure and the seabed and conduct IMR activities.

Typical diving and ROV activities are summarised in **Table 3-4**. These activities may be initiated to maintain the safety and operation of the facility and are carried out using detailed planning and maintenance procedures.

Table 3-4: Typical Diving and ROV Activities Undertaken at the Stag Facility

Diving/ ROV tasks	Specifications
Inspection and survey	Inspection of pipelines, pipeline risers and subsea infrastructure (including the CALM buoy and mooring inspection); non-destructive testing (NDT) inspection; photography and video; condition monitoring; seabed survey inspections.
Maintenance and repair	Cathodic protection measurements and anode replacement; cleaning and marine growth removal; pipeline/ riser coating removal and repair; free span correction; air lifting and dredging; general maintenance of structures, pipelines and risers; underbuoy hose removal and replacement; mooring chain maintenance and replacement.
Intervention activities/ valve operations	Installation and recovery of subsea temporary pig receivers/ launchers; installation of pipeline and riser repair clamps; replacement of flexible risers/ pipelines; installation of protection frame and subsea structures; subsea manifold valve operation.

2.3 Hazardous Substances and Chemical Selection Process

Production chemicals are required to be added to the production process to ensure the process is operating efficiently. The primary means of reducing the risk of environmental impacts from the composition of chemicals used is achieved through Jadestone’s Chemical Selection Evaluation and Approval Procedure (JS-70-PR-I-00033). The procedure prioritises the use of environmentally low risk chemicals.

The risk assessment process assesses chemicals based on toxicity, biodegradation and bioaccumulation to select an appropriate product. Selection is based on the United Kingdom’s Offshore Chemical Notification Scheme (OCNS):

- Chemicals that are Gold, Silver, group E and D under the OCNS Definitive Ranked Lists and have no substitution warning do not require further assessment, as they do not represent a significant impact on the environment in standard discharge scenarios;
- Chemicals not meeting the criteria above (i.e. OCNS white, blue, orange, purple, A, B, C or have product/ substitution warning) require additional assessment to understand the environmental implications for an expected portion to be discharged into the marine environment; or
- Chemicals that are not OCNS registered require further assessment to determine the environmental implications if the chemical is discharged into the marine environment.

Appendix L contains the template for the Environmental Risk Assessment of Chemicals for Operational Activities, extracted from the chemical selection evaluation and approval procedure (JS-70-PR-I-00033). Chemicals with substitution warnings are also considered to find alternatives where feasible.

The selection of chemicals that fall into the last two assessment types require the additional development of an ALARP justification using a standard template and are subject to periodic review as part of the continuous improvement of chemical selection and usage.

The quantity of chemicals used, and therefore the residual concentration discharged to the environment, is reduced to as low as practicable through routine sampling and assessment from various points in the production process. Concentrations and dosages of chemicals need to be maintained at certain levels to meet the production requirements, but excessive levels are not desirable due to increased operational costs as well as the potential for environmental impacts (Chemical Dosing - Process Chemicals, GA-19-PR-P-00015).

2.4 Maintenance and removal of property

2.4.1 Maintenance of property

Section 572(2) of the OPGGS Act requires that 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; and
- (b) used in connection with the operations authorised by the permit, lease, licence or authority

Through ongoing monitoring and maintenance (as described in **Section 2.2.5**), Jadestone will ensure that property is monitored, maintained and repaired as required throughout operations. This will also ensure that infrastructure is maintained in good condition and can be safely decommissioned when required. This includes:

- Routine inspections on operational and suspended infrastructure
- Assurance activities
- Maintenance activities
- Crane and lifting equipment load ability is maintained for decommissioning activities
- Disconnection of unused infrastructure in preparation for removal

2.4.2 Asset Lifecycle and removal of property

Jadestone is committed to managing the lifecycle of its assets through the implementation of Jadestone's Management of Aging Assets Philosophy (JS-00-PHL-G-00001) which applies to all Jadestone's operating assets. The objectives of this philosophy are to:

- Describe the systematic approach taken to implement, verify and assure the management of ageing assets;
- Identify how the organisation supports delivery on a sustainable basis;
- Describe how planning and implementation is affected; and
- Identify how validation and assurance activities influence the overall program.

The current expected commercial field life for Stag is estimated at 2035 therefore, no end of facility life (EOFL) decommissioning activities for the subsea or topsides infrastructure is scheduled to occur within the 5-year in-force period of this EP. **Table 2-5** below summarises the infrastructure within the field and its year of commission. Design life in the context of facilities is used in procurement to avoid any obsolescence issues arising during the nominated period, whereas facility integrity is indefinite subject to ongoing integrity management. As required, re-lifing projects occur which consider the age and integrity of property and future use in the consideration of life extension.

Structural components of the Stag facility were designed for a fatigue life of 50 years. Life extension beyond original design life is an ongoing independently certified process. Much of the structural components (Jacket, CALM buoy etc) have currently been extended out beyond 2023 subject to an agreed ongoing integrity

management program), and the current strategy for decommissioning the Stag field is to undertake removal of property at the end of field life which is currently estimated at the end of commercial field life 2035. Property may also be decommissioned and removed, if that property is determined at any time to have no future utility between now and the end of commercial field life.

Table 2-5: Year of commission and design life of infrastructure within Stag field

Infrastructure/Equipment	Year of Commission	Design Life
CPF comprising Jacket & Topsides	1998	Structure 50 years ¹ Facilities 15 years ²
Subsea export Pipeline & PLEM	1998	25 years ²
CALM Buoy	1998	25 years ²
Flexible Transfer Hoses – Underbuoy Hose & Offtake Hose	2022	10 years plus, dependent upon tested performance ³
Wells		
12H	1997	Not Applicable ⁴
14H	1998	Not Applicable ⁴
15H	2000	Not Applicable ⁴
17H	1999	Not Applicable ⁴
18H	1999	Not Applicable ⁴
21H	2000	Not Applicable ⁴
25H	2003	Not Applicable ⁴
27H	2008	Not Applicable ⁴
29H	2006	Not Applicable ⁴
32H	2008	Not Applicable ⁴
36H	2011	Not Applicable ⁴
37H	2010	Not Applicable ⁴
38H	2011	Not Applicable ⁴
40H	2011	Not Applicable ⁴
43H	2012	Not Applicable ⁴
44H	2012	Not Applicable ⁴
45H	2012	Not Applicable ⁴
48H	2013	Not Applicable ⁴
49H	2018	Not Applicable ⁴
50H	2022	Not Applicable ⁴
51H	2022	Not Applicable ⁴

Notes

- 1 Design life associated with Structural components is 50 years nominal with integrity management assured by an ongoing fitness for service certification programme
- 2 Design life associated with facilities (15 years) refers to the initial period in which procured items needed to be supported by suppliers and manufacturers. Integrity management of facilities is an ongoing process where fitness for service is maintained and reliability and obsolescence issues are managed
- 3 Flexible transfer hoses have a design life that is informed by periodic condition assessments (visual and pressure testing). Typical expected design life is > 10 years.
- 4 Wells, like facilities, are subjected to an ongoing integrity management programme to demonstrate fitness for service (**Section 2.2.5**).

Section 572 (3) of the OPGGS Act requires that a titleholder 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.

Unless other arrangements are made to the satisfaction of NOPSEMA decommissioning activities are not covered as part of this EP (including the plug and abandonment of wells) and will be subject to separate approval. Prior to the end of field life (currently estimated as 2035) whilst the title is still in force, a decommissioning plan will be in place that sets out the strategy for removal of property from the permit area. As parts of the facilities and infrastructure become redundant, these will be part of a removal plan, whilst the decision for removal of these will be subject to approval and costs. Cost optimisation can be achieved through multi-asset campaigns to share mobilisation/demobilisation fees, decrease vessel day rates and improve labour and services unit cost rates. Therefore, for infrastructure to remain in field under a maintenance and inspection regime (refer above) for any period of time following disuse, the assets will need to be assessed to ensure that:

- risks to other marine users by their presence is low
- environmental risks of leaving infrastructure in situ for a period of time are low
- the ability to remove the infrastructure at a future date is not compromised by leaving the infrastructure in situ for a period of time
- the costs to recover standalone pieces of equipment are considered disproportionate to the costs of leaving in situ until a later period when cost optimisation can occur.
- Following consideration of the above, there may be a change in the monitoring and maintenance regime that is in place, including additional maintenance for example, to ensure that Jadestone can continue to meet its obligations under the OPGGS Act.

2.4.3 Decommissioning Planning Process

As part of ongoing validation of the Stag Asset Decommissioning & Restoration (D&R) liability, Jadestone completes an external review of the facilities D&R technical basis and associated cost estimate annually with a report compiled every 3 years which effectively follows a 3 year cycles of 2 years top down review followed by a bottom up budget in the 3rd year. The cost estimate study is based on the available technical and market information using previous Operator D&R studies, facilities engineering documents, current Australia D&R Regulations and current Australia project and market execution cost norms.

The suspension of assets will require flushing and de-oiling to leave the infrastructure without hydrocarbon inventory and ensure integrity is maintained as part of the “lighthouse keeping” process required before D&R operations are executed. This includes:

1. WHP well and topsides flushing and purging
2. Subsea Flowlines, umbilicals and risers flushing and de-oiling
3. CALM buoy and mooring chains recovered. PLEM and riser recovery.
4. Flushing and purging oil export and water injection pipelines

Preliminary cost estimates have been completed to consider the costs associated with heavy lift vessels to remove infrastructure, allowance for deck strengthening on the WHP to allow for lifting, and site remediation and restoration works to clear debris post removal.

International Maritime Organisation (IMO) guidelines for the removal of offshore installations and structures stipulate that full jacket removal will be required if the abandoned installation is located in less than 75 meters water depth and weighing less than 4,000 MT (excluding topsides). As the Stag CPF is in water depth of less than 75 meters, this would require full removal of the Stag jacket.

Removal activities would be completed using a single lift of the jacket after water jet or explosive cutting of the piles at the mudline with the piles below the mudline planned to be left in-situ (subject to approval).

The base case for decommissioning at Stag is full removal, however consideration will be given to partial abandonment in situ which would be subject to further studies, management approval and regulatory approvals prior to execution and these options may change during the approvals process.

In developing the decommissioning framework prior to end of field life, Jadestone intends to undertake further technical and environmental studies to further inform decisions and comparative assessment of options for removal. These studies may include:

- Material degradation assessments of subsea infrastructure that may be considered for in situ abandonment;
- Engineering studies for removal of infrastructure based on current technologies, technical feasibility and availability of equipment and vessels;
- Waste management studies for end point disposal (including options for recycling, repurposing and disposal) of recovered infrastructure;
- Analysis of existing environmental data taken from in field monitoring (e.g. sediment and water quality, ROV footage) to identify ecological features and communities. Including understanding of any mercury or NORM;
- Opportunistic analysis of infrastructure that is removed from field for presence of NORM;
- Potential requirements for remediation and monitoring;

The timeframe allocated to planning for decommissioning allows for these studies to be scoped out and completed, comparative assessments to be completed and the preparation of a Cessation of Production EP and/or decommissioning EP and to have each assessed by NOPSEMA sufficiently in advance of activities commencing to ensure each EP is accepted prior to activities commencing and prior to end of field life.

Jadestone's commitment to having a decommissioning framework is provided in management control 054: *No later than five years prior to the end of field life, Jadestone will have a decommissioning framework that details how JSE will meet the obligations under s.572 of the OPGGS Act. This will include:*

- timeframes for regulatory approval documents and other milestones
- inventory of all in-field infrastructure
- design life and status of all in-field infrastructure
- Overall decommissioning concept

3. DESCRIPTION OF THE ENVIRONMENT

OPGG(S)(E) Regulation 13(2) requires the proponent to ‘(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.’

To address this requirement, Jadestone has evaluated the values and sensitivities within two types of areas related to the activity:

- The Operational Area – the geographical area encompassing the environment that may be affected by the planned activities (Section 1.4.2); and
- The Environment that May Be Affected (EMBA) – the geographical area encompassing the environment that has the potential to be affected by the unplanned events associated with the activities described (Section 5.7.2) depending upon the level of exposure.

The spatial extent of the EMBA and location of the Operational Area is presented in Figure 3-1. The EMBA is based on the low-level exposure of hydrocarbons on and in, the water and represents the largest extent of an oil spill due to the worst-case scenario as per NOPSEMA Bulletin #1. This is further described in Section 7.4 and below:

- Surface hydrocarbons EMBA– hydrocarbons that are ‘on’ the water surface ($>1 \text{ g/m}^2$)
- Entrained hydrocarbons EMBA– hydrocarbon that is entrained ‘in’ the water ($>10 \text{ ppb}$)
- Dissolved hydrocarbons EMBA– the dissolved component of hydrocarbon in’ the water ($>10 \text{ ppb}$), and
- Shoreline loading EMBA – hydrocarbons greater than 10 g/m^2 .

Details of the environmental values and sensitivities in the Operational Area are described here in Section 3. The environmental values and sensitivities in the EMBA have been used to inform the assessment of the unplanned events in particular, crude and marine diesel spills, oil spill response planning and oil spill risk assessment (Section 7.4 and 6.9). A full list of the environmental values and sensitivities in the EMBA is contained in searches of the protected matters database in Appendix B and Appendix C.

A number of spill scenarios have been modelled and the EMBA represents the worst case for all of the spills rather than the worst case of a single spill. Within the EMBA is a smaller RISK EMBA which is represented by higher thresholds (termed as ‘moderate’ in NOPSEMA bulletin #1), this represents the environment within which receptors could be affected (rather than just contacted) and is based on scientific knowledge to determine the potential for impact. This is further described in Section 7.5. All the receptors within the RISK EMBA are contained within the EMBA and therefore fully described within this chapter.

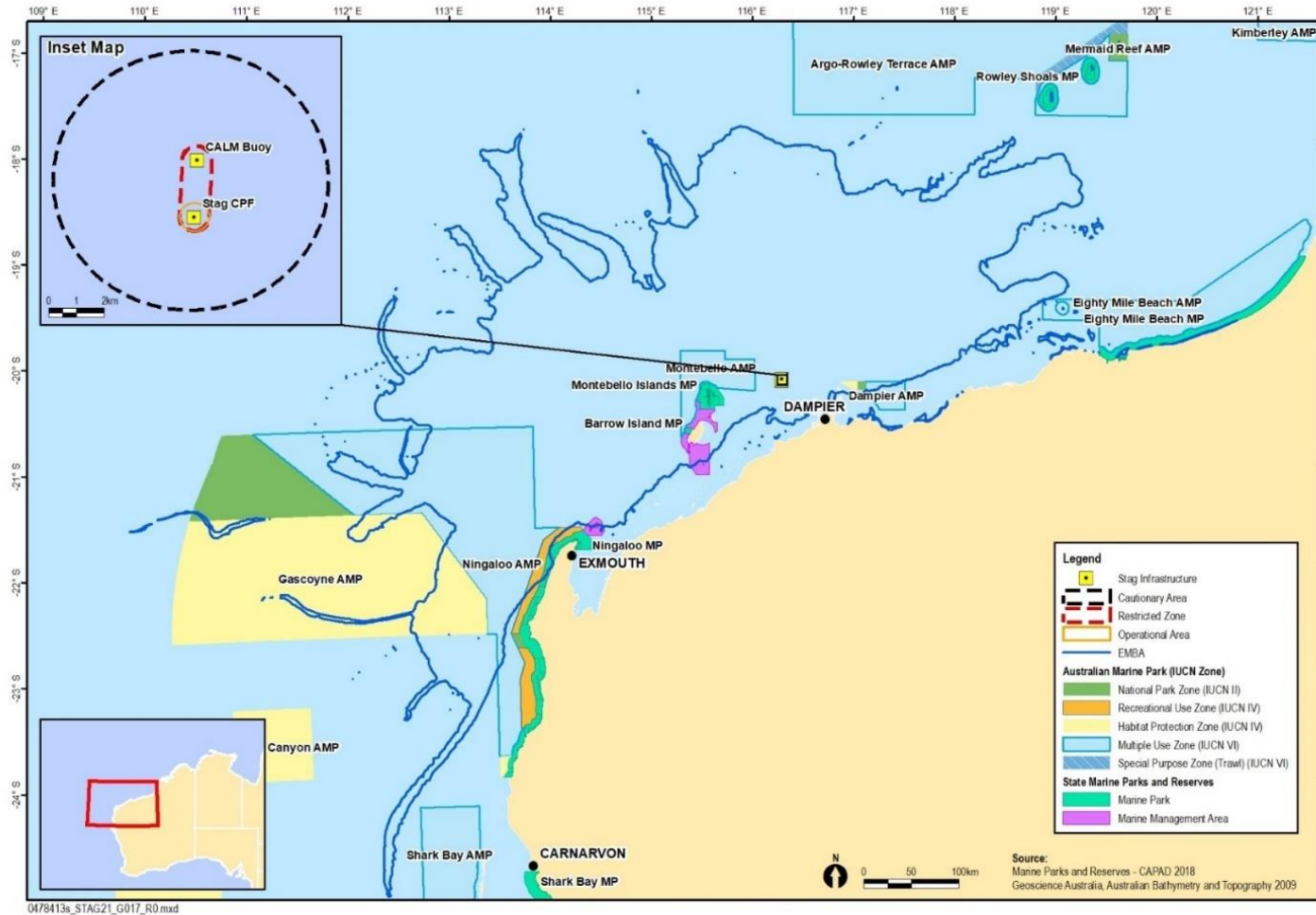


Figure 3-1: Annualised EMBA for Worst Case Scenario Hydrocarbon Spill

3.1 Regional Setting

The Operational Area and EMBA lie entirely within the Commonwealth waters of the North-west Marine Region (the region) and adjacent state waters between Ningaloo and Eighty Mile Beach. The region is distinguished by its predominantly wide continental shelf, very high tidal regimes (especially in the north), high cyclone incidence, unique current systems and warm, low-nutrient surface waters.

The region supports high species-richness of tropical Indo-west Pacific biota, but low levels of endemism (DSEWPaC 2012d). The offshore islands, coastline and waters within the region provide vital habitat to an extensive range of marine species including turtles, cetaceans, whale sharks and seabirds and has high fish biodiversity and consequently, is of value to commercial fish, prawn and crab fisheries.

3.2 Physical Environment

3.2.1 Climate

The region lies in the arid tropics experiencing high summer temperatures and periodic cyclones. Rainfall in the region is low with evaporation generally exceeding rainfall throughout the year although intense rainfall may occur during the passage of summer tropical cyclones and thunderstorms (Condie et al. 2006). Mean air temperatures over the neighbouring ocean area range from a minimum of 11°C in winter to a maximum of 37°C in summer. Due to the arid climate, daytime visibility in the area is generally greater than 5 nm (SSE 1991).

The summer and winter seasons fall into the periods September–March and May–July, respectively. Winters are characterised by clear skies, fine weather, predominantly strong east to south-east winds and infrequent rain. Summer winds are more variable, with strong south-westerlies dominating. Three to four cyclones per year are typical, with the official cyclone season being November through to April (BoM 2013).

3.2.2 Seawater Temperature and Salinity

Salinity is relatively uniform at 34–35 ppt throughout the water column and across the NWS. Due to the low rainfall, there is little freshwater run-off from the adjacent mainland (Blaber et al. 1985). NWS waters 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 correlated to sea surface temperatures and are greatest during the warm-water season (SSE 1991). Near bottom water temperature is approximately 23°C with no discernible seasonal variation.

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).

3.2.3 Wind

Non-cyclonic wind conditions are predicted for the Stag Field based on four years of continuous wind measurements at a nearby site (Wandoo platform; WNI 1995). Wind patterns are monsoonal with a marked seasonal pattern; wind shear on surface waters generates local-scale drift currents that can persist for extended periods (hours to days). During October–March, the prevailing non-storm winds are from the south-west, west and north-west at an average speed of less than 10 knots, peak average speeds of 15– 25 knots, and maximum speeds of 30 knots. Winds from the south-east to north-east quadrant are experienced at a frequency of less than 10% over these seasons. In June–August, winds are generally lighter and more variable in direction than in spring and summer. Non-storm winds prevail from north-east through to south-east at average speeds of 5–6 knots, peak average speeds of 10–15 knots, and maximum speeds of 20 knots. Transitional wind periods, during which either seasonal wind pattern may predominate, can be experienced in April–May and September of each year.

Extreme wind conditions in the area may be generated by tropical cyclones, strong easterly pressure gradients, squalls, tornados and waterspouts. Tropical cyclones generate the most significant storm

conditions on the NWS (SSE 1993). These clockwise-spiralling storms have generated wind speeds 50–120 knots within the region (SSE 1991). Tropical cyclones develop in the eastern Indian Ocean, and the Timor and Arafura Seas during the summer months of November to April. Since recordings began in 1960/61, tropical cyclones have approached from the northwest through to east, with the most frequent directions being from the north (34%) and east (36%). Due to the circular wind patterns involved however, winds can approach from any direction during the passage of the storm.

3.2.4 Waves

The wave climate is composed of locally generated wind waves (seas) and swells that are propagated from distant areas (WNI 1995). Sea directions run roughly parallel to prevailing wind directions. Hence, in summer, seas typically approach from the west and south-west, while in winter, seas typically approach from the south and east. Mean sea wave heights of less than 1 m with peak heights of less than 2 m are experienced in all months of the year (WNI 1995). Mean swell heights are low at around 0.4–0.6 m in all months. Due to the proximity of the mainland, the greatest exposure to swells is from the west (SSE 1993). Tropical cyclones have generated significant swell heights of up to 5 m in this area, although the predicted frequency of swells exceeding 2 m is less than 5% (WNI 1996). In the open ocean, sustained winds result in wind-forced currents of approximately 3% of the wind speed (Holloway and Nye 1985).

3.2.5 Tides and Currents

Sea surface currents over the NWS are generated by several components such as tidal forcing, local wind forcing and residual drift. Of these, tidal and wind forcing are the dominant contributions to local sea surface currents. The orientation and degree of drop-off of the continental shelf slope also influences the oceanography of the area. The tides of the NWS have a strong semi-diurnal signal with four tide changes per day (Holloway and Nye 1985; CMAR 2007). Peak tidal flows are from the north-northwest on the ebb, and to the south-southeast on the flood (Holloway and Nye 1985; SSE 1993; King 1994). 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 dominant offshore sea surface current (typically seaward of the 200m isobath) is the Leeuwin Current (Figure 3-2), which carries warm tropical water south along the edge of WA's continental shelf, reaching its peak strength in winter and becoming weaker and more variable in summer (CMAR 2007; Condie et al. 2006). The current is described as a surface current, extending in depth to 150 m (BHPB 2005; Woodside 2005). From September to mid-April the nearshore Ningaloo Current flows northwards, opposite to the Leeuwin Current, along the outside of the Ningaloo Reef and across the inner shelf (BHPB 2005; Woodside 2005). The Indonesian Throughflow is the other important current influencing the upper 200 m of the outer NWS (Woodside 2005; CMAR 2007). This current brings warm and relatively fresh water to the region from the western Pacific via the Indonesian Archipelago. Modelling undertaken by Woodside and CMAR indicates that significant east-west flows occur across the NWS to the north of the North-West Cape, possibly linking water masses in the area (Woodside 2005; Condie et al. 2006).

Offshore drift currents are represented as a series of interconnected eddies and connecting flows that can generate relatively fast (1–2 knots) and complex water movement. These offshore drift currents also tend to persist longer (days to weeks) than tidal current flows (hours between reversals). Therefore, in the event of an accidental oil spill, offshore drift currents have a greater influence than tidal currents on oil dispersion over timescales exceeding a few hours (APASA 2020).

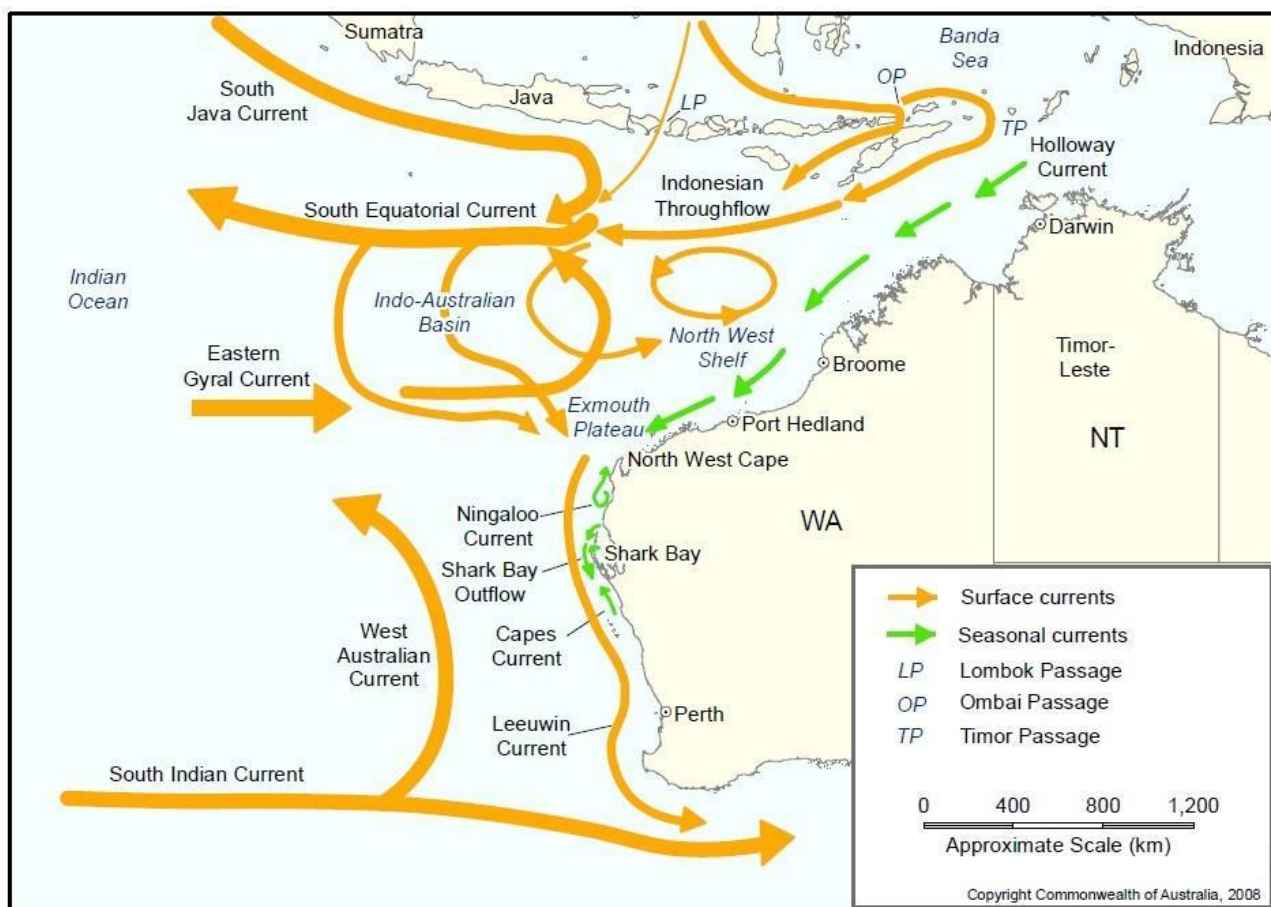


Figure 3-2: Surface Currents of the North-West Marine Region

3.2.6 Sedimentology

The Operational Area is characterised by a thick sequence of carbonate rock that is overlain by thin layers of unconsolidated fine to medium grained, carbonate sediments with occasional shell or gravel patches (Racal, 1994; Dames and Moore, 1995). Surveys conducted over the NWS indicate that a similar seafloor occurs extensively over this geographic region, but with spatial variation in the grain size and origin of the surface sediments (McLoughlin and Young, 1985; Woodside, 1990). Surface seabed sediments in the area are predominantly composed of skeletal remains of marine fauna, with lenses of weathered sands (McLoughlin and Young, 1985).

A debris seabed survey around the Stag Platform was undertaken as part of the Stag Apache Site Survey Campaign 2011 (Neptune Geomatics, 2011b). The survey confirmed that the surrounding seabed is free from debris. Two seabed types have been classified throughout the Operational area:

- Type A: Low relief unconsolidated calcareous fine to medium sand; and
- Type B: Low relief unconsolidated calcareous gravelly medium to coarse sand.

3.3 Subtidal Benthic Habitats

Benthic habitats are defined as those subtidal habitats lying below the lowest astronomical tide (LAT). The benthic habitats within the EMBA range from those at lowest astronomical tide (LAT) to more than 6,000 m at the canyons linking the Cuvier Abyssal Plain and Cape Range Peninsula (DEWHA 2012).

Benthic habitats are partially driven by light availability. Primary producers (photosynthetic corals, seagrass 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 is

predominantly dependent on the volumes of the suspended material in the water column. The photic zone in the offshore Pilbara approximately 70 m whereas in oceanic waters, the photic zone may extend to 120 m (DEWHA 2008).

3.3.1 Operational Area

3.3.1.1 Baseline Conditions

Apache Energy Ltd conducted sampling of the infauna and sediment characteristics within the Operational Area prior to development drilling as a baseline for comparison to the post-development (Kinhill 1997; 1998). This study confirmed that the benthic biota within the vicinity of Stag is comparable to that found over similar substratum and at similar depths over the wider region (Ward and Rainer 1988; Woodside 1988; Rainer 1991). The unconsolidated sediments in this habitat were found to support a diverse infauna, consisting predominantly of mobile burrowing species, which include molluscs; crustaceans (crabs, shrimps and smaller related species); polychaete, sipunculid and platyhelminth worms; asteroids (sea stars); echinoids (sea urchins), and other small infaunal animals.

Sediment and water quality data within the Operational Area was collected and analysed initially as a baseline study by Kinhill in 1997. The following characteristics were described:

- Water quality: temperature 29.6 –30.7°C at surface and 29.3–29.6°C seabed;
- Salinity 33.3–33.9 ppt;
- Oxygen 4.49 – 6.2 mg/L;
- Organic content 40% sediment;
- Sediment particle size was spatially (and temporally) variable;
- No hydrocarbons in marine sediments;
- Metals (barium, cadmium, chromium, copper, lead and zinc were low (below detection limits);
- Infauna 67.8 individuals/kg.

3.3.1.2 Post Drilling Conditions

There have been a number of studies undertaken after drilling has commenced (including Kinhill 1997, Kinhill 1998, CSIRO 2001, IRC 2001, and Oceanica 2015). Whilst for the most part there has been no changes to some aspects of the sediment and benthic habitat a few trends have been noted.

The sediments within the area of the Stag Facility are dominated by sand sized particles, with medium sand comprising the largest fraction. There were no clear trends in particle size distribution (PSD) with increasing distance from the CPF in sediment samples collected by Oceanica (2015). Most sediment was grey in colour and contains shells and other biota present. The majority of samples taken by Oceanica (2015) had no vegetation present and no obvious odour. This is consistent with results from a survey by CSIRO in 2001 (IRC 2001) who reported unconsolidated fine-medium and medium-coarse sands with patches of coral rubble (CSIRO 2001). Grain size characteristics were compared from sites 50m and 200m from the Stag platform against control sites. No differences were detected (IRC 2000).

The total abundance of benthic invertebrates declined considerably between baseline and post- drilling surveys, the decline was similar among all stations including controls irrespective of distance from well (Kinhill 1999).

There is small spatial variability in the infaunal assemblages (e.g. crustaceans, molluscs, ostracods, bivalves, polychaete worms and amphipods) surrounding the Stag Facility and this is typical of soft sediments in the surrounding areas (IRC 2001, Oceanica 2015). Total infaunal abundance ranged between sites closest and

further away from the platform (131 + 39 individuals m⁻² and 417 + 23 m⁻² respectively). Polychaete worms and crustaceans were the most dominant infauna (IRC 2001). Any differences in infaunal group abundances were of similar magnitude with control locations. Similar results were obtained in a more contemporary study by Oceanica (2015), who reported prawns, polychaetes, tube polychaetes, amphipods and bryozoans in sediment samples collected.

While there are no significant benthic primary producers (benthic photosynthetic organisms) associated with the soft sediment habitat within the Operational Area, some small patches of algae were found by Oceanica (2015). The subsea infrastructure such as the CPF platform, CALM buoy mooring and the MODU spud cans and legs, are likely to provide attachment points with sufficient light availability for algae as well as other filter feeding organisms (e.g. hydroids, bryozoans and molluscs). ROV footage from July 2020 indicated that the biofouling assemblage observed on the Stag field infrastructure was representative of that which would be expected of any structure immersed for an extended period in the waters in that region (PGM Environment 2021).

Pipelines have been shown to have a high abundance of commercially important fish, including snapper and grouper, as well as the presence of thousands of larval fish and juveniles suggesting the pipelines may actually enhance fish stocks (McLean et al., 2017). Although little is known about the habitat preference of syngnathids and pipefish, it is unlikely that they would occur in the operational area, with research showing a preference for coral reefs in tropical areas (Foster & Vincent 2004; Scales 2010).

Sediment contamination

Studies completed in 2000 (IRC 2001) and 2015 (Oceanica 2015) measured levels of contaminants in sediments at sites close to the Stag CPF and further away. Both these studies reported that concentrations of hydrocarbons were below detection limits at all sites and depths. This is consistent with the pre and post drilling surveys (Kinhill, 1997, Kinhill 1998 and Kinhill 1999) earlier.

Unlike hydrocarbons, some trace metals were above detection limits and some were elevated. Barium concentrations increased between baseline and post- drilling surveys (Kinhill 1999). During the IRC study in 2001:

- Barium concentrations were higher within 50m of the Stag platform and ranged from 76 ppm to 189 ppm. Other locations away from the platform ranged between 10.5 ppm and 45.5 ppm while the control locations had a range of 10.5 ppm and 23 ppm.
- Trace metal concentrations for chromium, copper, lead, and zinc were elevated within 50m of the platform when compared to locations further from the platform and the controls (IRC 2001).
- Cadmium concentrations were below detection limit of 0.2 ppm, while Chromium concentrations ranged from 14 ppm at 500m southwest of the Stag platform to 26.5 ppm at a control site.
- Copper concentrations were generally similar across all locations with values ranging from 4 ppm to 6.5 ppm.
- Lead concentrations were generally below detection (< 2 ppm) with the exception of 4.5 ppm and 5.0 ppm recorded 50m northwest of the Stag platform. (IRC 2001).
- Zinc concentrations were highest at 50m northwest of the stag platform with 23 ppm and 15.5 ppm and 17.0 ppm at two control locations.

A more comprehensive study was undertaken in 2015 (Oceanica 2015) to assess sediment quality and demonstrate that 95% species protection trigger values and sediment ISQG values are met at the boundary

of the area of impact. TPH, BTEX and PAH in sediment samples were all below the laboratory LoRs. While there are no ANZECC/ARMCANZ guideline values for TPH and BTEX, PAH concentrations were all below their ANZECC/ARMCANZ ISQG-Low and -High values.

Metal concentrations for all sediment samples were below their respective ANZECC/ARMCANZ ISQG-Low and High values (where available). There were no ANZECC/ARMCANZ guidelines for barium, iron, manganese and strontium but the concentrations away from the produced water discharge point were not substantially different to those further away. Highest concentrations in any one sample for these metals are 370, 10,000, 110 and 4500 mg/kg respectively (Oceanica 2015). Zinc concentrations were elevated in the vicinity of the Stag platform (highest reading 41 mg/kg at 70m away) but decreased to background levels at 250 m from the Stag platform (5.3 mg/kg). This is similar to previous monitoring in 2000 (IRC 2001). Lead and barium concentrations results were similar to those reported in 2000; however, the copper and chromium results were slightly lower than those in 2000.

3.3.2 EMBA

A wide range of benthic habitats occur within the EMBA including benthic primary producer habitats (i.e. photosynthetic organisms) such as macroalgal beds, seagrass meadows and hard corals which are distributed in shallow subtidal and intertidal waters, as well as intertidal water/ shoreline distributed habitats such as mangroves and salt marshes. Benthic primary producers are important components of ecosystems as they provide the source of energy driving food webs and provide shelter for a diverse array of organisms.

Other subtidal habitats within the EMBA include unconsolidated sediment, which is the most common subtidal habitat on the NWS, and rocky substrate (e.g. outcropping limestone pavement). Subtidal rocky substrate typically supports a mosaic benthic community which may comprise benthic primary producers such as macroalgae and hard corals in the photic zone. In deeper waters and/or where light is limited, hard substrate may have a community dominated by habitat-forming filter feeding organisms such as various soft corals, sponges and hydroids.

Other intertidal and shoreline habitats in the EMBA include intertidal sand/mud flats, intertidal rocky reefs, rocky shorelines and sandy beaches. Intertidal mud/sand flats are particularly extensive along the more northerly mainland shorelines of the EMBA, where the tidal range is greatest, and comprise large areas of exposed mud and sand at low tide. These are important foraging habitats for shorebirds, including important migratory species, which consume benthic organisms living in and on these flats. Protected sand/mud flat habitats within the EMBA include the Eighty-Mile Beach Ramsar site (also a proposed Marine Park; refer Section 3.7.4). There are numerous sandy beaches within the EMBA, on both offshore islands and the mainland, that are important nesting sites for a number of protected marine turtle species (refer Section 3.6.4).

Habitat diversity is highest in shallower waters where light availability promotes the occurrence of benthic primary producers, and in areas where hard substrate provides attachment points for a greater diversity of habitat forming organisms. Within the EMBA benthic habitat diversity is therefore highest within waters along the Ningaloo coastline, coastal waters between the Dampier Archipelago and Eighty Mile Beach, shallow waters around offshore islands extending from North-West Cape to Eighty Mile Beach (including Muiron, Thevenard, Montebello/ Barrow/ Lowendal, Dampier Archipelago and Turtle islands) and offshore shoals (e.g. Rowley shoals).

A more detailed description of benthic primary producers within the EMBA is provided in the sections below.

3.3.3 Coral Reefs and Communities

Across the NWS, corals tend to occur in relatively shallow areas with strong currents where water movement provides a constant supply of nutrients and particulate food. Corals occur as extensive reefs, patch reefs, isolated bombooras or in scattered colonies across the limestone pavement that dominates the shallow water

areas of the region. They contain photosynthetic unicellular algae called zooxanthellae and are therefore reliant on sunlight for their survival

Corals can be grouped into the following categories:

- Sceleractinian corals (hard corals) – reef-building corals;
- Non-scleractinian corals (sometimes referred to as calcified soft corals) – generally not considered to be reef-building; and
- Soft corals belonging to the order Alcyonacea – non reef-building.

Coral spawning usually occurs during the months of March and April in two concentrated events each of three to four days' duration, occurring on nocturnal, neap and ebb tides 7 to 10 nights following the full moon. In addition to this main spawning period in autumn, coral recruitment occurs throughout the year, with brooding species implicated. There have also been recent observations inferring broadcast spawning of corals along the NWS in October to November, although this appears to be a minor event relative to the March/April spawning.

Regionally, cyclone damage to corals may be significant (WAM 1993; LDM 1996) through physical disturbance and sedimentation (Heinsohn and Spain 1974; Van Woesik et al. 1991; Stejskal 1992). Bleaching of corals surrounding coastal islands was part of a worldwide phenomenon that has been linked to global warming (Hoegh-Guldberg 1999). Other natural events, such as sedimentation and predation may also contribute to temporal variability of live coral cover. Coral predators such as the crown-of-thorns seastars, *Acanthaster planci*, and the corallivorous gastropods, *Drupella cornus* and *D. rugosa*, have been recorded in the NWS region.

Communities subject to frequent natural perturbation are likely to be either resilient or transient and highly dynamic in terms of cover and distribution (WAM 1993). The ability of such species to recolonise after large-scale natural or human disturbance is also likely to be high, although there is interspecific variation in rate of recovery. Fast-growing *Acropora* species, for example, can recover from severe damage in a few years whereas slow-growing massive species may take up to 30 years to recover from major damage (WAM 1993).

Dampier Archipelago

The closest coral reefs to the Stag facility are those around the Dampier Archipelago, 32 km southeast of the location (Figure 3-3). Coral communities occur throughout the proposed reserves and together, the shallow intertidal and subtidal reef communities comprise 8% (approximately 18,300 ha) of the major marine habitats. The most diverse coral areas in the proposed reserves are found on the seaward slopes of Delambre Island, Hamersley Shoal, Sailfish Reef, Kendrew Island and north-west Enderby Island. Live coral cover can vary greatly from reef to reef, as indicated by contrasting covers of 10 to 60% on Sailfish Reef and Hamersley Shoal, respectively. The proposed reserves have a high diversity of hard corals, with at least 229 species recorded from Western Australian Museum (WAM) surveys (CALM 2005b).

Montebello/Barrow/Lowendal Islands

Coral reefs surround the Barrow/Lowendal/Montebello Island complex (Figure 3-4), 75–96 km southwest of the Stag Facility. Approximately 6% of the Montebello/Barrow Islands Marine Parks are comprised of shallow intertidal and subtidal reef communities. The best developed of these communities are in the relatively clear water and high energy conditions of the fringing reefs to the west and south-west of the Montebello Islands, at Biggada Reef on the west side of Barrow Island. Coral 'bommies' and patch reefs occur in the more turbid and lower energy waters along the eastern edge of the Montebello Islands and the south-eastern edge of Barrow Island (CALM 2004).

Corals occur on submerged limestone reefs and submarine slopes as fringing reefs and patch reefs in the shallow waters (5–10 m) to the south, east and north of the Lowendal Islands. Corals are also present in

slightly deeper waters (up to 20 m) on exposed limestone pavement running north towards the Montebello Islands (LeProvost Semeniuk Chalmers 1986; LDM 1994). This habitat extends south along the eastern edge of the Barrow Island Shoals.

Corals are abundant around Barrow Island, growing as high profile reefs and on pavement on the west and east coasts. The most significant coral reefs around Barrow Island are Biggada Reef on the west coast, Dugong Reef and Batman Reef off the south-east coast, and those along the edge of the Lowendal Shelf on the east side of Barrow Island (Chevron 2008).

Quantitative sampling of seven sites around the Lowendal Islands showed a range of 34 to 63 species or taxa per site, with massive forms such as Favites and Porites, and tubular and digitate species of Acropora dominating the assemblages (LDM 1994). No corals were present in the channel between the Lowendal Islands and the northern tip of Barrow Island. A small submerged fringing reef lies in shallow water on the northeast side of Barrow Island. A total of 235 species comprising 60 coral genera have been recorded from the Montebello Islands during surveys carried out by the WA Museum (WAM 1993).

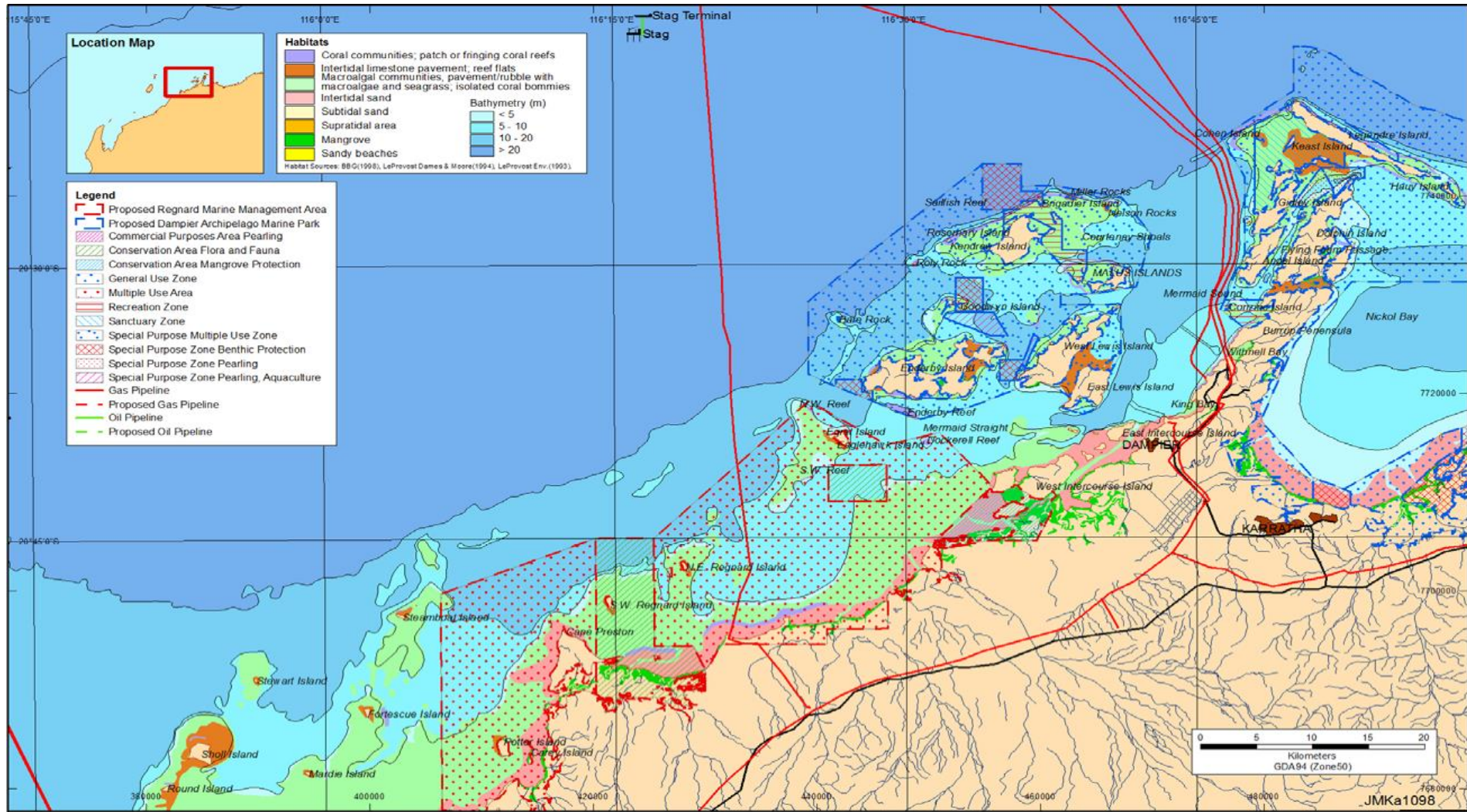


Figure 3-3: Marine Habitats Surrounding the Dampier Archipelago

Offshore Islands between North-West Cape and Dampier Archipelago

Hard corals occur as components of shallow intertidal and subtidal habitats around numerous small offshore islands within this region (including Muiron, Thevenard, Airlie and Serrurier islands) associated with limestone pavement create fringing intertidal reefs, patch reefs or represent isolated coral bomboras. Corals around Muiron Islands are contained within the State managed Muiron Island Marine Management Area.

Ningaloo Reef

Ningaloo Reef is the largest fringing barrier coral reef, and the second largest coral reef system in Australia. The most diverse coral communities along this coastline are in the relatively clear water, high energy environment of the fringing barrier reef and low energy lagoonal areas to the west of North-West Cape. The diversity of hard corals along this coastline is high with at least 217 species representing 54 genera of hermatypic (reef building) corals recorded to date (Veron and Marsh 1988). All 15 families of hermatypic corals are represented, however species diversity and community structure vary with environmental conditions such as exposure to wave action, currents, depth and water clarity. Figure 3-5 provides an overview of habitats, including coral communities. The Ningaloo Reef is protected within the Ningaloo Coast World Heritage Area (Section 3.7.1) and Ningaloo Marine Park (Commonwealth and State waters (Sections 3.7.6.7 and 3.8).

Rowley Shoals

The Rowley Shoals are a collection of three atoll reefs, Clerke, Imperieuse and Mermaid, which are located about 300 km northwest of Broome. The shoals contain 214 coral species and ~ 530 species of fish (Done et al. 1994; Gilmour et al. 2007). The reefs provide a distinctive biophysical environment in the region as there are few offshore reefs in the northwest. They have steep and distinct reef slopes and associated fish communities. In evolutionary terms, the reefs may play a role in supplying coral and fish larvae to reefs further south via the southward flowing Indonesian Throughflow. Both coral communities and fish assemblages differ from similar habitats in eastern Australia (Done et al. 1994). Mermaid Reef is a submerged reef protected by the Commonwealth and managed under the Mermaid Reef Australian Marine Park (see Section 3.7.6.5). Clerke Reef and Imperieuse Reef include permanent sandy cays above the high water mark and are managed by the Western Australian Government as the Rowley Shoals Marine Park (Section 3.8.8).

Coastline between Dampier Archipelago and Eighty Mile Beach

The coastline in this region is subject to high tidal currents and infrequent cyclonic events, and shallow coastal waters are typically very turbid due to suspension of fine sediments driven by these currents. Coral communities along this stretch of coastline typically have lower diversity and density than shorelines further south (e.g. Dampier Archipelago and Ningaloo Reef) and are associated with outcropping limestone subtidal pavement or intertidal rocky shorelines. Corals further offshore typically exhibit greater diversity and density where sediments are coarser and water conditions are less turbid. A total of 51 species of coral from 19 genera have been identified from areas offshore from Port Hedland which is lower than the 120 coral species from 43 genera recorded in Dampier Port and inner Mermaid Sound (Blakeway and Radford 2005). Along this stretch of coastline, corals are less likely to form biogenic reefs and more likely to be present as components of mosaic communities with other benthic organisms.

Rankin Bank and Glomar Shoals

Rankin Bank (19° 46' 44.184" S, 115° 36' 59.220" E) and Glomar Shoals (19° 36' 41.846" S, 116° 44' 4.472" E) are shoals located, over 35nm each way from the Montebellos and approximately 150 km north of Dampier. Glomar Shoal and Rankin Bank are the only large, complex, bathymetrical features on the outer western shelf of the West Pilbara (AIMS 2014). Species of major recreational interest found on these shoals include saddletail snapper, red emperor, cods, coral and coronation trout, sharks, trevally, tuskfish, tunas, mackerels and billfish (Fletcher and Santoro 2012).

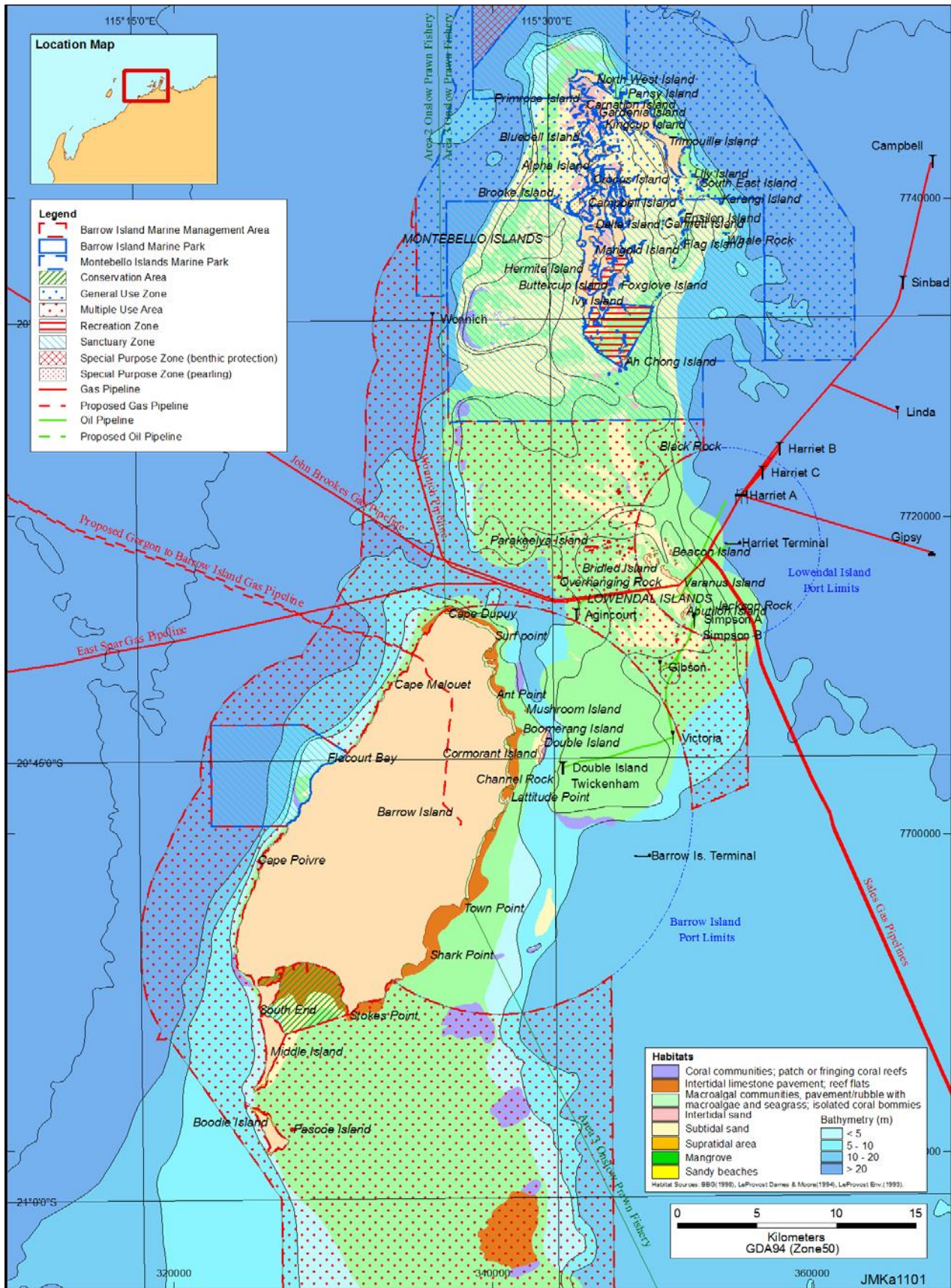


Figure 3-4: Marine Habitats Surrounding the Montebello, Lowendal and Barrow Islands

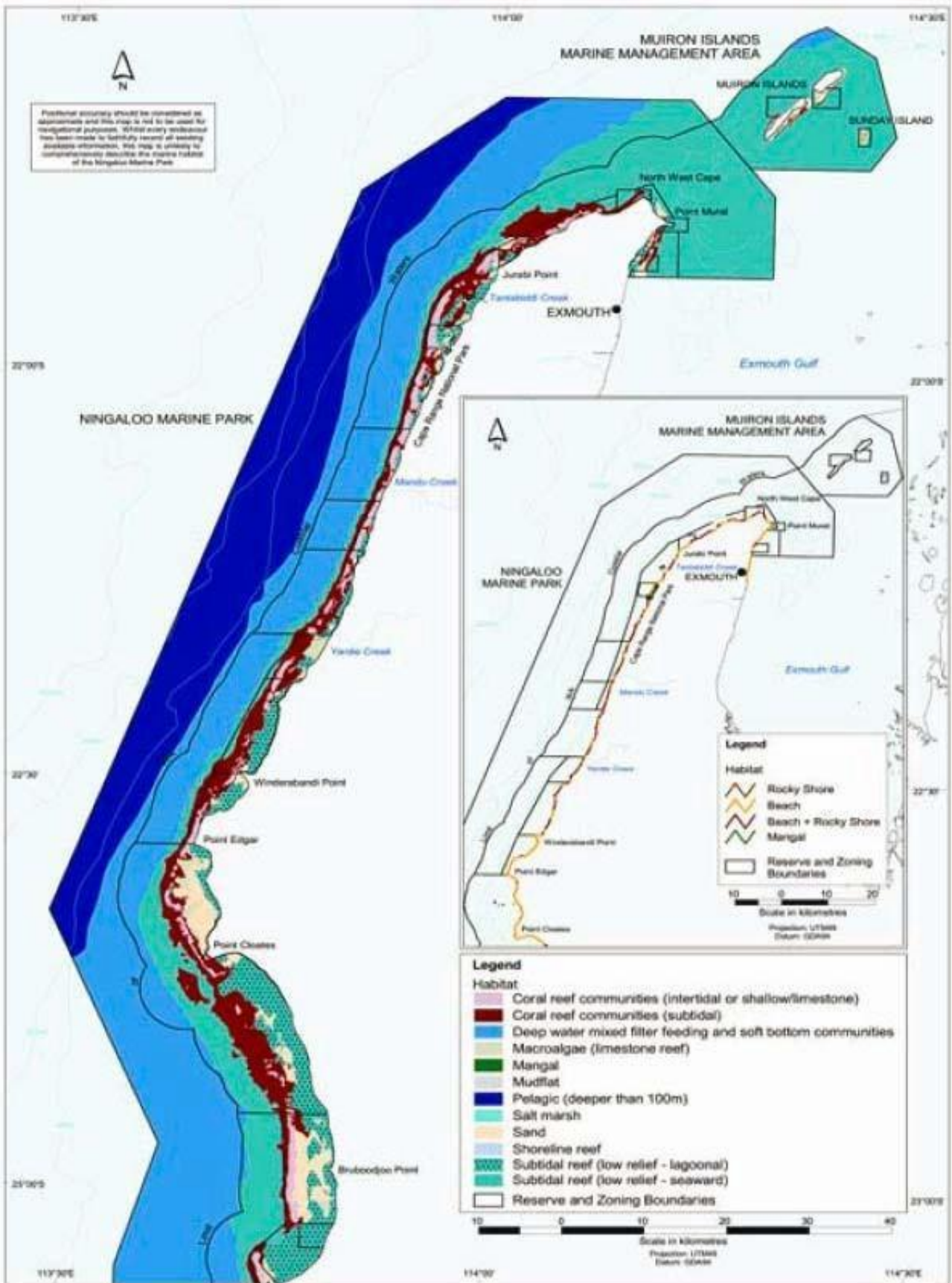


Figure 3-5: Marine Habitats Surrounding the Ningaloo Marine Park North of Point Cloates

The Glomar Shoals have been identified as a Key Ecological Feature (KEF) of the North-west Marine Bioregion (Falkner et al. 2009). The area is known to be an important for many commercial and recreational fish species such as Rankin cod, brown striped snapper, red emperor, crimson snapper, bream and yellow-spotted triggerfish (Falkner et al. 2009; Fletcher and Santoro 2012). Catch rates at the Glomar Shoals are high, indicating that it is an area of high productivity.

3.3.4 Macroalgae and Seagrasses

Macroalgae are most prolific over the shallow pavement limestone reefs adjacent to the offshore islands in the region, including those of the Dampier Archipelago 32 km southeast of the Stag Facility location. Seagrasses form extensive meadows over some of the shallow water sandflats (down to approximately 15 m water depth). In deeper waters, macroalgae and seagrasses are less abundant due to lower light levels reaching the benthos.

Macroalgae and seagrasses are important primary producers in tropical inshore waters. Seagrasses are directly grazed by dugongs (Prince 1986) and both seagrasses and macroalgae are grazed by green turtles. Few fish species graze directly on seagrass or macroalgae but both vegetation types support a diverse and abundant invertebrate fauna that are the principal food source for many inshore fish species (Blaber and Blaber 1980). Small crustaceans, such as amphipods, copepods and isopods, emerge from macroalgae and seagrasses at night and are fed upon by planktivorous fish such as herring, sardine and anchovy (Robertson and Watson 1978). Dense schools of these fish are in turn fed upon by both predatory fish, such as tuna and mackerel, and diving birds, such as shearwater and terns. Beds of seagrasses and macroalgae may support the juvenile stages of prawn species that are commercially important in the region (Loneragan et al. 2003).

Dampier Archipelago

Macroalgae dominate submerged limestone reefs and also grow on stable rubble and boulder surfaces in the Dampier Archipelago/Cape Preston region (Figure 3-3). These communities are most commonly found on shallow limestone pavement in depths less than 10 m. Low relief limestone reefs, which are dominated by macroalgae, account for 17% (~ 35,460 ha) of the major marine habitats within the Dampier Australian Marine Park. Brown algae are the most abundant group of algae in the region, with *Sargassum* sp., *Dictyopteris* sp. and *Padina* sp. being the dominant species. The most common green algae are the articulate coralline *Halimeda* sp, while prominent red algal species include crustose corallines, non-corallines and algal turf. Seagrass occurs in the larger bays and sheltered flats of the region. Six species of seagrass are present on the subtidal soft sediment habitats, these being *Cymodocea angustata*, *Halophila ovalis*, *Halophila spinulosa*, *Halodule uninervis*, *Thalassia hemprichii* and *Syringodium isoetifolium*. Seagrasses do not form extensive meadows within the proposed reserves, but rather form interspersed seagrass/macroalgae beds. The most significant areas of seagrass are found between Keast and Legendre islands and between West Intercourse Island and Cape Preston (CALM 2005b). Macroalgae and seagrasses are important primary producers, trapping light energy from the sun and making it available to the ecosystem. They also provide important habitats for molluscs, sea urchins, sea stars, sea cucumbers, crabs and fishes. Marine turtles feed on algae and seagrass, and the ephemeral seagrass typically found in the area is likely to be the preferred food source for the resident dugong population.

Montebello/ Barrow/ Lowendal Islands

Macroalgae are the dominant macrophyte in the Montebello/Lowendal/Barrow Island region, occupying approximately 40% of the benthic habitat area of the region (CALM 2004) (Figure 3-4). At least 132 macroalgal taxa occur in marine habitats around Barrow Island with most thought to be widely distributed in the tropical Indo-Pacific region (Dr J. Huisman, pers. comm. in Chevron 2005). Macroalgae generally attach to hard substrates such as rock, although species such *Caulerpa*, *Halimeda*, *Udotea* and *Penicillus* can anchor in soft sediments or attach to shell fragments or rubble.

The most numerically abundant macroalgae are of the *Sargassum* genus, which cover the shallow subtidal rock platforms around the islands. Seasonally, *Sargassum* grows large foliose fronds bearing reproductive

structures and then senesce each winter. Consequently, the biomass of the macroalgal beds varies greatly with this seasonal cycle of growth and senescence. Other abundant taxa in the Montebello/Lowendal/Barrow Island region include *Halimeda*, *Caulerpa*, *Dictyopteris*, *Dictyota*, *Cystoseira*, *Padina*, *Codium* and *Laurencia* (Chevron 2008).

On the east coast of Barrow Island, macroalgal diversity is highest in the rock pools and toward the deeper edge of the intertidal zone (Chevron 2008). The dominant macroalgae on the east coast platforms are *Cystoseira trinodis*, *Sargassum* spp., *Caulerpa* spp. and *Halimeda* spp. Macroalgal turfs are widespread on the intertidal pavement reef and comprise red algae such as *Laurencia*, *Chondria*, *Ceramium*, *Centroceras clavulatum*, *Gelidiopsis* and *Hypnea* (Chevron 2005; 2008).

Seagrasses in the Montebello/Lowendal/Barrow Island region are sparsely interspersed between macroalgae and do not form extensive meadows. Six species have been recorded to date: *Cymodocea angustata*, *Halophila ovalis*, *Halophila spinulosa*, *Halodule uninervis*, *Thalassia hemprichii* and *Syringodium isoetifolium* (CALM 2004). Most of these are small, ephemeral species that grow on subtidal sands and in intertidal pools and have a seed bank in the surficial sediments that allows them to recolonise quickly following disturbance. The most common species are *Halophila ovalis* on the deeper subtidal sand and *Syringodium isoetifolium* and *Halodule uninervis* in the rock pools (Chevron 2005, 2008).

Offshore Islands between North-West Cape and Dampier Archipelago

Macroalgae and seagrass occur around the numerous small offshore islands within this region (including Muiron Islands, 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 and the Ningaloo Coastline.

Ningaloo Coastline

Macroalgal meadows 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 MMA (CALM 2005a) (Figure 3-5). Macroalgal communities within the Park have been broadly described (Bancroft and Davidson 2001). The dominant genera are *Sargassum*, *Padina*, *Dictyota* and *Hydroclathrus* (McCook et al. 1995). Seagrass species are generally patchily distributed and are not a major component or a major primary producer on the reef (CALM 2005a). The biogeography of several species such as *Cymodocea angustata*, *Cymodocea serrulate*, *Halodule uninervis*, *Haliphola ovalis*, *Haliphola spinulosa*, *Syringodium isoetifolium*, and *Thalassodendron ciliatum* suggest that these species are likely to occur in the reserves. It is also highly likely that some temperate species have their northernmost limit in the reserves.

Exmouth gulf

Exmouth Gulf is a rich marine environment. It is a resting ground for humpback whales, and important area for dugong and turtles. The mangrove systems on the eastern margins are areas of high primary productivity feeding and are a nursery for fish both within the Gulf and the nearby Ningaloo Reef (Section 3.8.7).

The mangroves along the eastern side of the gulf stretch for nearly 50 km. They have been identified by BirdLife International as a 420 km² Important Bird Area (IBA) because they support over 1% of the world populations of pied oystercatchers and grey-tailed tattlers, as well as being an important site for the restricted-range dusky gerygone. Another IBA is 11 ha Sunday Island, lying in the north of the Gulf near the Muiron Islands, which is an important nesting site for roseate terns.

Coastline between Dampier Archipelago and Eighty Mile Beach

Tropical macroalgae and seagrass species occur in the shallow waters along this stretch of coastline and are typically associated with areas of outcropping hard substrate and protected soft sediments, respectively. Abundance and biomass typically exhibit strong seasonal trends. Common algae species in the Port Hedland region include tropical genera such as *Sargassum*, *Caulerpa* and *Halimeda* with seagrass including ephemeral *Halophila* spp (BHPB 2011).

3.4 Intertidal Shoreline Habitats

3.4.1 Mangroves

Mangroves are recognised as significant as they are productive coastal forest systems, providing habitat and shelter for infauna, epifauna, gastropods, crustaceans, fish and other marine species. Mangroves are important nursery areas for fish, lobster and prawn species, some of which are targeted by recreational and commercial fishers. Mangroves may also provide shelter for other species such as juvenile turtles. Ospreys (*Pandion haliaetus*) and white-bellied sea eagles (*Haliaeetus leucogaster*) roost in mangroves, while a range of smaller birds nest in them (DEC 2007a). Mangroves are also recognised for their capacity to protect coastal areas from erosion due to storms and storm surge. In WA, mangroves are generally of high conservation significance and are protected throughout under the Wildlife Conservation Act 1950.

The regional mangroves of mainland and islands from Exmouth to Eighty Mile Beach represent Australia's only 'tropical-arid' mangroves. Within the NWS region, mangroves are present on the Montebello and Lowendal Islands, along the south eastern and southern shores of Barrow Island, in sheltered pockets on the offshore islands of the Dampier Archipelago, along the western side of the Cape Range Peninsula, on the eastern shore of Exmouth Gulf, and in extensive stretches along many creeks and watercourses on the mainland coast. WA does not support any unusual endemic or restricted mangrove species. All mangrove species within WA are common and widespread elsewhere, either in northern Australia, or in the Indo-pacific region proximal to northern Australia.

Dampier Archipelago

Six species of mangrove are found within the Dampier Archipelago/Cape Preston region, these being the white mangrove (*Avicennia marina*), red mangrove (*Rhizophora stylosa*), club mangrove (*Aegialitis annulata*), ribbed fruit orange mangrove (*Bruguiera exaristrata*), yellow leaf spurred mangrove (*Ceriops tagal*) and river mangrove (*Aegiceras corniculatum*). Mangrove communities (mangals) account for 3% (~5,950 ha) of the Dampier Archipelago Marine Park and Cape Preston MMA (Figure 3-3). Most of these communities are along the mainland coast on the tidal flats at Regnard Bay, the Maitland River mouth, King Bay and Nickol Bay. Well-developed communities also occur in some of the sheltered bays on the islands, for example at West Intercourse Island, in Searipple Passage and the southern shores of West Lewis and East Lewis islands (CALM 2005b). The mangrove communities at the Fortescue River delta, Cape Preston area, West Intercourse Island, Enderby Island, Searipple Passage/Conzinc Bay and Dixon Island have been assessed by Semeniuk (1997) as having international significance from a biodiversity and ecological basis.

Montebello/ Barrow/ Lowendal Islands

The mangroves of the Montebello Islands (Figure 3-4) are globally significant because they are the world's only mangroves growing in lagoons of offshore islands (Semeniuk 1997). Six species of mangrove are found on the islands: *Avicennia marina*, *Bruguiera exaristata*, *Ceriops tagal*, *Rhizophora stylosa*, *Aegialitis annulata* and *Aegiceras corniculatum*. Mangroves on the Montebello islands occur as isolated trees through to patches of continuous forest, the largest being a 15 ha stand in Stephenson Channel (DEC 2007a).

Within the Lowendal Island group, three species of mangroves are found on Varanus, Abutilon and Bridled Islands. Mangrove distribution within the Lowendals is very restricted, being largely determined by local geomorphology, substrate type, and soil water and groundwater salinity (VCSRG 1988).

On Barrow Island, mangroves are restricted to a few small areas on the east and southern coast at Mattress Point, south of Chevron camp, near the airstrip, at Stokes Point and near Pelican Island on the western side of Bandicoot Bay (Chevron 2008). *Avicennia marina* is the most common species, although *Rhizophora stylosa* is also present. These mangroves are generally poorly developed in comparison to their mainland counterparts and generally occur as a narrow band of stunted trees. Nevertheless, mangroves on Barrow Island are important habitat for many avifauna species, including ospreys and white-bellied sea eagles, and for red fiddler crabs (*Uca* sp.) at Square Bay (RPS BBG 2005).

Ningaloo Coastline

Three species of mangroves have been identified within Ningaloo Marine Park. The dominant species is the white mangrove (*Avicennia marina*), with the red mangrove (*Rhizophora stylosa*) and the ribbed-orange fruit mangrove (*Bruguiera exaristata*) existing in limited numbers (May et al. 1983). The largest mangrove community (~31 ha), found within Mangrove Bay, is characterised by established trees to 5 m in height. Established mangrove stands can also be found associated with tidal creek systems including a well-developed mangal within Yardie Creek.

Coastline between Dampier Archipelago and Eighty Mile Beach

Mangroves are a common habitat within sheltered areas such as estuaries, tidal creeks and sheltered bays, along the mainland between Dampier Archipelago and Eighty Mile Beach. Seven species of mangrove have been recorded within the Port Hedland Industrial Area, with *Avicennia marina* and *Rhizophora stylosa* being the most abundant (BHPB 2011). *Avicennia marina* is the dominant mangrove within mangrove stands at Eighty Mile Beach.

3.4.2 Coastal Salt Marsh

Coastal salt marsh is a transitional habitat between land and salty or brackish water (e.g. in bays and estuaries). It is dominated by halophytic (salt tolerant) herbaceous plants (e.g. samphires). In the Port Hedland Industrial Management Unit and surrounding areas, salt marsh habitat commonly replaces mangrove stands with increasing distance from the water line where sediments are drier and more saline (BHPB 2011). Salt marshes are also a feature of the landscape further north, at Eighty Mile Beach. Salt marshes may be inundated by spring high tides and therefore may be exposed to oil spills on spring high tides.

3.4.3 Sandy Beaches

Sandy beaches are those areas within the intertidal zone in which unconsolidated sediment has been deposited by wave and tidal action. Sandy beaches can vary from low to high energy zones which will influence their profile through varying rates of erosion and accretion. Sandy shorelines are generally interspersed among areas of hard substrate (e.g. sandstone) that form intertidal platforms and rocky outcrops. Sandy beaches provide habitat to a variety of burrowing invertebrates and subsequently provide foraging grounds for shorebirds (DNP 2013), as well as important habitat for nesting turtles.

Sandy beaches are found throughout the bioregion on both the mainland at Eighty Mile beach, Dampier and Onslow, as well as on many of the numerous islands throughout including Barrow Island, Murion Islands, Thevenard, Serrurier, Dampier Archipelago, Bedout Island, North Turtle Island, and the chain of nearshore islands covered under the Great Sandy Island Nature Reserves. Eighty Mile Beach Marine Park is one of the Australia's largest uninterrupted sandy beaches (stretching 220 km) and is an important feeding ground for small wading birds that migrate to the area each summer, travelling from countries thousands of kilometres away (DEC 2011). It is also a listed Ramsar wetland (see Section 3.7.4).

3.4.4 Mud Flats

Intertidal mudflats form when fine sediment carried by rivers and the ocean is deposited in a low energy environment. Tidal mudflats are highly productive components of shelf ecosystems responsible for recycling organic matter and nutrients through microbial activity. This microbial activity helps stabilise organic fluxes by reducing seasonal variation in primary productivity which ensures a more constant food supply (Robertson 1988). Intertidal sand and mudflats support a wide range of benthic infauna and epifauna which graze on microscopic algae and microbenthos, such as bivalves, molluscs, polychaete worms and crustaceans (Zell 2007).

The high abundance of invertebrates found in intertidal sand and mudflats provides an important food source for finfish and shellfish which swim over the area at high tide. Mudflats have also been shown to be significant nursery areas for flatfish. During low tide, these intertidal areas are also important foraging areas for

indigenous and migratory shorebirds. Mudflats also play a vital role in protecting shorelines from erosion (Wade and Hickey 2008).

Eighty Mile beach has significant intertidal mudflats that are used by birds in spring and summer including species listed as threatened under the EPBC Act or listed on the IUCN Red List of Threatened Species (2017). The sediments that dominate these flats are generally of terrigenous origin (Wilson 2013).

3.4.5 Rocky Shorelines

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, and 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 area of interest.

Intertidal rock pavement and rocky shores are typically associated with high stress environments, with periods of desiccation, predation and sometimes strong wave energies. The higher tidal ranges and less severe wave action in the north mean that smooth intertidal slopes are not common. Intertidal rock pavement is a significant part of the marine landscape, due to the high biological productivity, and their sediments on the coast through erosion and biological production of material such as shell fragments. Some platforms protect nearshore waters, such as Ningaloo and North-West Cape, which is separated from the coast by shallow water lagoons.

Rocky coasts occur where there is a lack of sandy sediment or where erosion has exposed the underlying rock. Rocky shores can include pebble/cobble, boulders, and rocky limestone cliffs (often at the landward edge of reef platforms). Rocky shorelines are an important foraging area for seabirds and habitat for invertebrates found in the intertidal splash zone (Morton and Britton in Jones 2004). For example, oyster catchers and ruddy turnstones feed along beaches and rocky shorelines.

Rocky shores dominate on most of the Barrow and Montebello islands and provide habitat for a variety of intertidal organisms. CALM (2004) estimated the linear extent of rocky shore habitat in the zone as approximately 63% of the coastline, and a further 11% was categorised as beach interspersed with rocky shore. Rocky shores provide food for shorebirds (Chevron 2010) and are also common within the Dampier Archipelago, notably King and Conzinc Bays, and Angel, Gidley, Enderby and the Lewis Islands.

3.4.6 Summary of Habitats within the Operational Area and EMBA

Table 3-1 summarises the habitats that may be affected by routine events at the Stag Facility within the Operational Area as well as unplanned events that may arise within a larger EMBA.

Table 3-1: Environmental Values and Sensitivities for Habitats within the Operational Area

Habitats	Environmental value	Sensitivities within the Operational Area	Sensitivities within the EMBA
Subtidal Benthic Habitats			
Soft sediments and benthic fauna	Support a diverse infauna consisting predominantly of mobile burrowing species that include molluscs, crustaceans (crabs, Shrimps and smaller related species), polychaetes, sipunculid and platyhelminth worms, asteroids (sea stars), echinoids (sea urchins) and other small animals. Biological activity occurs throughout the year.	Yes – Soft sediment is the dominant habitat.	Yes – Soft sediment is the dominant subtidal habitat throughout the EMBA.

Habitats	Environmental value	Sensitivities within the Operational Area	Sensitivities within the EMBA
Hard Coral habitat	Food source for some fish species; Integral source of carbonate sediments; large component of primary productivity and habitat to regional marine ecology Peak coral spawning occurs March–April Coral spawning also occurs October–November.	No	Yes – Important coral localities: Dampier Archipelago, Ningaloo Reef, Muiron Islands Barrow/ Montebello/Lowendal Island group and Rowley Shoals.
Macroalgae beds	Primary producers; dugong and turtle feeding habitat; support a diverse and abundant fauna of small invertebrates that are the principal food source for many inshore tropical fish species Produce reproductive structures and then senesce each winter (May–September).	No	Yes – Macroalgal habitat prevalent within shallow waters (photic zone) associated with primarily rocky substrate along the mainland coast and associated with offshore islands.
Seagrasses meadows	Primary producer; dugong feeding habitat Throughout the year they are growing or shedding fronds.	No	Yes – Seagrasses occur within the photic zone along the Dampier Archipelago, Ningaloo Reef, Muiron Islands Barrow/ Montebello/ Lowendal Island group.
Hard substrates and epiflora/ fauna	Support higher diversity of Epifauna than soft sediment habitats and provide surfaces for attachment of fauna (e.g. hard coral, soft corals, sponges) and macroalgae.	No	Yes – Hard substrates occur throughout the EMBA. Filter feeding epifauna can occur across a range of depths. Benthic primary production associated with hard substrate restricted to shallow photic zone.
Intertidal Shoreline Habitats			
Mangroves	An important primary producer habitat along shorelines of the Pilbara mainland and islands. Important habitat for birds, molluscs, crustaceans, juvenile fish; bird watching hide. Important for shoreline stabilisation and nutrient recycling.	No	Yes – Along mainland coastline between Ningaloo coast to Broome; Montebello and Lowendal Islands south eastern and southern shores of Barrow Island and in sheltered pockets on the offshore islands of the Dampier Archipelago and Exmouth Gulf.
Salt marsh	Primary producer habitat commonly occurring landward of mangrove stands. Salt marshes stabilise sediments, recycle nutrients and provide habitat for coastal fauna.	No.	Yes – Can be distributed landward of mangrove habitat in brackish environment. Known occurrence between Port Hedland and Eighty Mile Beach.
Sandy beaches	Shorebird foraging/ breeding habitat; turtle nesting habitat. Crested tern nesting post-wet season; turtle nesting October to	No	Yes – Sandy beaches occur throughout the region. Important sites occur on Eighty Mile beach, Dampier and Onslow, as well as on many of the numerous islands

Habitats	Environmental value	Sensitivities within the Operational Area	Sensitivities within the EMBA
	February; hatchling emergence November to April.		including Barrow Island, Murion Islands, Thevenard, Serrurier, Dampier Archipelago, Bedout Island, North Turtle Island.
Mud/sand flats	Support a diverse assemblage of vertebrates and invertebrates, macroalgae and seagrass. Biological activity occurs throughout the year.	No	Yes – Found throughout the EMBA. Important site is Eighty-Mile Beach which is a Ramsar site important for migratory shorebirds.
Rocky shorelines	Foraging area for shorebirds. Invertebrates found in the vertical splash zone; roosting areas for seabirds. Biological activity occurs throughout the year.	No	Yes – Found throughout the EMBA including Ningaloo Coast, Muiron Islands, Montebello/Barrow/ Lowendal Islands and Dampier Archipelago.

3.5 Marine Fauna

Fauna that may be present within the EMBA for the activity include plankton, invertebrates, fish, marine mammals, marine reptiles and seabirds.

3.5.1 Plankton

Plankton is divided into two categories: phytoplankton and zooplankton. Phytoplanktonic algae are important primary producers and range in size from 0.2 to 200 mm. Zooplankton are small, mostly microscopic animals that drift with the ocean currents, and it has been estimated that 80% of the zooplankton in waters off Australian continental shelf and shelf margin are the larval stages of fauna that normally live on the seabed (Raymont, 1983). A common feature of plankton populations is the high degree of temporal and spatial variability. Phytoplankton in tropical regions have marked seasonal cycles with higher concentrations occurring during the winter months (June–August) and low in summer months (December–March) (Hayes et al., 2005; Schroeder et al., 2009). Zooplankton rely on phytoplankton as food and are subject to similar seasonality.

3.5.2 Invertebrates

Pelagic invertebrates other than zooplankton include mobile cnidarians (jellyfish), salps and squid. Larger marine fauna such as leatherback turtles may consume jellyfish, whereas fish and large mammals such as dolphins and whales generally consume squid.

The mostly sandy substrates within the North-west Marine Bioregion are thought to support low densities of benthic communities, such as bryozoans, molluscs and echinoids (DEWHA, 2008a). In areas of harder substrates, sponge communities are sparsely distributed.

Apache sampled the biota surrounding the location of the Stag Facility and loadout location prior to development drilling of this Facility, to provide a baseline for comparison to the post-development and post-commissioning situation (Kinhill, 1997, 1998). Sampling confirmed that the benthic biota within the vicinity of Stag Field was comparable to that found over similar substratum and at similar depths over the wider region (Ward and Rainer, 1988; Woodside, 1988; Rainer, 1991). The unconsolidated sediments in this habitat support a diverse infauna, consisting predominantly of mobile burrowing species such as crustaceans (crabs, shrimps and smaller related species), polychaete, sipunculid and platyhelminth worms, asteroids (sea stars), echinoids (sea urchins), and other small infaunal animals.

The abundance and composition of this infauna is variable over both space and time (Ward and Rainer, 1988; Rainer, 1991; Kinhill, 1997). Differences between locations are related to such factors as depth and seafloor texture while changes over time within a location may be related to changes in the physical environment, such as water temperature or wave-induced currents. Ward and Rainer (1988) reported a seasonal pattern in the abundance of small species of decapod crustaceans in this region. However, because they only sampled at two times, it is not clear if this pattern was related to season or to other factors, such as storm events, which operate at much shorter time scales. By comparison to the infauna, the diversity and abundance of large encrusting animal species (epibenthic fauna) in this region is relatively low (Ward and Rainer, 1988; Woodside, 1988; Kinhill, 1997). This is probably due to instability of the sediment and the lack of exposed and colonisable reef.

3.5.3 Fish

The NWMR supports large populations of cartilaginous fishes (such as sharks and rays), that are typically higher-order predators and perform an important ecological role through the regulation of prey species. The NWMR contains 157 chondrichthyan species (sharks, skates and rays), 18 of which are endemic. This includes 94 shark species, many of which are found in other parts of Australia, and which represent approximately 19% of the world's shark species (Heupel and McAuley, 2007). Sharks, skates and rays occupy a broad range of habitats, from shallow to deep-water, with some species being pelagic.

Large pelagic fish such as tuna, mackerel, swordfish, sailfish and marlin are another important component of the ecosystem and are found mainly in oceanic waters and occasionally on the continental shelf (Brewer et al., 2007). Both juvenile and adult phases of the large pelagic species are highly mobile and have wide geographic distributions, although the juveniles more frequently inhabit warmer or coastal waters (DEWHA 2008a).

The demersal habitat of the NWS hosts a diverse assemblage of fish of tropical Indo-west Pacific affinity, with up to 1,400 species known to occur – many in shallow coastal waters (Allen et al., 1988). Last et al. (2005) described the North-west Shelf Province as being characterised by a high level of endemism and species diversity. Many of these fish species are commercially exploited by trawl and trap fisheries, for example the genera *Lethrinus* (emperor) and *Lutjanus* (snapper) (Sainsbury et al., 1985).

Within the southern portion of the North-west Shelf Province, small pelagic fish (e.g. lantern fishes) comprise a third of the total fish biomass (Bulman, 2006), and play an important ecological role, not only for this particular area but for the entire NWMR. They inhabit a range of marine environments, including inshore and continental shelf waters and form a vital link within and between many of the region's trophic systems, feeding on pelagic phytoplankton and zooplankton and providing a food source for a wide variety of predators including large pelagic fish, sharks, seabirds and marine mammals (Mackie et al., 2007).

The shallow waters (<30 m) of the Dampier Archipelago 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, 2004). The majority of these species were found over hard substrate, but significant numbers were 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. 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). EPBC Act protected fish species within the Dampier Archipelago include the dwarf sawfish (*Pristis clavata*).

The Glomar Shoals, approximately 70 km north-east of the Stag Facility (Section 3.7.6.8), have been identified as a Key Ecological Feature (KEF) of the North-west Marine Bioregion (Falkner et al., 2009). The area is known to be an important 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 (Brewer et al., 2007;

Falkner et al., 2009; Fletcher and Santoro, 2012). Catch rates at the Glomar Shoals are high, indicating that it is an area of high productivity.

Continental Slope Demersal Fish Communities have also been identified as a KEF within the Stag Facility EMBA (Section 3.7.6.8) which are located 110 km NW of the Stag Facility. This KEF represents the continental slope between North-West Cape and the Montebello Trough, which supports more than 500 fish species, 76 of which are endemic, making it the most diverse slope bioregion in Australia. The slope of the Timor Province and the Northwest Transition also contains more than 500 species of demersal fish, of which 64 are considered to be endemic, and is the second richest area for demersal fish species across the entire Australian continental slope.

Similar to that of the Stag Facility and surrounds, the fish fauna of Barrow/Lowendal/Montebello Islands are widespread throughout the Indo-west Pacific region, but also include species protected by legislation. Protected species within the Barrow/Lowendal/Montebello Islands include the whale shark (*Rhincodon typus*), great white shark (*Carcharodon carcharias*) and grey nurse shark (*Carcharias taurus*).

The warm waters of the NWS are thought to be the location of spawning for some fish species. Some fish species are likely to be more susceptible than others to impact due to their physical characteristics (e.g. size, ability to move quickly) and behaviours (e.g. schooling, spawning aggregations). The life stage (i.e. egg, larvae, juvenile, adult) of a fish is also likely to influence its susceptibility to impacts. A summary of key species likely to spawn in the EMBA (DoF 2013) can be found in Table 3-2.

Table 3-2: Spawning Dates for Key Fish Species

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Blacktip shark <i>(Carcharhinus tilstoni and C. limbatus)</i>												
Goldband snapper <i>(Pristipomoides multidentis)</i>												
Rankin cod <i>(Epinephelus multiinotatus)</i>												
Red Emperor <i>(Lutjanus sebae)</i>												
Sandbar shark <i>(Carcharhinus plumbeus)</i>												
Spanish mackerel <i>(Scomberomorus commerson)</i>												
Pink snapper <i>(Pagrus auratus)</i>												
Baldchin groper <i>(Choerodon rubescens)</i>												
Crystal (snow) crab <i>(Chaceon spp.) Gascoyne</i>												
Champagne (spiny) crab <i>(Hypothalassia acerba)</i>												

3.5.4 Crustaceans

The NWMR is thought to contain a high diversity of crustaceans across a range of habitats, from intertidal sites to the deeper waters of the slope and the abyss. Dominant species groups include copepods, prawns, scampi and crabs. These groups display a strong biogeographic affinity with the Indo-west Pacific, with few endemic species present. As well as being preyed upon by large pelagic fish, crustaceans are also a significant food for cephalopods (squid and octopus species; DEWHA 2008a). The North-West Slope Trawl Fishery (NWSTF) targets scampi in the NWMR. Data from the fishery suggests that muddy sediments support significant populations of crustaceans (DoF 2012).

3.5.5 Cephalopods

Approximately 81 different species of cephalopod are believed to occur in the NWMR, five of which may be endemic as they have only been recorded from one location or are thought to have a very restricted distribution (DEWHA 2008a). The area between Kalbarri and the Dampier Archipelago appears to be particularly significant for octopus, dumpling squids and several species of cuttlefish (DEWHA 2008a). Squid are an important food item for a number of species in the NWMR. Sperm whales, for example, feed exclusively on the Japanese flying squid (*Todarodes pacificus*) and sharpnose squid (*Ancistrocheirus lesueurii*), while seabirds (such as black noddies and red-footed boobies) feed on the purple back flying squid (*Sthenoteuthis oualaniensis*; DEWHA 2008a).

Information on species listed under the EPBC Act such as sharks, turtles, cetaceans and avifauna are covered in Section 3.6.

Table 3-3 summarises the fauna that may be affected by routine events at the Stag Facility within the Operational Area as well as unplanned events that may arise within a larger EMBA.

3.6 Threatened and Migratory Species

The EPBC Act lists both threatened and migratory species that are protected under Commonwealth legislation and various international conventions and treaties.

A search of the EPBC Act Protected Matters Database in December 2022 (Appendix B and Appendix C) identified 57 threatened species (endangered, vulnerable, and critical2 endangered) as occurring or having habitat within the EMBA (Table 3-3). Twenty of these threatened species are terrestrial and have been excluded as it is unlikely that they would be impacted from an oil spill associated with the activity.

The relevant sections of this EP discuss the likelihood of these species and their biologically important areas occurring within the Operational Area and EMBA. Those species that have been identified as likely to be present in the Operational Area and EMBA are summarised in Table 3-3 and further detailed below.

BIAs such as an aggregation, resting, nesting or feeding areas or known migratory routes for these species are shown in Figure 3-6 to Figure 3-13. The relevant sections also outline the management such as:

- Recovery plans;
- Conservation advice; or
- Threat abatement plan for the impacts of marine debris on vertebrate marine life (DoEE 2018).

The requirements of the species recovery plans and conservation advices are considered to identify any requirements that may be applicable to the risk assessment. Recovery plans, conservation advice, management plans and threat abatement plans relevant to species that occur or may occur within the Operational Area and EMBA are detailed in Table 3-4.

No listed threatened ecological communities were identified within the EMBA. Further detail on species identified as threatened or migratory is presented in the following sections. Appendix B and Appendix C contain the full PMST search and includes additional listed species that are not classified as threatened or

migratory under the EPBC Act but are considered 'Other matters protected by the EPBC Act'. This list comprises additional cetaceans, birds, fish (pipefish, pipehorses and seahorses) and reptiles (sea snakes).

Table 3-3: Marine Fauna and Management Considerations in the Operational Area and EMBA

Class	Common Name	Scientific Name	EPBC Act Status	Cons Advice	Recovery Plan	Relevant Threat Abatement Plan	BIA	Operational Area Presence	EMBA presence	Relevant hazard
Fish and Sharks	Grey nurse shark (west coast population)	<i>Carcharias taurus</i>	V	No	Yes	Marine debris ³	Not relevant to EMBA	Yes	Yes	Planned Events: Light Emissions Noise Emissions Operational Discharges Drilling Discharges Physical disturbance Spill Response Activities Unplanned Events (all)
	White shark	<i>Carcharodon carcharias</i>	V; M	No	Yes	No	Not relevant to EMBA	Yes	Yes	
	Dwarf sawfish	<i>Pristis clavata</i>	V; M	Yes	Yes	No	EMBA	Yes	Yes	
	Green sawfish	<i>Pristis zijsron</i>	V; M	Yes	Yes	No	EMBA	Yes	Yes	
	Whale shark	<i>Rhincodon typus</i>	V; M	Yes	No	No	EMBA	Yes	Yes	
	Reef Manta Ray	<i>Manta alfredi</i>	M	No	No	No	None	Yes	Yes	
	Giant Manta Ray	<i>Manta birostris</i>	M	No	No	No	None	Yes	Yes	
	Narrow sawfish	<i>Anoxypristis cuspidata</i>	M	No	No	No	None	Yes	Yes	
	Oceanic Whitetip Shark	<i>Carcharhinus longimanus</i>	M	No	No	No	None	Yes	Yes	
	Freshwater/ Largetooth sawfish	<i>Pristis pristis</i>	V; M	Yes	Yes	No	EMBA	No	Yes	
	Blind Gudgeon	<i>Milyeringa veritas</i>	V	Yes	No	No	None	No	Yes	Unplanned Events: Unplanned release of Stag crude Oil

³ Threat abatement plan for the impacts of marine debris on vertebrate wildlife of Australia's coasts and oceans (DoEE 2018)

Class	Common Name	Scientific Name	EPBC Act Status	Cons Advice	Recovery Plan	Relevant Threat Abatement Plan	BIA	Operational Area Presence	EMBA presence	Relevant hazard
	Blind Cave Eel	<i>Ophisternon candidum</i>	V	Yes	No	No	None	No	Yes	Unplanned release of marine diesel
	Shortfin mako	<i>Isurus oxyrinchus</i>	M	No	No	No	None	No	Yes	
	Longfin mako	<i>Isurus paucus</i>	M	No	No	No	None	No	Yes	
	Porbeagle mackerel shark	<i>Lamna nasus</i>	M	No	No	No	None	No	Yes	
Marine mammals	Blue whale	<i>Balaenoptera musculus</i>	E; M	No	Yes	Marine debris	EMBA	Yes	Yes	Planned Events: Light Emissions Noise Emissions Operational Discharges Drilling Discharges Physical disturbance Spill Response Activities Unplanned Events (all)
	Humpback whale	<i>Megaptera novaeangliae</i>	M	No	No	Marine debris	EMBA	Yes	Yes	
	Bryde's whale	<i>Balaenoptera edeni</i>	M	No	No	Marine debris	None	Yes	Yes	
	Killer whale	<i>Orcinus orca</i>	M	No	No	Marine debris	None	Yes	Yes	
	Indo-Pacific humpback dolphin	<i>Sousa chinensis</i>	M	No	No	No	Not relevant to EMBA	Yes	Yes	
	Spotted bottlenose dolphin (Arafura/Timor Sea populations)	<i>Tursiops aduncus</i>	M	No	No	Marine debris	Not relevant to EMBA	Yes	Yes	
	Sei whale	<i>Balaenoptera borealis</i>	V; M	Yes	No	Marine debris	None	No	Yes	
	Fin whale	<i>Balaenoptera physalus</i>	V; M	Yes	No	Marine debris	None	No	Yes	

Class	Common Name	Scientific Name	EPBC Act Status	Cons Advice	Recovery Plan	Relevant Threat Abatement Plan	BIA	Operational Area Presence	EMBA presence	Relevant hazard
	Southern right whale	<i>Eubalaena australis</i>	E; M	No	Yes	Marine debris	Not relevant to EMBA	No	Yes	marine diesel
	Antarctic minke whale	<i>Balaenoptera bonaerensis</i>	M	No	No	Marine debris	None	No	Yes	
	Dugong	<i>Dugong dugon</i>	M	No	No	Marine debris	EMBA	No	Yes	
	Australian Snubfin Dolphin	<i>Orcaella heinsohni</i>	M	No	No	No	Not relevant to EMBA	No	Yes	
	Sperm whale	<i>Physeter macrocephalus</i>	M	No	No	No	Not relevant to EMBA	No	Yes	
Marine reptiles	Loggerhead turtle	<i>Caretta caretta</i>	E; M	No	Yes	Marine debris	EMBA	Yes	Yes	Planned Events: Light Emissions Noise Emissions Operational Discharges Drilling Discharges Physical disturbance Spill Response Activities Unplanned Events (all) Unplanned Events: Unplanned release of Stag crude Oil
	Green turtle	<i>Chelonia mydas</i>	V; M	No	Yes	Marine debris	EMBA	Yes	Yes	
	Leatherback turtle	<i>Dermochelys coriacea</i>	E; M	Yes	Yes	Marine debris	EMBA	Yes	Yes	
	Hawksbill turtle	<i>Eretmochelys imbricata</i>	V; M	No	Yes	Marine debris	EMBA	Yes	Yes	
	Flatback turtle	<i>Natator depressus</i>	V; M	No	Yes	Marine debris	EMBA	Yes	Yes	
	Short-nosed seasnake	<i>Aipysurus apraefrontalis</i>	CE	Yes	No	No	None	No	Yes	
	Leaf- scaled seasnake	<i>Aipysurus</i>	CE	Yes	No	No	None	No	Yes	

Class	Common Name	Scientific Name	EPBC Act Status	Cons Advice	Recovery Plan	Relevant Threat Abatement Plan	BIA	Operational Area Presence	EMBA presence	Relevant hazard
		<i>foliosquama</i>								Unplanned release of marine diesel
	Salt-water crocodile	<i>Crocodylus porosus</i>	M	No	No	No	None	No	Yes	
Birds	Curlew Sandpiper	<i>Calidris ferruginea</i>	CE; Mw	Yes	No	No	None	Yes	Yes	Planned Events: Light Emissions Atmospheric emissions Operational Discharges Drilling Discharges Physical disturbance Spill Response Activities Unplanned Events (all)
	Eastern Curlew	<i>Numenius madagascariensis</i>	CE; Mw	Yes	No	No	None	Yes	Yes	
	Red Knot	<i>Calidris canutus</i>	E; Mw	Yes	No	No	None	Yes	Yes	
	Southern giant-petrel	<i>Macronectes giganteus</i>	E; Mw	No	Yes	Marine Debris Bycatch	Not relevant to EMBA	Yes	Yes	
	Australian fairy tern	<i>Sternula nereis nereis</i>	V	Yes	Yes	No	EMBA	Yes	Yes	
	Streaked shearwater	<i>Calonectris leucomelas</i>	M	No	No	No	None	Yes	Yes	
	Lesser frigatebird	<i>Fregata ariel</i>	M	No	No	No	EMBA	Yes	Yes	
	Common noddy	<i>Anous stolidus</i>	M	No	No	No	Not relevant to EMBA	Yes	Yes	
	Common sandpiper	<i>Actitis hypoleucos</i>	Mw	No	No	No	None	Yes	Yes	
	Osprey	<i>Pandion haliaetus</i>	Mw	No	No	No	None	Yes	Yes	
	Sharp-tailed sandpiper	<i>Calidris acuminata</i>	Mw	No	No	No	None	Yes	Yes	
	Pectoral Sandpiper	<i>Calidris melanotos</i>	Mw	No	No	No	None	Yes	Yes	
	Australian Lesser	<i>Anous tenuirostris</i>	V	Yes	No	No	Not	No	Yes	

Class	Common Name	Scientific Name	EPBC Act Status	Cons Advice	Recovery Plan	Relevant Threat Abatement Plan	BIA	Operational Area Presence	EMBA presence	Relevant hazard
	Noddy	<i>melanops</i>					relevant to EMBA			Unplanned release of Stag crude Oil Unplanned release of marine diesel
	Great Knot	<i>Calidris tenuirostris</i>	CE; Mw	Yes	No	No	None	No	Yes	
	Northern Siberian Bar-tailed Godwit (menzbieri)	<i>Limosa lapponica menzbieri</i>	CE; Mw	Yes	No	No	None	No	Yes	
	Lesser Sand Plover	<i>Charadrius mongolus</i>	E; Mw	Yes	No	No	None	No	Yes	
	Greater Sand Plover	<i>Charadrius leschenaultii</i>	V; Mw	Yes	No	No	None	No	Yes	
	Australian painted snipe	<i>Rostratula australis</i>	E; Mw	Yes	No	No	None	No	Yes	
	giant									
	Soft-plumaged petrel	<i>Pterodroma mollis</i>	V	Yes	No	No	Not relevant to EMBA	No	Yes	
	Abbott's Booby	<i>Papasula abbotti</i>	E	Yes	No	No	None	No	Yes	
	Christmas Island White-tailed tropicbird	<i>Phaethon lepturus fulvus</i>	E	Yes	No	No	None	No	Yes	
	-nosed albatross	<i>Thalassarche carteri</i>	V; M	No	Yes	Bycatch Marine Debris	Not relevant to EMBA	No	Yes	

Class	Common Name	Scientific Name	EPBC Act Status	Cons Advice	Recovery Plan	Relevant Threat Abatement Plan	BIA	Operational Area Presence	EMBA presence	Relevant hazard
	Shy Albatross	<i>Thalassarche cauta</i>	E; M	Yes	Yes	Bycatch Marine Debris	Not relevant to EMBA	No	Yes	
	Campbell Albatross	<i>Thalassarche impavida</i>	V; M	No	Yes	Bycatch	Not relevant to EMBA	No	Yes	
	Black-browed Albatross	<i>Thalassarche melanophris</i>	V; M	No	Yes	Bycatch Marine Debris	Not relevant to EMBA	No	Yes	
	White-capped Albatross	<i>Thalassarche steadi</i>	V; M	No	Yes	Bycatch Marine Debris	Not relevant to EMBA	No	Yes	
	Flesh-footed Shearwater	<i>Ardenna carneipes</i>	M	No	No	Marine debris Bycatch	Not relevant to EMBA	No	Yes	
	Wedge-tailed shearwater	<i>Ardenna pacificus</i>	M	No	No	Marine debris Bycatch	EMBA	No	Yes	
	Fork-tailed swift	<i>Apus pacificus</i>	M	No	No	No	None	No	Yes	
	Great frigatebird	<i>Fregata minor</i>	M	No	No	No	Not relevant to EMBA	No	Yes	
	Caspian tern	<i>Hydroprogne caspia</i>	M	No	No	No	Not relevant to EMBA	No	Yes	
	White-tailed	<i>Phaethon lepturus</i>	M	No	No	No	EMBA	No	Yes	

Class	Common Name	Scientific Name	EPBC Act Status	Cons Advice	Recovery Plan	Relevant Threat Abatement Plan	BIA	Operational Area Presence	EMBA presence	Relevant hazard
	tropicbird									
	Red-tailed tropicbird	<i>Phaethon rubricauda</i>	M	No	No	No	Not relevant to EMBA	No	Yes	
	Little tern	<i>Sternula albifrons</i>	M	No	No	No	EMBA	No	Yes	
	Bridled tern	<i>Onychoprion anaethetus</i>	M	No		No	Not relevant to EMBA	No	Yes	
	Roseate tern	<i>Sterna dougallii</i>	M	No	No	No	EMBA	No	Yes	
	Masked booby	<i>Sula dactylatra</i>	M	No	No	No	Not relevant to EMBA	No	Yes	
	Brown booby	<i>Sula leucogaster</i>	M	No	No	Marine debris	EMBA	No	Yes	
	Red- footed Booby	<i>Sula sula</i>	M	No	No	No	Not relevant to EMBA	No	Yes	
	Ruddy turnstone	<i>Arenaria interpres</i>	Mw	No	No	No	None	No	Yes	
	Sanderling	<i>Calidris alba</i>	Mw	No	No	No	None	No	Yes	
	Red-necked Stint	<i>Calidris ruficollis</i>	Mw	No	No	No	None	No	Yes	
	Long-toed Stint	<i>Calidris subminuta</i>	Mw	No	No	No	None	No	Yes	
	Double Banded Plover	<i>Charadrius bicinctus</i>	Mw	No	No	No	None	No	Yes	
	Oriental Plover	<i>Charadrius veredus</i>	Mw	No	No	No	None	No	Yes	

Class	Common Name	Scientific Name	EPBC Act Status	Cons Advice	Recovery Plan	Relevant Threat Abatement Plan	BIA	Operational Area Presence	EMBA presence	Relevant hazard
	Swinhoe's snipe	<i>Gallinago megala</i>	Mw	No	No	No	None	No	Yes	
	Pin-tailed snipe	<i>Gallinago stenura</i>	Mw	No	No	No	None	No	Yes	
	Oriental Pratincole	<i>Glareola maldivarum</i>	Mw	No	No	No	None	No	Yes	
	Broad-billed Sandpiper	<i>Limicola falcinellus</i>	Mw	No	No	No	None	No	Yes	
	Asian Dowitcher	<i>Limnodromus semipalmatus</i>	Mw	No	No	No	None	No	Yes	
	Bar-Tailed Godwit	<i>Limosa lapponica</i>	Mw	No	No	No	None	No	Yes	
	Black-tailed godwit	<i>Limosa limosa</i>	Mw	No	No	No	None	No	Yes	
	Little Curlew	<i>Numenius minutus</i>	Mw	No	No	No	None	No	Yes	
	Whimbrel	<i>Numenius phaeopus</i>	Mw	No	No	No	None	No	Yes	
	Ruff	<i>Philomachus pugnax</i>	Mw	No	No	No	None	No	Yes	
	Pacific Golden Plover	<i>Pluvialis fulva</i>	Mw	No	No	No	None	No	Yes	
	Grey Plover	<i>Pluvialis squatarola</i>	Mw	No	No	No	None	No	Yes	
	Greater Crested Tern	<i>Thalasseus bergii</i>	Mw	No	No	No	None	No	Yes	
	Grey- tailed Tattler	<i>Tringa brevipes</i>	Mw	No	No	No	None	No	Yes	
	Wood Sandpiper	<i>Tringa glareola</i>	Mw	No	No	No	None	No	Yes	
	Common Greenshank	<i>Tringa nebularia</i>	Mw	No	No	No	None	No	Yes	

Class	Common Name	Scientific Name	EPBC Act Status	Cons Advice	Recovery Plan	Relevant Threat Abatement Plan	BIA	Operational Area Presence	EMBA presence	Relevant hazard
	Marsh Sandpiper	<i>Tringa stagnatilis</i>	Mw	No	No	No	None	No	Yes	
	Common Redshank	<i>Tringa totanus</i>	Mw	No	No	No	None	No	Yes	
	Terek Sandpiper	<i>Xenus cinereus</i>	Mw	No	No	No	None	No	Yes	

Key EPBC: WC Act; V = vulnerable; OPF = Other Protected Fauna; CE = Critically Endangered; P1 = Priority Flora and Fauna List; M = Migratory marine; Mw = Migratory wetland; S = Schedule; LC = Least concern

Table 3-4: Biologically Important Areas located within the EMBA

Class	Common Name	Scientific Name	BIA Area	Overlaps Operational Area	Overlaps EMBA
Sharks and Fish	Dwarf sawfish	<i>Pristis clavata</i>	Foraging	X	✓
			Nursing	X	✓
			Pupping	X	✓
	Green sawfish	<i>Pristis zijsron</i>	Foraging	X	✓
			Nursing	X	✓
			Pupping	X	✓
	Freshwater/ Largetooth sawfish	<i>Pristis pristis</i>	Foraging	X	✓
			Pupping	X	✓
	Whale shark	<i>Rhincodon typus</i>	Foraging	X	✓
Marine mammals	Pygmy Blue whale	<i>Balaenoptera musculus brevicauda</i>	Distribution	✓	✓
			Foraging	X	✓
			Migration	X	✓
	Humpback whale	<i>Megaptera novaeangliae</i>	Migration	✓	✓
	Dugong	<i>Dugong dugon</i>	Breeding	X	✓
			Calving	X	✓
			High Density foraging	X	✓
			Nursing	X	✓
Turtles	Loggerhead turtle	<i>Caretta caretta</i>	Foraging	X	✓
			Internesting Buffer	X	✓
			Nesting	X	✓
	Green turtle	<i>Chelonia mydas</i>	Aggregation	X	✓
			Basking	X	✓

Class	Common Name	Scientific Name	BIA Area	Overlaps Operational Area	Overlaps EMBA
			Foraging	X	✓
			Interesting	X	✓
			Interesting Buffer	X	✓
			Mating	X	✓
			Migration Corridor	X	✓
			Nesting	X	✓
	Hawksbill turtle	<i>Eretmochelys imbricata</i>	Foraging	X	✓
			Interesting	X	✓
			Interesting buffer	X	✓
			Mating	X	✓
			Migration corridor	X	✓
			Nesting	X	✓
	Flatback turtle	<i>Natator depressus</i>	Aggregation	X	✓
			Foraging	X	✓
			Interesting	X	✓
			Interesting Buffer	✓	✓
			Mating	X	✓
			Migration corridor	X	✓
Nesting			X	✓	
Seabirds	Wedge-tailed shearwater	<i>Ardenna pacificus</i>	Breeding	✓	✓
	Lesser frigatebird	<i>Fregata ariel</i>	Breeding	X	✓
	White-tailed tropicbird	<i>Phaethon lepturus</i>	Breeding	X	✓

Class	Common Name	Scientific Name	BIA Area	Overlaps Operational Area	Overlaps EMBA
	Roseate tern	<i>Sterna dougallii</i>	Breeding	X	✓
	Fairy tern	<i>Sternula nereis</i>	Breeding	X	✓
	Brown booby	<i>Sula leucogaster</i>	Breeding	X	✓
	Lesser Crested Tern	<i>Thalasseus bengalensis</i>	Breeding	X	✓
	Little Tern	<i>Sterna albifrons</i>	Breeding	X	✓
			Resting	X	✓

3.6.1 Listed Species Recovery Plans, Conservation Advice and Threat Abatement Plans

Jadestone considered recent updates to Recovery Plans, Conservation Management Plans, Threat Abatement Plans or approved Conservation Advice in place for EPBC Act-listed threatened species that may potentially occur or utilise habitat within the EMBA (Table 3-3).

Recovery Plans set out the research and management actions necessary to stop the decline of and support the recovery of listed threatened species. In addition, Threat Abatement Plans provide for the research, management, and any other actions necessary to reduce the impact of a listed key threatening process on native species and ecological communities. The Minister decides whether a threat abatement plan is required for key threatening processes listed under Section 183 of the EPBC Act.

Table 3-5 provides information on the specific requirements of the relevant conservation advice, species recovery plans and threat abatement plans that is applicable to this petroleum activity, and demonstrates how current management requirements have been taken into account during the preparation of the EP.

Table 3-5: Relevant Management Plans for Listed Threatened and Migratory Species

Species or Group	Relevant Plan/ Conservation Advice	Threats and or Management Strategies relevant to the Activity	Addressed (where relevant) in EP Section
Fish, Sharks and Rays			
Grey nurse shark (west coast population)	Recovery Plan for the Grey Nurse Shark (<i>Carcharias taurus</i>) (DoE, 2014a) Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018)	Pollution and disease	7.5, 7.6
		Ecosystem effects – habitat modification	7.5, 7.6
Great white shark	Recovery plan for the White Shark (<i>Carcharodon carcharias</i>) (DSEWPaC, 2013a)	Ecosystem effects as a result of habitat modification	7.5, 7.6
Dwarf sawfish	Approved Conservation Advice on <i>Pristis lavate</i> (dwarf sawfish) (DEWHA, 2009) Sawfish and River Sharks Multispecies Recovery Plan (DoE, 2015a)	Habitat degradation and modification	7.5, 7.6
Freshwater/ largetooth sawfish	Approved Conservation Advice for <i>Pristis pristis</i> (largetooth sawfish) (DoE, 2014b) Sawfish and River Sharks Multispecies Recovery Plan (DoE, 2015a)	Habitat degradation and modification	7.5, 7.6
Green sawfish	Approved Conservation Advice for <i>Pristis zijsron</i> (green sawfish) (DEWHA, 2008c) Sawfish and River Sharks Multispecies Recovery Plan (DoE, 2015a)	Habitat degradation and modification	7.5, 7.6
Whale shark	Approved Conservation Advice for <i>Rhincodon typus</i> (whale shark) (TSSC, 2015a)	Boat strike from large vessels	7.2
		Habitat disruption from mineral exploration, production and transportation	7.5, 7.6

Species or Group	Relevant Plan/ Conservation Advice	Threats and or Management Strategies relevant to the Activity	Addressed (where relevant) in EP Section
Blind gudgeon	Approved Conservation Advice for <i>Milyeringa veritas</i> (blind gudgeon) (DEWHA, 2008d)	Habitat degradation and modification including pollution	7.5, 7.6
Blind cave eel	Approved Conservation Advice for <i>Ophisternon candidum</i> (Blind Cave Eel) (DEWHA, 2008e)	Habitat degradation and modification including pollution	7.5, 7.6
Marine Mammals			
Sei Whale	Approved Conservation Advice for <i>Balaenoptera borealis</i> (sei whale) (TSSC, 2015b) Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018)	Anthropogenic noise and acoustic disturbance	6.2
		Habitat degradation including pollution (increasing port expansion and coastal development)	7.5, 7.6
		Pollution (persistent toxic pollutants)	7.5, 7.6
		Vessel strike	7.2
Blue whale	Blue Whale Conservation Management Plan 2015 - 2025 (DoE, 2015b) Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018)	Noise Interference	6.2
		Habitat Modification	7.5, 7.6
		Vessel Disturbance/ strike	7.2
Fin whale	Approved Conservation Advice for <i>Balaenoptera physalus</i> (fin whale) (TSSC, 2015c) Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018)	Anthropogenic noise and acoustic disturbance	6.2
		Habitat degradation including coastal development, port expansion and aquaculture	7.5, 7.6
		Pollution (persistent toxic pollutants)	7.5, 7.6
		Vessel strike	7.2
Southern right whale		Entanglement/ marine debris	7.3
		Vessel disturbance/ strike	7.2

Species or Group	Relevant Plan/ Conservation Advice	Threats and or Management Strategies relevant to the Activity	Addressed (where relevant) in EP Section
	Conservation Management Plan for the Southern Right Whale 2011 – 2021 (DSEWPaC, 2012h) Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia’s coasts and oceans (DoEE, 2018)	Noise interference	6.2
		Habitat modification	7.5, 7.6
Humpback whale	Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia’s coasts and oceans (DoEE, 2018)	Habitat degradation including coastal development and port expansion	7.5, 7.6
		Entanglement	7.3
		Vessel disturbance and strike	7.2
Bryde’s whale	Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia’s coasts and oceans (DoEE, 2018)	Marine debris	7.3
Killer whale	Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia’s coasts and oceans (DoEE, 2018)	Marine debris	7.3
Spotted bottlenose dolphin (Arafura/Timor Sea populations)	Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia’s coasts and oceans (DoEE, 2018)	Marine debris	7.3
Antarctic minke whale	Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia’s coasts and oceans (DoEE, 2018)	Marine debris	7.3
Dugong	Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia’s coasts and oceans (DoEE, 2018)	Marine debris	7.3
Marine Reptiles			

Species or Group	Relevant Plan/ Conservation Advice	Threats and or Management Strategies relevant to the Activity	Addressed (where relevant) in EP Section
Short-nosed seasnake	Approved Conservation Advice on <i>Aipysurus apraefrontalis</i> (Short-nosed seasnake) (DSEWPaC, 2011a)	Habitat degradation	7.5, 7.6
Leaf-scaled seasnake	Approved Conservation Advice on <i>Aipysurus foliosquama</i> (Leaf-scaled seasnake) (DSEWPaC, 2011b)	Degradation of reef habitat	7.5, 7.6
All marine turtles including: Loggerhead Turtle Green Turtle Leatherback Turtle Hawksbill Turtle Flatback Turtle	Recovery plan for marine turtles in Australia 2017 – 2027 (DoEE, 2017) National Light Pollution Guidelines for Wildlife including Marine Turtles, Seabirds and Migratory Shorebirds (DoEE, 2020) Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018)	Light pollution	6.1
		Habitat modification/ loss	7.5, 7.6
		Chemical and terrestrial discharge/ deteriorating water quality	6.4, 6.5, 7.4, 7.5
		Marine debris	7.3
		Vessel disturbance/ strike	7.2
		Noise interference	6.2
Leatherback Turtle	Approved Conservation Advice on <i>Dermochelys coriacea</i> (DEWHA, 2008f)	Vessel strike	7.2
		Degradation of foraging areas	7.2, 7.3
Birds			
All seabirds and migratory shorebirds	National Light Pollution Guidelines for Wildlife including Marine Turtles, Seabirds and Migratory Shorebirds (DoEE, 2020)	Habitat modification	7.5, 7.6
All seabirds	Wildlife Conservation Plan for Seabirds (CoA, 2020)	Light pollution	6.1
		Habitat loss and degradation from pollution	7.5, 7.6

Species or Group	Relevant Plan/ Conservation Advice	Threats and or Management Strategies relevant to the Activity	Addressed (where relevant) in EP Section
Migratory species within the combined EMBA: + Asian dowitcher; + Bar-tailed godwit; + Common greenshank; + Common sandpiper; + Oriental plover; + Oriental pratincole; + Pectoral sandpiper; and + Sharp-tailed sandpiper	Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015)	Habitat loss and degradation	7.5, 7.6
		Pollution and Contaminants	7.5, 7.6
Red knot	Approved Conservation Advice for <i>Calidris canutus</i> (Red knot) (TSSC, 2016a) Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015)	Habitat loss and habitat degradation	7.5, 7.6
		Pollution/contamination impacts	7.5, 7.6
Australian lesser noddy	Approved Conservation Advice for <i>Anous tenuirostris melanops</i> (Australian lesser noddy) (TSSC, 2015i)	Habitat modification	7.5, 7.6
Curlew sandpiper	Approved Conservation Advice for <i>Calidris ferruginea</i> (Curlew Sandpiper) (DoE, 2015c)	Habitat loss and degradation from pollution	7.5, 7.6
Great knot	Approved Conservation Advice for <i>Calidris tenuirostris</i> (Great knot) (TSSC, 2016e) Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015)	Habitat loss and degradation from pollution	7.5, 7.6
Greater sand plover	Approved Conservation Advice for <i>Charadrius leschenaultii</i> (Greater sand plover) (TSSC, 2016b)	Habitat loss and habitat degradation	7.5, 7.6
		Pollutant/ contaminant impacts	7.5, 7.6

Species or Group	Relevant Plan/ Conservation Advice	Threats and or Management Strategies relevant to the Activity	Addressed (where relevant) in EP Section
	Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015)		
Lesser sand plover	Approved Conservation Advice for <i>Charadrius mongolus</i> (Lesser sand plover) (TSSC, 2016d) Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015)	Habitat loss and habitat degradation	7.5, 7.6
		Pollutant/ contaminant impacts	7.5, 7.6
Northern Siberian bar-tailed godwit	Approved Conservation Advice for <i>Limosa lapponica menzbieri</i> (Bar-tailed godwit (northern Siberian)) (TSSC, 2016c)	Habitat loss and habitat degradation	7.5, 7.6
		Pollutant/ contaminant impacts	7.5, 7.6
Southern giant petrel	National recovery plan for albatrosses and giant petrels 2022 (DCCEEW 2022) Threat Abatement Plan for the incidental catch (or bycatch) of seabirds during oceanic longline fishing operations (CoA, 2018) Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018)	Marine pollution	7.5, 7.6
Northern giant petrel	National recovery plan for albatrosses and giant petrels 2022 (DCCEEW 2022) Threat Abatement Plan for the incidental catch (or bycatch) of seabirds during oceanic longline fishing operations (CoA, 2018) Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018)	Marine pollution	7.5, 7.6

Species or Group	Relevant Plan/ Conservation Advice	Threats and or Management Strategies relevant to the Activity	Addressed (where relevant) in EP Section
Eastern curlew	Approved Conservation Advice for <i>Numenius madagascariensis</i> (eastern curlew) (DoE, 2015d)	Habitat loss and degradation from pollution	7.5, 7.6
Abbott's booby	Approved Conservation Advice for the Abbott's booby <i>Papasula abbotti</i> (TSSC, 2020a)	Habitat loss, disturbance and modifications	7.5, 7.6
		Marine debris - plastics	7.3
Christmas Island white-tailed tropicbird	Approved Conservation Advice for <i>Phaethon lepturus fulvus</i> white-tailed tropicbird (Christmas Island) (DoE, 2014c)	None listed relevant to the Activity	N/A
Soft-plumaged petrel	Approved Conservation Advice for <i>Pterodroma mollis</i> (soft-plumaged petrel) (TSSC, 2015h)	None listed relevant to the Activity	N/A
Australian painted snipe	Approved Conservation Advice on <i>Rostratula australis</i> (Australian painted snipe) (DSEWPaC, 2013b)	None listed relevant to the Activity	N/A
		Oil spills	7.5, 7.6
		Marine plastics/ debris	7.3
		Marine pollution	7.5, 7.6
Australian fairy tern	National Recovery plan for the Australian Fairy Tern (<i>Sternula nereis nereis</i>) (COA 2020)	Oil spills	7.5, 7.6
	Approved Conservation Advice on <i>Sternula nereis nereis</i> (fairy tern) (TSSC, 2011)		
Shy albatross	Conservation Advice <i>Thalassarche cauta</i> Shy Albatross (TSSC, 2020b) National recovery plan for albatrosses and giant petrels 2022 (DCCEEW, 2022)	Marine plastics/ debris	7.3

Species or Group	Relevant Plan/ Conservation Advice	Threats and or Management Strategies relevant to the Activity	Addressed (where relevant) in EP Section
	Threat Abatement Plan for the incidental catch (or bycatch) of seabirds during oceanic longline fishing operations (CoA, 2018) Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018)	Marine pollution	7.5, 7.6
White-capped albatross	National recovery plan for albatrosses and giant petrels 2022 (DCCEEW, 2022) Threat Abatement Plan for the incidental catch (or bycatch) of seabirds during oceanic longline fishing operations (CoA, 2018) Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018)	Marine pollution	7.5, 7.6
		Marine debris	7.3
Black-browed albatross	National recovery plan for albatrosses and giant petrels 2022 (DCCEEW, 2022) Threat Abatement Plan for the incidental catch (or bycatch) of seabirds during oceanic longline fishing operations (CoA, 2018) Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018)	Marine pollution	7.5, 7.6
		Marine debris	7.3
Campbell albatross	National recovery plan for albatrosses and giant petrels 2022 (DCCEEW, 2022) Threat Abatement Plan for the incidental catch (or bycatch) of seabirds during	Marine pollution	7.5, 7.6

Species or Group	Relevant Plan/ Conservation Advice	Threats and or Management Strategies relevant to the Activity	Addressed (where relevant) in EP Section
	oceanic longline fishing operations (CoA, 2018)		
Flesh-footed Shearwater	Threat Abatement Plan for the incidental catch (or bycatch) of seabirds during oceanic longline fishing operations (CoA, 2018) Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018)	Marine pollution	7.5, 7.6
Wedge-tailed Shearwater	Threat Abatement Plan for the incidental catch (or bycatch) of seabirds during oceanic longline fishing operations (CoA, 2018) Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018)	Marine pollution	7.5, 7.6
Brown Booby	Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018)	Marine debris	7.3

3.6.2 Fish

Fifteen species of EPBC listed fish and rays have been identified as potentially occurring within the EMBA. Of these, four species have a BIA that overlaps with the EMBA including the; whale shark, green, dwarf and freshwater sawfishes (Figure 3-6 and Table 3-4).

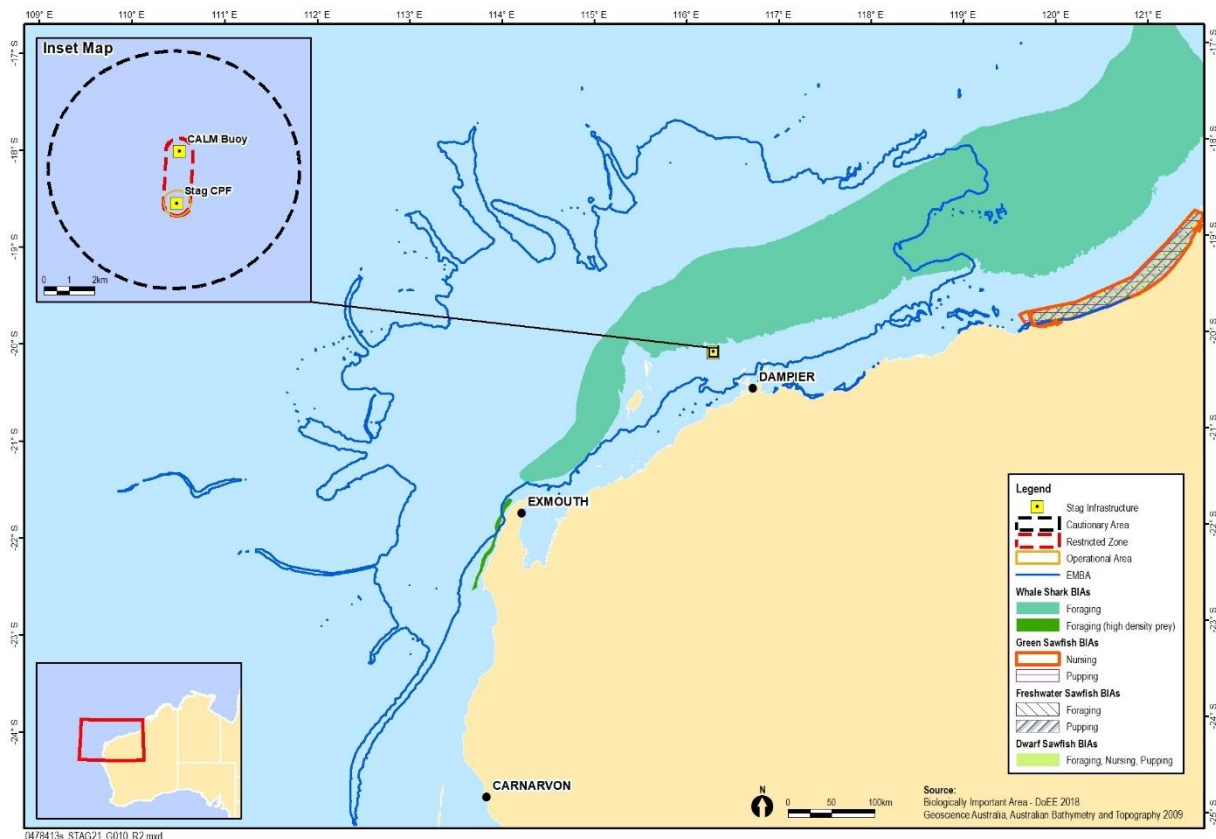


Figure 3-6: Biologically Important Areas for Sharks and Fish within the EMBA

Grey Nurse Shark

In Australia, the grey nurse shark has an inshore coastal distribution primarily in sub-tropical to cool temperate waters on the continental shelf. There are two separate, genetically distinct grey nurse shark populations in Australian waters—one on the east coast and one on the west coast (Stow et al., 2006 as cited in CoA 2014). The range of the west coast population is not well known; however, records indicate that the species is widely distributed from the NWS (including coastal waters in Exmouth Gulf), south to the Great Australian Bight (CoA 2014).

It is thought that individuals have a high degree of site fidelity, although some studies have suggested that the species exhibits some migratory characteristics moving between different habitats and localities (McAuley, 2004).

Grey Nurse Sharks are often observed aggregating above the seabed (at depths 10–40 m) near deep sandy-bottomed gutters or rocky caves in the vicinity of inshore rocky reefs and islands (CoA 2014). 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). No key aggregation sites have been identified in WA waters.

As outlined in the Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) 2014 (DoEE 2014), the principal current threats to the grey nurse shark in Australia are:

Mortality related to incidental capture by commercial and recreational fisheries; and

Mortality related to shark control activities such as beach meshing or drum lining.

Although individuals may be present in the EMBA, based on their distribution it is likely limited to individuals only.

White Shark

The great white shark (*Carcharodon carcharias*) is listed as vulnerable under the EPBC Act and may occur within the spill trajectory area as they are known to prey on humpback whales and have been recorded in NWC waters during humpback migrations. 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. In Australia, great white sharks have been recorded from central Queensland around the south coast to north-west WA but may occur further north on both coasts (Last and Stevens, 2009). They are widely but not evenly distributed in Australian waters and is considered uncommon to rare compared to most other large sharks (CITES, 2004). 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).

Dwarf Sawfish

The dwarf sawfish (*Pristis clavata*) is listed as vulnerable under the EPBC Act. 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). The majority of records of dwarf sawfish in WA have come from shallow estuarine waters of the Kimberley region which are believed to be nursery areas, with immature juveniles remaining in these areas up until three years of age (Thorburn et al., 2004). Sawfish regularly use the tidal creeks and mangrove areas of Roebuck Bay, within the EMBA, for breeding and refuge (Bennelongia, 2009). The updated sawfish recovery plan (CoA 2015) indicates where pupping is known and likely to occur along the Pilbara coastline, with main areas within the EMBA being along Eighty Mile Beach. A foraging, pupping and nursing BIA overlaps the EMBA (Figure 3-6 and Table 3-4). Similarly, the Recovery Plan indicates that adults are known to occur along the coast north of Exmouth and within the EMBA and operational area.

Freshwater and Green Sawfish

In Australian waters, green sawfish have historically been recorded in the coastal waters off Broome, Western Australia, around northern Australia and down the east coast as far as Jervis Bay, NSW (Stevens et al., 2005). Important areas for freshwater sawfishes include King Sound, and the Fitzroy, Durack, Robinson and Ord rivers. Both species are wider ranging than the dwarf sawfish.

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 (Peeverell 2005, Thorburn et al. 2007). It is believed that mature freshwater sawfish enter less saline waters during the wet season to give birth (Peeverell 2005) and freshwater river reaches play an important role as nursery areas (DoE 2014c).

The green sawfish inhabits muddy bottom habitats and enters estuaries (Allen, 1997; Stead, 1963). It has been recorded in inshore marine waters, estuaries, river mouths, embankments and along sandy and muddy beaches (Peeverell et al., 2004; Stevens et al., 2005; Thorburn et al., 2004). Stead (1963) reported that this species was frequently found in shallow water. Green sawfish have been recorded in very shallow water (<1 m) to offshore trawl grounds in over 70 m of water (Stevens et al., 2005).

Smaller specimens (<2.5 m in length) are more common in foreshore and offshore coastal waters (Thorburn et al., 2004), as well as estuaries and river mouths at slightly reduced salinities, but do not venture into freshwater. Larger individuals (>2.5 m in length) are found in both inshore and offshore waters.

The updated sawfish recovery plan (CoA 2015) indicates where pupping is known and likely to occur along the Pilbara coastline, with main areas within the EMBA being along Eighty Mile Beach. There is an identified foraging, nursing and pupping BIA for the Green Sawfish and a foraging and pupping BIA for the Freshwater Sawfish (Figure 3-6 and Table 3-4). Similarly, the Recovery Plan indicates that adults are known to occur along the coast north of Exmouth within the EMBA and operational area.

Principal threats to sawfish species are fishing activities (by-catch, traditional or illegal fishing) and habitat degradations or modification.

Whale Shark

The whale shark (*Rhincodon typus*) is an oceanic and coastal, pelagic fish, generally found in tropical areas where the surface temperature is 21–25°C. It is a filter feeder and, commonly ranges in size from 4–10 m (Colman, 1997). This species was listed as Vulnerable under the EPBC Act in 2001 and is also classified as Vulnerable on the World Conservation Union's Red List of Threatened Species (IUCN, 2012). In WA, whale sharks are protected under the Wildlife Conservation Act 1950, the Conservation and Land Management Act 1984 and the Fish Resources Management Act 1994.

There is a general lack of knowledge on many aspects of whale shark biology, including definitive migration patterns. They are normally oceanic and cosmopolitan in their distribution and are known to aggregate in the reef front waters adjacent to the Ningaloo Reef between March to June (Colman, 1997; Wilson et al., 2006) with the highest frequency of sightings occurring in April (Wilson et al., 2001). However, the season is variable and individual whale sharks have been recorded at other times of the year. The EMBA overlaps a foraging and high density foraging BIA (Figure 3-6 and Table 3-4), While the species spends the majority of its time in deeper water, it is also encountered close to or at the surface.

Whale shark presence coincides with the coral mass spawning period, when there is an abundance of food (krill, planktonic larvae and schools of small fish) in the waters adjacent to the reef. Estimates of the size of the population participating in the Ningaloo aggregation are between 300 and 500 individuals (Meekan et al., 2006).

Preliminary 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 WA population migrate through the NWMR. 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.

The most significant threat to whale sharks is intentional and unintentional mortality from fishing outside of Australian waters. In Australian waters, threats to the recovery of the species include boat strike from large vessels and habitat disruption from mineral exploration, production and transportation. Other lesser threats include disturbance from domestic tourism operations, marine debris and climate change.

Ongoing threats to whale sharks, together with life history characteristics; including slow growth, late maturation and extended longevity (Colman, 1997); means the whale shark remains susceptible to declines across its international range.

Manta Rays

The giant and reef manta rays can be found throughout the waters of WA. They are listed as migratory and may be found in locations such as Ningaloo. 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, 2014b).

Narrow sawfish

The narrow sawfish (*Anoxypristis cuspidate*) 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).

Oceanic White-tip 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 (Fourmanoir 1961, Last and Stevens 1994).

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), and a related species of the genus *Milyeringa*, the Barrow cave gudgeon (*Milyeringa justitia*) has also been noted at Barrow Island (Humphreys 1999). The Barrow cave gudgeon is listed as Vulnerable under the WA EPBC Act. They have been recorded in waters ranging from fresh to seawater at depths of up to 33 m in caves and 50 m in wells and bores. Both species are restricted to either caves or groundwater (Humphreys and Blyth 1994) and are the only two vertebrate animals known from Australia for this (DoE 2014a).

Shortfin and Longfin Mako Shark

The shortfin mako and longfin mako sharks are listed as Migratory under the EPBC Act. The longfin mako is a 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.

Porbeagle Mackerel Shark

The Porbeagle is wide-ranging and inhabits temperate, subarctic and subantarctic waters of the North Atlantic and Southern Hemisphere (Francis et al. 2002). In Australia, the species occurs in waters from southern Queensland to south-west Australia (Last and Stevens 2009). Animals typically occur in oceanic waters off the continental shelf, although they occasionally enter coastal waters (Francis et al. 2002).

The Porbeagle primarily inhabits oceanic waters and areas around the edge of the continental shelf although they occasionally move into coastal waters, but these movements are temporary (Campana and Joyce 2004;

Francis et al. 2002). Individuals are known to undertake seasonal migrations, possibly in search of food, although the timing and details of these migratory movements are not well-understood (Saunders et al. 2011).

Pipefish and seahorse (Syngnathidae)

Other EPBC Act protected marine species that may occur within the EMBA include various species of pipefishes and seahorses (Family Syngnathidae). Knowledge about the distribution, abundance and ecology of both syngnathids and solenostomids is limited (DSEWPaC 2012). In tropical areas such as the EMBA, species are primarily found among coral reefs (Foster & Vincent 2004; Scales 2010).

3.6.3 Marine Mammals

Marine mammals occur in the waters of the Stag Facility, some being seasonal visitors while others occur at low densities year-round. Marine mammals that may occur in the region include cetaceans (whales, porpoises and dolphins) and dugongs. A search of the EPBC Act protected matters database (Appendix C) revealed 32 cetaceans that may occur within the EMBA. The search identified four threatened marine mammal species that may occur within the EMBA, including two species listed as vulnerable, the sei whale (*Balaenoptera borealis*) and fin whale (*Balaenoptera physalus*), and two species listed as endangered, the blue whale (*Balaenoptera musculus*) and southern right whale (*Eubalaena australis*). As of February 2022, humpback whales were removed from the Vulnerable list as it was determined that the species is no longer eligible for inclusion in any category of the list. It is however still listed as migratory under the EPBC Act. Thirteen marine mammals were also identified as migratory including the humpback whale.

The blue whale, humpback whale and dugong have identified BIAs that overlap the EMBA. Further information on relevant BIAs for these species is provided in Figure 3-7 and Table 3-4. In addition, seven marine mammals were identified as migratory.

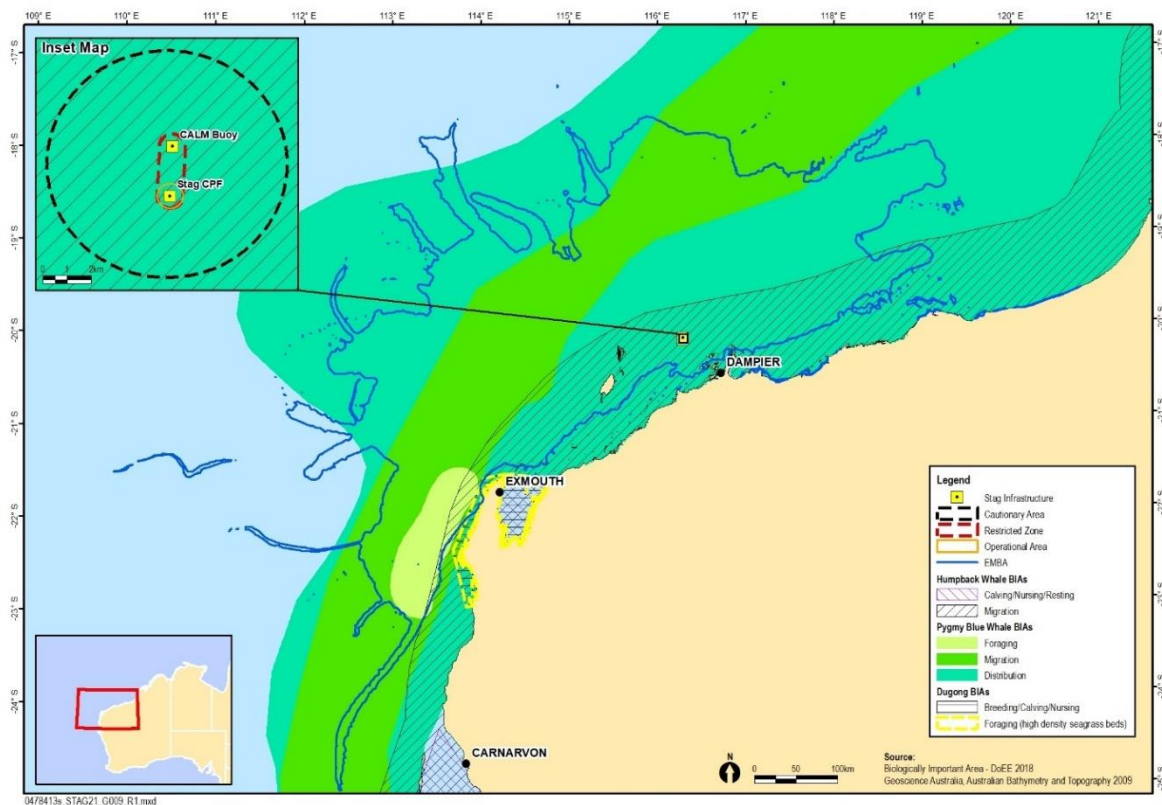


Figure 3-7: Biologically Important Areas for Marine Mammals within the EMBA

Blue Whale

Blue whales are found in all oceans of the world. They are the largest living animal and can grow to a length of over 30 m and weigh an average of 100–120 t. There are two recognised subspecies in Australia: the 'true' blue whale (*Balaenoptera musculus intermedia*) and the 'pygmy' blue whale (*Balaenoptera musculus brevicauda*) (DSEWPaC, 2012d). Both of these species are covered by the Blue Whale Conservation Management Plan 2015 (DoEE 2015). In general, the southern blue whale is found south of 60° S and pygmy blue whales are found north of 55° S (DEWHA, 2008a, b). As southern blue whales feed predominantly in polar waters it has been suggested that all blue whales sighted in Australian waters are pygmy blue whales (DEH, 2005). During summer–autumn true blue whales feed mainly in the Antarctic, mostly on krill, while pygmy blue whales are thought to feed in productive regions in temperate latitudes (Branch *et al.*, 2007).

The Perth Canyon is the only area so far identified off the WA coast where pygmy blue whales aggregate with some predictability. The area represents a significant feeding ground for pygmy blue whales between January and April, with aerial surveys between 1999 and 2004 recording an average of 30 individuals at the peak of the season (March–May) (Jenner *et al.*, 2002; McCauley *et al.*, 2004). Acoustic detections suggest that true blue whales also over-winter around the Perth Canyon and head south in mid-October (McCauley *et al.*, 2004).

The pygmy blue whale has three identified BIAs: (a foraging and migration) overlaps the EMBA and a distribution BIA overlaps both the EMBA and operational area (Figure 3-7 and Table 3-4). However, Blue whale migration is thought to follow deep oceanic routes, although little is known about their precise migration routes (DSEWPaC, 2012d). The blue whale is rarely present in large numbers outside recognised aggregation areas. Chevron's Wheatstone project cetacean monitoring studies indicated that during their southern migration blue whales were recorded between the 750 m and the 850 m isobaths and between the 300 m and the 350 m isobaths (RPS, 2010). These data also showed a seasonal migration pattern further west from May to August (moving northwards), with a southwards migration occurring between November and December (RPS, 2010). These findings are supported by acoustic detections undertaken off the Montebello Islands which showed a northerly pulse from late March to early August with peak migration in June and July, and a pulse of southerly transiting whales from early October to late November, with a peak migration period occurring from early November to early December (McCauley and Jenner, 2010).

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 National Conservation Values Atlas has identified the pygmy whale migration pathway on the continental shelf edge at depth of 500 to 1,000 m (Figure 3-7) (McCauley & Jenner 2010).

Humpback Whale

Humpback whales are moderately large baleen whales that occur throughout Australian waters and are the most commonly sighted whale in the NWMR (DSEWPaC, 2012e).

The WA humpback whale population (known as the Group IV population) is genetically distinct from the eastern Australian population and was severely depleted by whaling activities. The population was estimated at 12,000 to 16,000 individuals in 1934 and continued to decline to an estimated 800 individuals prior to the moratorium on whaling in the southern hemisphere in 1962 (Chittleborough, 1965). More recent population estimates have suggested whale numbers have increased to ~ 28,830 in 2008 (Hedley *et al.*, 2011 as cited in DoE 2015). Numbers have increased further in recent years and the Action Plan for Australian Mammals 2012 by Woinarski *et al.*, 2014, and a recent paper from Bejder *et al.*, 2015 recommend that humpback whales no longer meet any criteria for listing as threatened under the EPBC Act. As of February 2022, humpback whales were removed from the Vulnerable list as it was determined that the species is no longer eligible for inclusion in any category of the list. Despite removal from the threatened species list, it will remain a Migratory species under the EPBC Act and BIAs are still recognised for the species.

Humpback whales migrate annually between summer feeding grounds in Antarctica and breeding aggregation areas in Southern Kimberley between Broome and the northern end of Camden Sound. There is an identified migratory BIA that overlap both the EMBA and operational area (Figure 3-7 and Table 3-4).

The humpback whale migration pathway is within the continental shelf boundary or 200 m bathymetry along the WA coastline (DoE, 2015). However actual sightings recorded by Jenner et al (2001) and Double et al. (2010 and 2012) indicate that the route is actually much closer to shore, particularly along the Pilbara coast, with migrating whales tending to travel within 50 km of the coast between North-West Cape and Camden Sound.

Humpback whales pass north along the waters west of Barrow Island to the Montebello Islands during their annual winter migration from the Antarctic. Once past the Montebello Islands their migration route heads east towards their breeding grounds in the Kimberley. The northward migration past Montebello and Barrow Islands generally occurs from mid-July with the peak in late July, though this can vary by up to three weeks. Unlike the northern migration, which tends to follow the deeper water of the continental shelf, the southward migration concentrates whales closer to the mainland with a peak Aug–mid-Sep (DoE 2015).

Major calving areas have been identified in the Kimberley region and particularly between Lacepede Islands (16°8S) and Camden Sound (15°38S) (Jenner et al., 2001) which are more than 900 km from the Stag Operational Area.

Whales may travel through the operational area on a seasonal basis as part of their migratory movements. The Stag Platform is more than 900 km from core calving grounds and more than 250 km from identified resting areas at Exmouth Gulf and southern Kimberley. As such, whales may be present in the area as part of the season migration.

Indo-Pacific Humpback dolphin

The Indo-pacific humpback dolphin is typically found in water less than 20m deep but has been recorded in water up to 40m deep. This species is generally found in association with river mouths, mangroves, tidal channels and inshore reefs (DoEE 2016a). This species of dolphin is known to have resident groups that forage, feed, breed and calve in the state waters of Roebuck Bay and areas further north (DoEE 2016a).

No BIA for the Indo-pacific humpback dolphin is located within the EMBA or Operational Area, although a foraging and breeding BIA is located in the shallower waters off Broome.

Spotted Bottlenose dolphin

The Indo-Pacific 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 <10m deep) inshore waters (Bannister et al., 1996; Hale et al., 2000). The known distribution of the Indo-Pacific bottlenose dolphin extends from Shark Bay north to the western edge of the Gulf of Carpentaria in Australia (DoEE, 2016b).

No BIA for the spotted bottlenose dolphin is located within the EMBA or Operational Area, although a foraging BIA is located in the shallower waters off Broome.

Sei Whale

Sei whales have been infrequently recorded in Australian waters (Bannister et al., 1996) which could be due to the similarity in appearance of sei whales and bryde's whales leading to incorrect recordings. There are no known mating or calving locations in Australian waters (Parker, 1978). The species is migratory, moving between Australian waters and Antarctic feeding areas but their movements are unpredictable and not well documented. They have been sighted inshore (in the proximity of the Bonney upwelling, Victoria) as well as in deeper offshore waters and have only been sighted in summer and autumn.

Fin Whale

Fin whales are listed as vulnerable and migratory under the EPBC Act. The fin whale is the second largest species after the blue whale. Fin whale distribution in Australia is known primarily from stranding events and whaling records and the whales are thought to be present along the western coast of Australia to NSW. The Australian Antarctic waters are important feeding grounds for fin whales but there are no known mating or calving locations in Australian waters (Morrice et al., 2004). The migration routes and location of winter breeding grounds are uncertain, but presence has been detected in summer and autumn months.

Southern Right whale

Southern right whales from Australian populations probably forage between about 40°S and 65°S, generally south of Australia. In the region of the Sub-Tropical Front (41–44°S) they mainly consume copepods, while at higher latitudes (south of 50°S) krill is the main prey item. The species feeds in the Southern Ocean in summer, moving close to shore in winter. Right whales feed by surface skimming or shallow dives, trapping plankton on fine baleen fibres. The migratory paths between calving and feeding areas are not well understood (CoA 2012).

The Conservation Management Plan for the Southern Right Whale 2011-2021 (CoA 2013) indicates that the core coastal range for southern right whale is from Perth along the southern coastline to Sydney. Although sightings have been recorded as far north as Exmouth these are rare (Bannister et al. 1996) and no BIA are located in the waters surrounding the Operational Area or the EMBA.

Given that major calving areas and aggregations occur in proximity to the Great Australian Bight, southern right whales are unlikely to be present in high numbers within the operational area or EMBA, and any occurrence would be infrequent and limited to transiting individuals.

Australian Snubfin Dolphin

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). No BIA for the Australian snubnose dolphin is located within the Operational Area EMBA, although a foraging BIA is located in the shallower waters off Broome.

Dugong

Dugongs are listed as a Migratory species under the EPBC Act and protected under Schedule 4 of the WA Wildlife Conservation Act. They are also listed on the Appendix 1 of the Convention of International Trade in Endangered Species (CITES) and on Appendix II of the Convention on the Conservation of Migratory Species of Wild Animals 1979. Dugongs (*Dugong dugon*) are large herbivorous marine mammals (up to 3 metres) that feed off seagrass and generally inhabit coastal areas in shallow waters (less than 5 m).

Dugong distribution and movement is based on the abundance, size and species of seagrass meadow. Key populations along the WA coast are principally located at: Shark Bay (the largest resident population in Australia), Ningaloo Marine Park, 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).

A high density foraging BIA (seagrass beds) and a Breeding/ Calving / Nursing BIA is located in the waters around Ningaloo Reef and Exmouth Gulf. . A foraging and migration BIA, is also located in Roebuck Bay, this is located outside the EMBA however.

Sperm Whale

Sperm whales typically occur in deep waters (greater than 200m) off the continental shelf along the southern coastline between Cape Leeuwin and Esperance (Bannister et al. 1996). Although there is a lack of detailed information on migration timings, sperm whales are known to migrate northwards in winter and southwards in summer. 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 have been identified in the waters surrounding the Operational Area or the EMBA.

Given that major foraging areas occur off Perth and in proximity to the Great Australian Bight, sperm whales are unlikely to be present in high numbers within the operational area or EMBA, and any occurrence would be infrequent and limited to transiting individuals.

Other whale species

Other cetacean species whose broad distributions overlap with the operational area and EMBA include whales that are infrequently observed and usually restricted to cooler or deep waters such as Bryde's whales, Antarctic minke and killer whales. As no BIA for these species are known in the region, and they are generally restricted to deeper waters, it is unlikely they will be encountered in significant numbers.

3.6.4 Marine Reptiles

Marine turtles and sea snakes have been identified as potentially occurring within the EMBA.

Marine Turtles

Five species of threatened marine turtles may occur within the EMBA, three of these species are classed as threatened-vulnerable under the EPBC Act, the hawksbill (*Eretmochelys imbricata*), flatback (*Natator depressus*) and green turtles (*Chelonia mydas*) with two species, the loggerhead (*Caretta caretta*) and leatherback turtle (*Dermochelys coriacia*), classed as threatened-endangered. Green, flatback, hawksbill, and loggerhead turtles nest on the sandy beaches of offshore islands and the mainland within the Stag Facility EMBA. The leatherback turtle may also visit the open waters of the region.

These species are all identified within the Recovery Plan for Marine Turtles in Australia (DoEE, 2017). The Operational Area overlaps with nesting and internesting areas identified as habitat critical to the survival of the Flatback Turtles, while Green, Loggerhead and Hawksbill turtles have critical nesting habitat areas located within the EMBA.

The nearest turtle nesting sites to the operational area are located ~ 35 km to the south-east at Dampier Archipelago and ~ 60 km to the south-west at Barrow, Montebello and Lowendal Islands. Table 3-6 outlines turtle activity within the Operational Area and EMBA and the figures below show BIAs specific to turtle species.

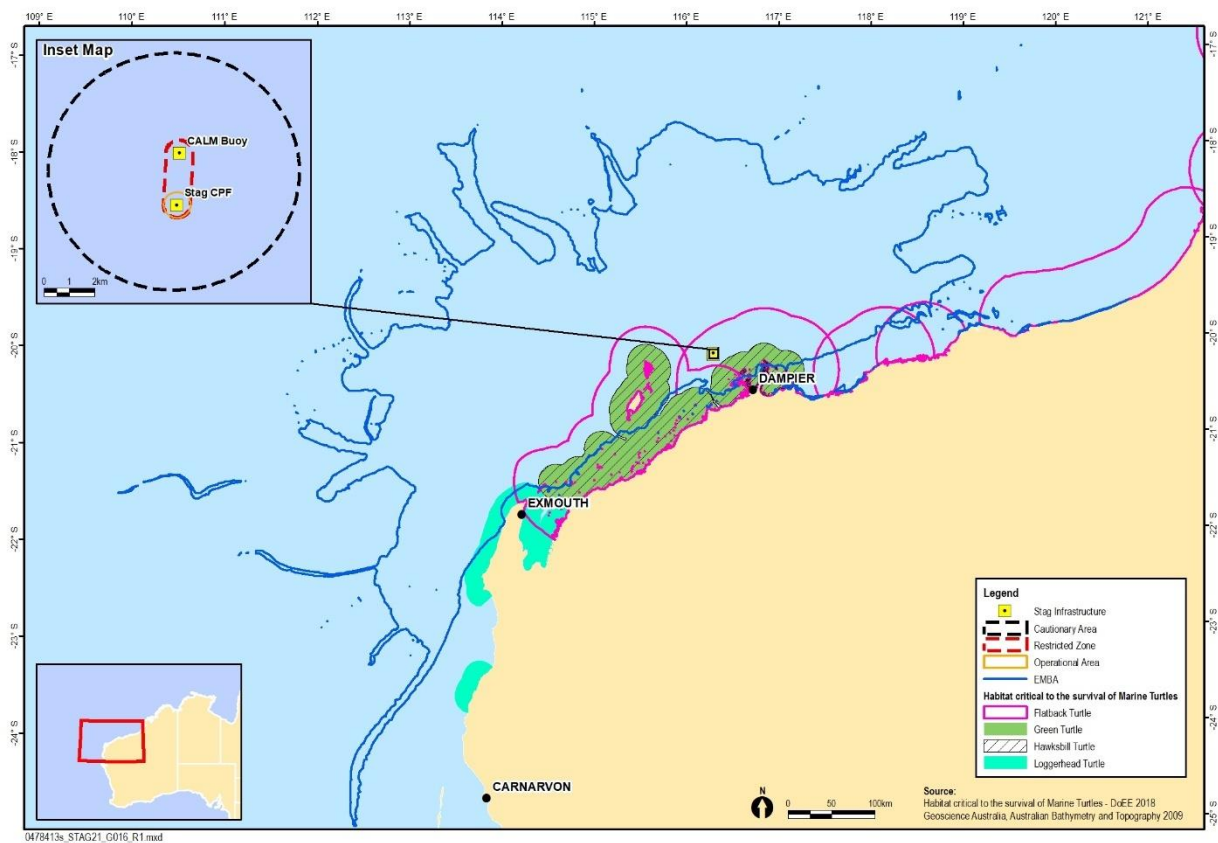


Figure 3-8: Habitat critical to the survival of marine turtles

Loggerhead turtles

WA supports one genetic stock of loggerhead turtles with nesting encompassing Muiron Islands, Ningaloo Coast south to about Carnarvon and islands near Shark Bay, including Dirk Hartog Island (Limpus, 2008b), with occasional nesting recorded from Varanus and Rosemary Islands (DSEWPac, 2012f). One nesting loggerhead has been tagged on Varanus Island since 1986 (Apache, 1999). Low numbers of loggerheads have also been observed on Barrow Island (Chevron, 2008). The annual nesting population in the region is thought to be in the several thousand (Limpus, 2008b). Foraging, internesting buffer and nesting BIAs have been identified and overlap the EMBA (Figure 3-9). The closest known breeding/nesting grounds to the Stag Facility are Rosemary Island (Dampier Archipelago) and Barrow and Varanus Islands. Loggerhead Turtles regularly use Roebuck Bay as a seasonal feeding and transit area on migration (Bennelongia, 2009). Interestingly, the Turtle Recovery Plan (CoA 2016) only identified Gnarloo and the Ningaloo coast as nesting locations.

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 (BHPB, 2005). Within the Ningaloo Marine Park, loggerhead turtles tend to nest in higher proportions in the southern areas of the reserves (CALM, 2005a).

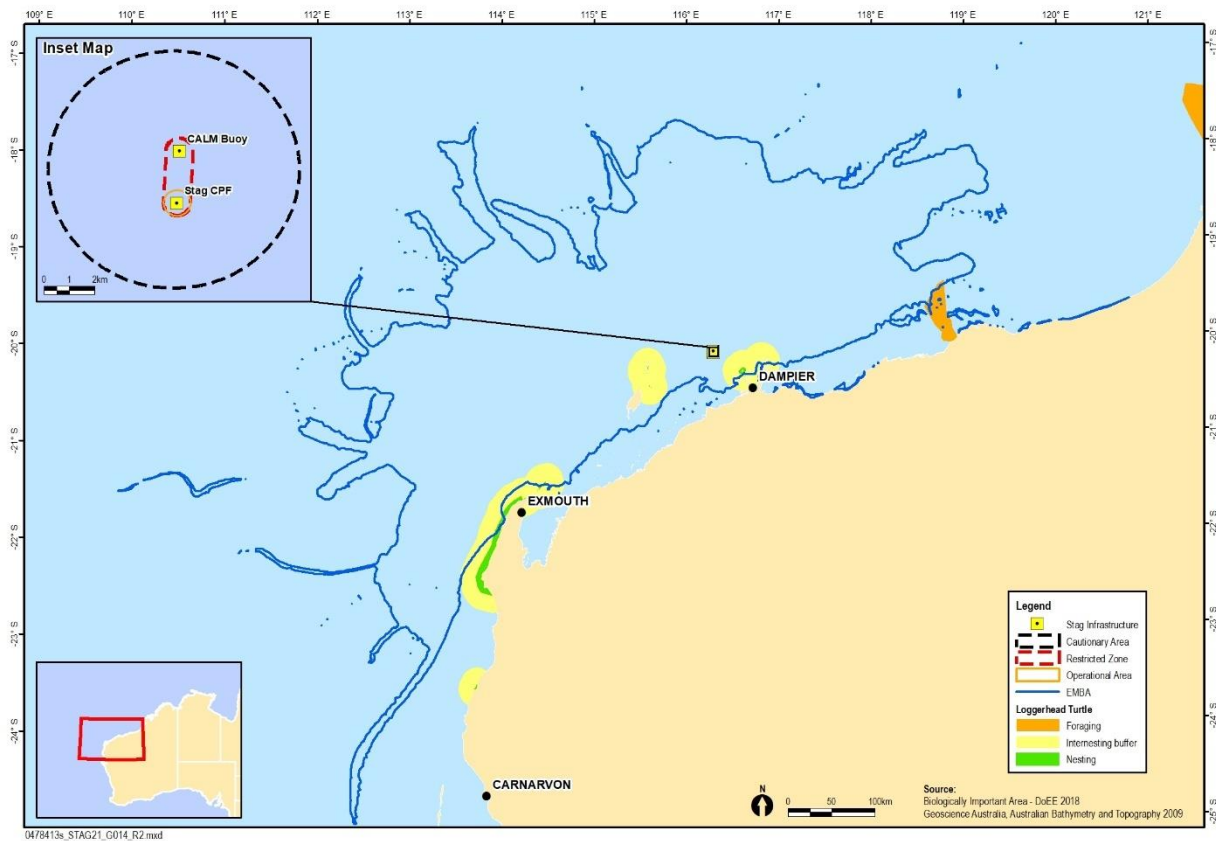


Figure 3-9: Biologically Important Areas for the Loggerhead Turtle

Green turtles

Green turtles are the most widespread and abundant turtle species in WA waters, nesting from the Ningaloo coast to the Lacepede Islands and out to Scott and Ashmore Reefs (Prince, 1994; Limpus, 2008a; DSEWPaC, 2012f), with three distinct breeding stocks: the NWS stock, the Scott Reef stock and the Ashmore Stock (Dethmers, et al., 2006; Limpus, 2008a). The NWS 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, North-West Cape and Browse Island (Prince, 1994; Limpus, 2008a). Numerous other small rookeries also occur in WA. 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). Low numbers of green turtles have also been observed nesting on Airlie Island and Varanus Island (Pendoley Environmental, 2011). The closest known breeding/nesting grounds to the Stag Facility are Barrow, Montebello and Varanus Islands.

Green turtle nesting abundance fluctuates significantly from year to year, depending on environmental variables and food availability at feeding sites. In an aerial survey of Pilbara waters in April 2000, Prince (2001) estimated a mixed species population of 57,000 turtles of which most were green turtles. Several BIAs (aggregation, basking, foraging, internesting, internesting buffer, mating, migration corridor and nesting) have been identified that overlap the EMBA (Table 3-4 and Figure 3-10). No BIAs overlap the Operational Area.

Chevron (2005, 2008) reported that green turtles nest predominantly on the sandy west coast beaches of Barrow Island. In addition to nesting, green turtles mate and forage close to Barrow Island during the summer breeding season. Aggregations of green turtles have been reported from the shallow areas along the west coast of Barrow Island, with turtles foraging on and around nearshore reefs. Green turtles have also been

observed to the south and south-east of Barrow Island, around dugong Reef and over the Barrow Shoals (Chevron, 2005, 2008). The Recovery Plan for Marine Turtles in Australia (CoA 2017a) identifies Barrow Island and all waters within a 20km radius of the island as critical habitat to the survival of the green turtles.

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 and hatchlings emerging through summer and early autumn, although nesting does occur year-round (Chevron, 2005, 2008; Pendoley, 2005). The Turtle Recovery Plan (CoA 2017) identifies the nesting period the NWS stock as November to March with peaks in January and February.

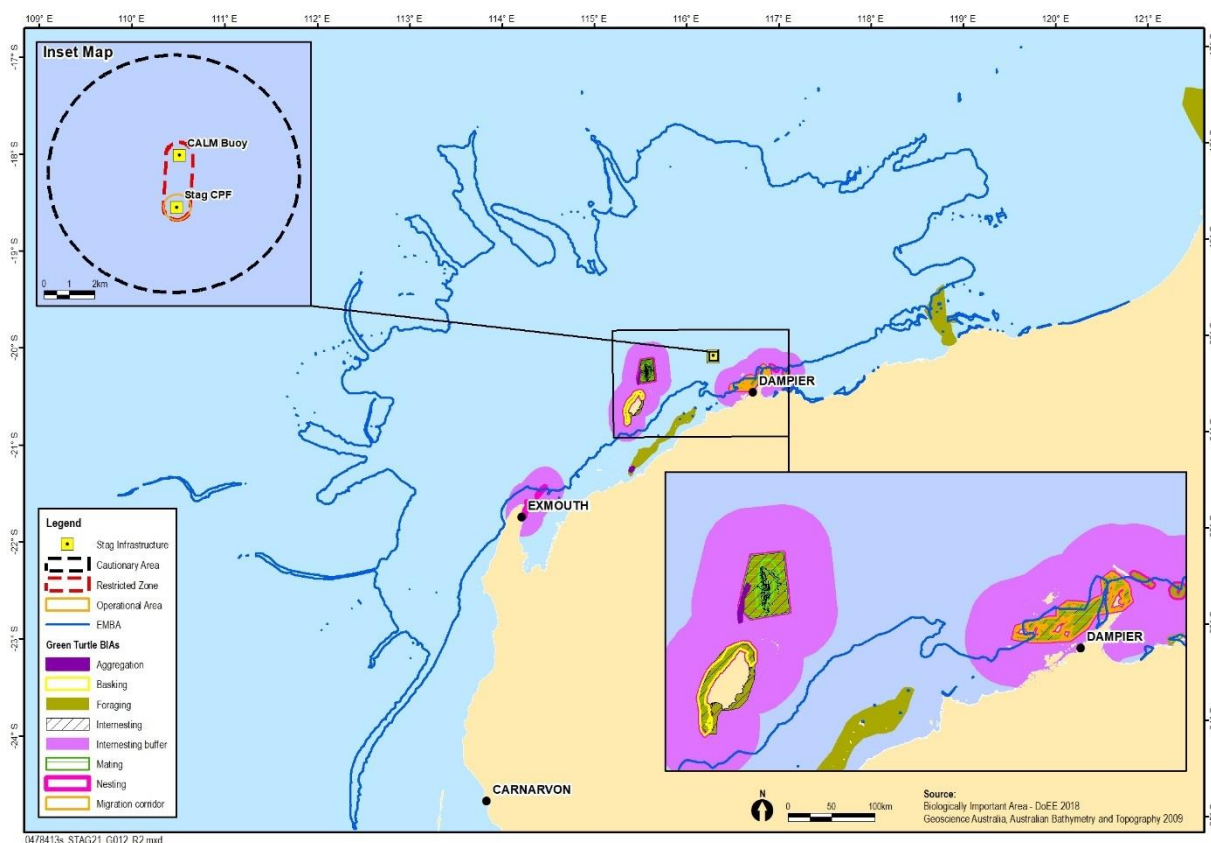


Figure 3-10: Biologically Important Areas for the Green Turtle

Leatherback turtles

The leatherback turtle (*Dermochelys coriacea*) is a pelagic feeder, found in tropical, subtropical and temperate waters, but is uncommon throughout their Australian range (DSEWPaC, 2012f). No major leatherback turtle nesting areas have been recorded in Australia, although scattered isolated nesting (1–3 nests per annum) occurs in southern Queensland and Northern Territory (Limpus and McLachlan, 1994). At least two nesting attempts have been reported in WA (Limpus, 2009b). There are no listed BIASs that overlap the EMBA or operational area.

Leatherback turtles feed mainly on pelagic, soft-bodied marine organisms such as jellyfish, which occur in greatest concentrations in areas of upwelling or convergence (DSEWPaC, 2012f). The leatherback turtle is a highly pelagic species with adults only going ashore to breed. Individuals may be encountered within the Stag Operational Area but are unlikely to be encountered in significant numbers given that no confirmed breeding

occurs in WA and that leatherbacks in WA are most commonly sighted feeding in the southwest region (DSEWPaC, 2011b).

Hawksbill Turtles

WA supports one genetic stock of hawksbill turtles with nesting centred on the Dampier Archipelago. The WA stock is the largest in the Indian Ocean and is one of the largest hawksbill turtle populations remaining in the world (Limpus, 2009a). Several BIAs (foraging, internesting, internesting buffer, mating, migration corridor and nesting) have been identified that overlap the EMBA (Table 3-4 and Figure 3-11). No BIAs overlap the Operational Area

In WA, their nesting range is relatively small and extends from the Muiron Islands to the Dampier Archipelago, a distance of ~ 400 km. The most significant breeding areas are within the Dampier Archipelago, Montebello Islands, Lowendal Islands and Barrow Island supporting hundreds of nesting females annually (Pendoley, 2005; Limpus, 2009a). Rosemary Island within the Dampier Archipelago may support in the order of 1,000 nesting females annually and may be the largest remaining hawksbill nesting population globally.

Low density nesting is also known from Airlie Island, Muiron Islands and Cape Range (Limpus, 2009a). The closest known breeding/ nesting grounds to the Stag Facility are Rosemary Island (Dampier Archipelago), Montebello and Lowendal Islands.

On Varanus Island, hawksbills tend to nest in greater numbers on the eastern beaches (Pipeline Beach, Harriet Beach, and Andersons Beach). Between 1986 and 1999, approximately 350 individual hawksbills were tagged on Varanus Island (Apache, 1999). Maxwell (2003) used these data to predict that up to 260 hawksbills may visit Varanus Island each year, although a maximum number of nests at 180 per year have been recorded. The most recent turtle tagging program on Varanus Island in the 2010 breeding season reported 70 turtles coming ashore. Of these 70 turtles, 27 were hawksbills and eight were newly tagged. Pipeline Beach was the most frequented beach on Varanus Island (Pendoley Environmental, 2011).

Hawksbill turtles also nest along the North-West Cape/ Ningaloo coast, Muiron Islands, and the Montebello Islands. Rosemary Island is probably the largest hawksbill rookery, with numbers at the other sites comparable to those found on Varanus Island. This suggests a total annual hawksbill turtle stock in WA of approximately 1,000–1,500 animals. With an interbreeding period of 2–4 years, 2,000–4,500 hawksbill turtles probably nest in WA waters (Morris, 2004).

On Barrow Island, nesting occurs at low densities on the beaches of both the west and east coasts, however, Barrow Island is not considered a regionally important nesting site for hawksbill turtles (Chevron, 2008).

Although hawksbills are known to nest year-round, the Turtle Recovery Plan (CoA 2017) indicates that peak nesting periods are October to February. The location of feeding areas and biology of the species within this region is largely undocumented (Limpus, 2009a) but it is thought that individuals may migrate up to 2,400 km between their nesting and foraging grounds (DSEWPaC, 2012f).

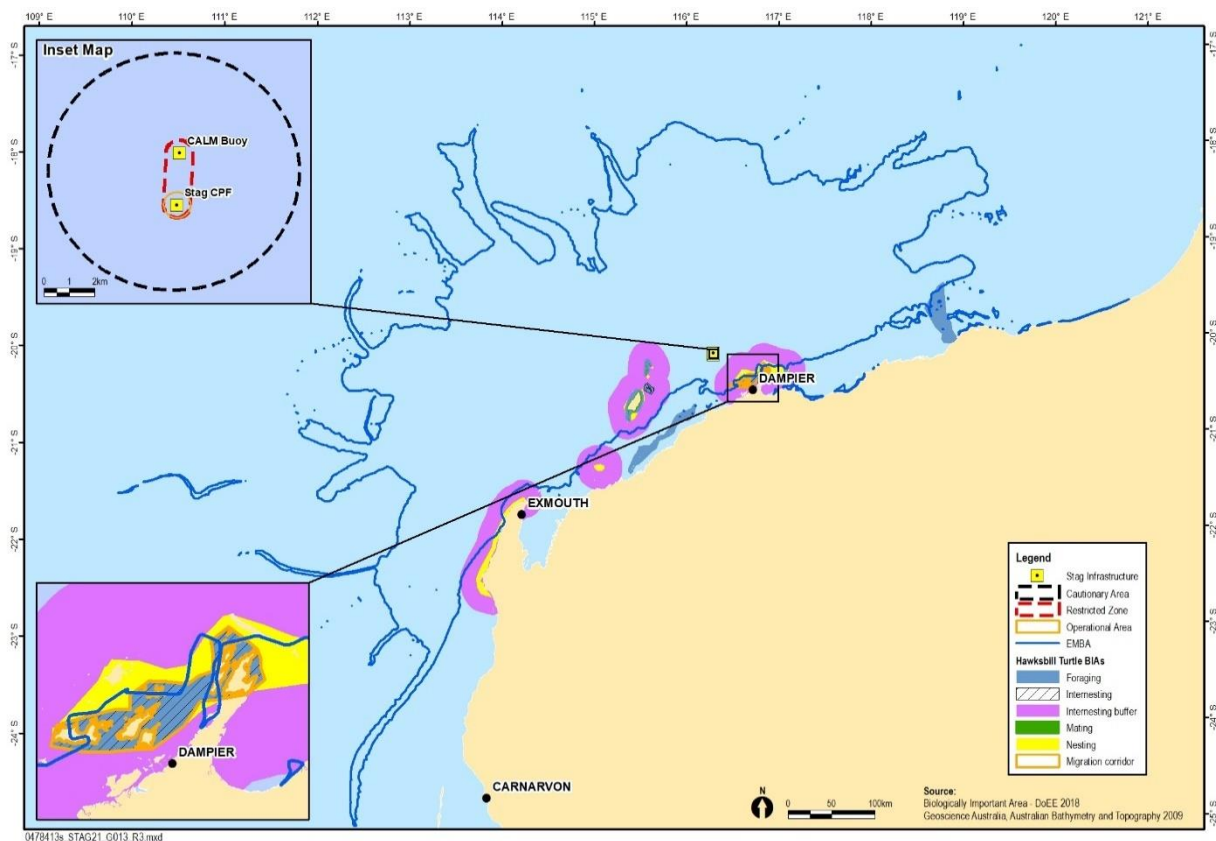


Figure 3-11: Biologically Important Areas for the Hawksbill Turtle

Flatback Turtles

The flatback turtle is endemic to the northern Australian continental shelf and all nesting occurs in Australia with approximately one third of the total breeding for the species occurring in WA. WA supports two genetic stocks of flatback turtles: the Pilbara Stock characterised by summer nesting and Southwest Kimberley stock which breeds year-round with a winter peak (Limpus 2007; CoA 2016). Several BIAs (aggregation, foraging, internesting, internesting buffer, mating, migration corridor and nesting) have been identified that overlap the EMBA (Table 3-4 and Figure 3-12). An internesting buffer BIAs overlap the Operational Area

Nesting locations for both stocks are outlined in Table 3-6. The closest known breeding/ nesting grounds to the Stag Facility are Dampier Archipelago, Barrow, Montebello, Varanus and Lowendal Islands. The Turtle Recovery Plan (CoA 2017a) has proposed a 60 km inter-nesting buffer for the flatback turtle which overlaps the Stag Operational Area.

Pendoley (2005) focussed on documenting the activity of flatback turtles on Barrow Island, Lowendal Islands and Montebello Islands and identified that the east coast of Barrow Island supports an important rookery for flatbacks. A turtle tagging program over three nesting seasons from 2005 to 2008 tagged a total of 2,979 flatbacks at Barrow Island and 1,060 flatbacks at Mundabullangana (Chevron 2008). Tagging shows that flatback turtle nesting on Barrow Island is focused on central east coast beaches, which include Mushroom, Bivalve, Terminal, and Yacht Club North and South beaches. Peak of nesting occurs during the December–January periods (Pendoley, 2005; Chevron, 2008).

Post-nesting females commonly sleep on the intertidal platform off the east coast rookery of Barrow Island at low tide. 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. There have been occasional records of nesting by flatback turtles on the Jurabi Coast and Muiron Islands (CALM, 2005a).

From long-term tagging studies on Varanus Island and Pendoley’s observations, the nesting season for flatback turtles peak 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 (Pendoley Environmental, 2011).

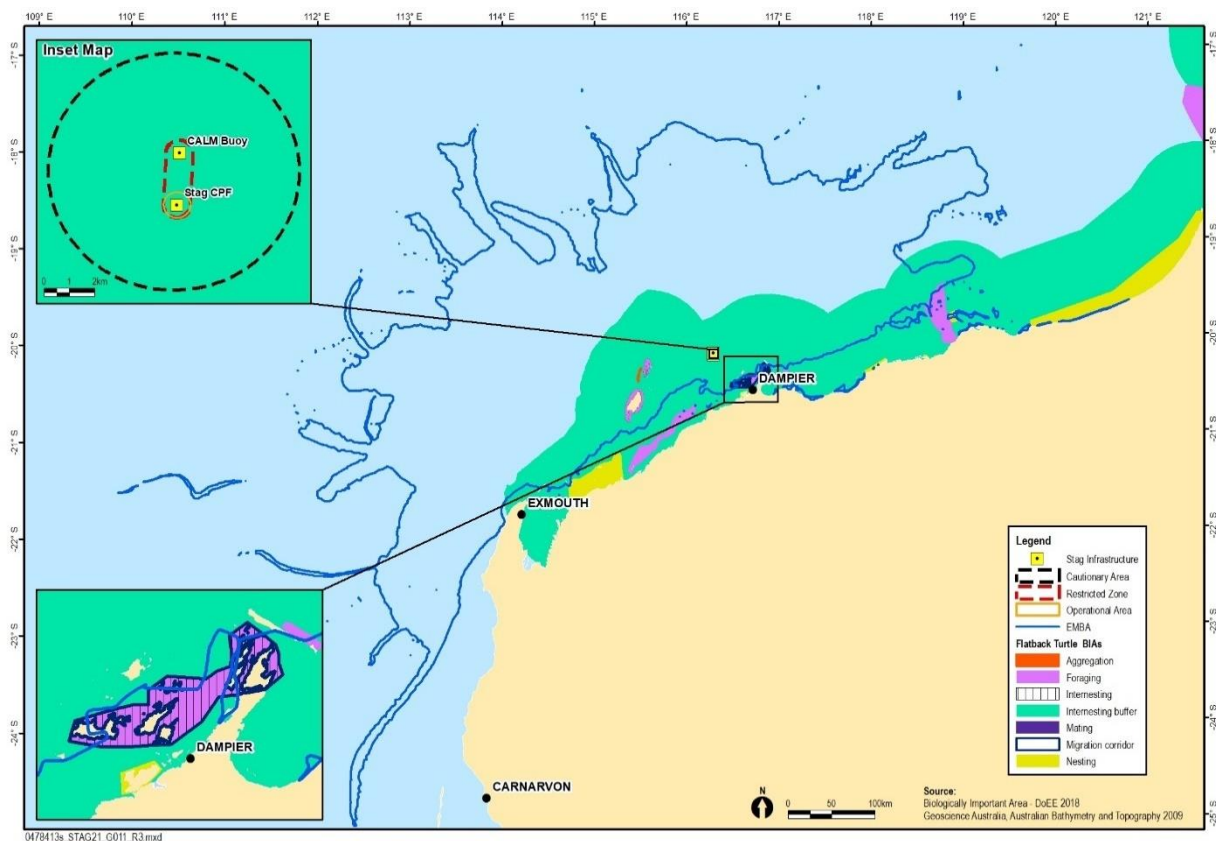


Figure 3-12: Biologically Important Areas for the Flatback Turtle

Saltwater Crocodile

The salt-water crocodile (*Crocodylus porosus*) is a migratory species under the EPBC Act and is also listed as a specially protected species (other specially protected fauna) under the BC Act. In WA, the species is found in most major river systems of the Kimberley, including the Ord, Patrick, Forrest, Durack, King, Pentecost, Prince Regent, Lawley, Mitchell, Hunter, Roe and Glenelg Rivers. The largest populations occur in the rivers draining into the Cambridge Gulf and the Prince Regent River and Roe River systems. There have also been isolated records in rivers of the Pilbara region, around Derby near Broome and as far south as Carnarvon on the mid-west coast (DEC 2009a).

Sea snakes

A search of EPBC Act protected matters revealed 18 listed seasnakes that may occur within the EMBA (Appendix C). Of these species, two are considered threatened (critically endangered), the short-nosed sea snake (*Aipysurus apraefrontalis*) and the leaf-scaled sea snake (*Aipysurus foliosquama*). There are no listed BIAs for any sea snakes.

Storr et al. (1986) estimate nine genera and 22 species of sea snakes and kraits occur in WA waters. However, little is known of the distribution of individual species, population sizes or aspects of their ecology. Sea snakes are essentially tropical in distribution, and habitats reflect influences of factors such as water depth, nature of seabed, turbidity and season (Heatwole and Cogger, 1993). Sea snakes and kraits are widespread throughout waters of the NWS 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.

The short-nosed sea snake is listed as critically endangered under the EPBC Act. However, most specimens have been collected from Ashmore and Hibernia Reefs (Minton and Heatwole, 1975) which are not within the EMBA. This species is believed to show strong site fidelity to shallow coral reef habitats in <10 m of water.

Table 3-6: Marine Turtle Activity

Species	Hawksbill turtle	Flatback turtle		Green turtle	Loggerhead turtle	Leatherback turtle
Stock	WA Stock	Pilbara Stock	Southwest Kimberley	NWS Stock	WA Stock	Australia
Nesting period	Year Round	October -March	Year Round	November -March	November -Mar	December -Jan
Nesting peak	Oct-Feb	Nov-Jan	Dec-Jan	Jan - Feb	January	-
Internesting buffer	20 km	60 km	60 km	20 km	20 km	-
Important rookeries	Nesting location: Dampier Archipelago (including Rosemary Island, Delambre Island), Montebello Islands (including Ah Chong Island, South East Island and Trimouille Island), Lowendal Islands (including Varanus Island, Beacon Island, Bridled Island), Sholl Island	Nesting location: Montebello Islands, Mundabullangana Beach, Barrow Island, Thevenard Island, Cemetery Beach, Dampier Archipelago (including Delambre Island and Huay Island), coastal islands from Cape Preston to Locker Island	Nesting location: Eighty Mile Beach, Eco Beach, Lacepede Islands	Nesting locations: Adele Island, Maret Island, Cassini Island, Lacepede Islands, Barrow Island, Montebello Islands (all with sandy beaches), Serrurier Island, Dampier Archipelago, Thevenard Island, Northwest Cape, Ningaloo coast.	Nesting location: South Murion Island, North-West Cape, Gnarloo Bay.	There are no Confirmed leatherback turtle nesting sites in Western Australia. Scattered nesting occurs in southern Queensland and Northern Territory such as Coburg Peninsula (outside operational area)
Generalised diet	Omnivorous, feeding on algae, sponges, soft corals and other soft-bodied invertebrates	Primarily carnivorous, feeding on soft-bodied invertebrates. Juveniles eat gastropod molluscs, squid, siphonophores. Limited data indicate that cuttlefish, hydroids, soft corals, crinoids, molluscs and jellyfish are also eaten (SPRAT, DoEE website and DoEE 2016).		Primarily herbivorous, foraging on algae, seagrass and mangroves. In their pelagic juvenile stage, they feed on algae, pelagic crustaceans and molluscs	Carnivorous, feeding predominantly on benthic invertebrates in habitats ranging from near shore to 55 m. During their post-hatchling stage, they feed on algae, pelagic crustaceans and molluscs	Oceanic and Therefore, remain planktivorous throughout their life, feeding on jellyfish and large planktonic ascidians (e.g. sea squirts) in the water column

3.6.5 Birds

Marine waters and coastal habitat in the EMBA contain 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 and are either primarily terrestrial or they may forage in coastal waters. Resident coastal and terrestrial species include species such as the osprey (*Pandion haliaetus*) (DEWHA 2008).

Shorebirds, including waders and wetland birds, inhabit the intertidal zone and adjacent areas. Some shorebird species are resident while others are migratory and include species that utilise the East Asian–Australasian Flyway. Shorebirds that regularly migrate through the area include the Scolopacidae (curlews, sandpipers etc.) and Charadriidae (plovers and lapwings) families.

Seabirds include those species whose primary habitat and food source is derived from pelagic waters and 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, petrels, shearwaters, tropicbirds, frigatebirds, boobies and albatrosses (DEWHA 2008).

A search of the EPBC protected matters database in December 2021, revealed 74 listed bird species, 18 of which are classified as threatened and may occur within the EMBA. Further information on these species is provided below. The protected matters search also identified numerous migratory marine bird species and migratory wetland bird species that may occur within the EMBA (Appendix C). Of these there have been eight birds identified that have BIAs within the EMBA (Table 3-4) Figure 3-13 shows the location of the BIAs within the EMBA and operational area.

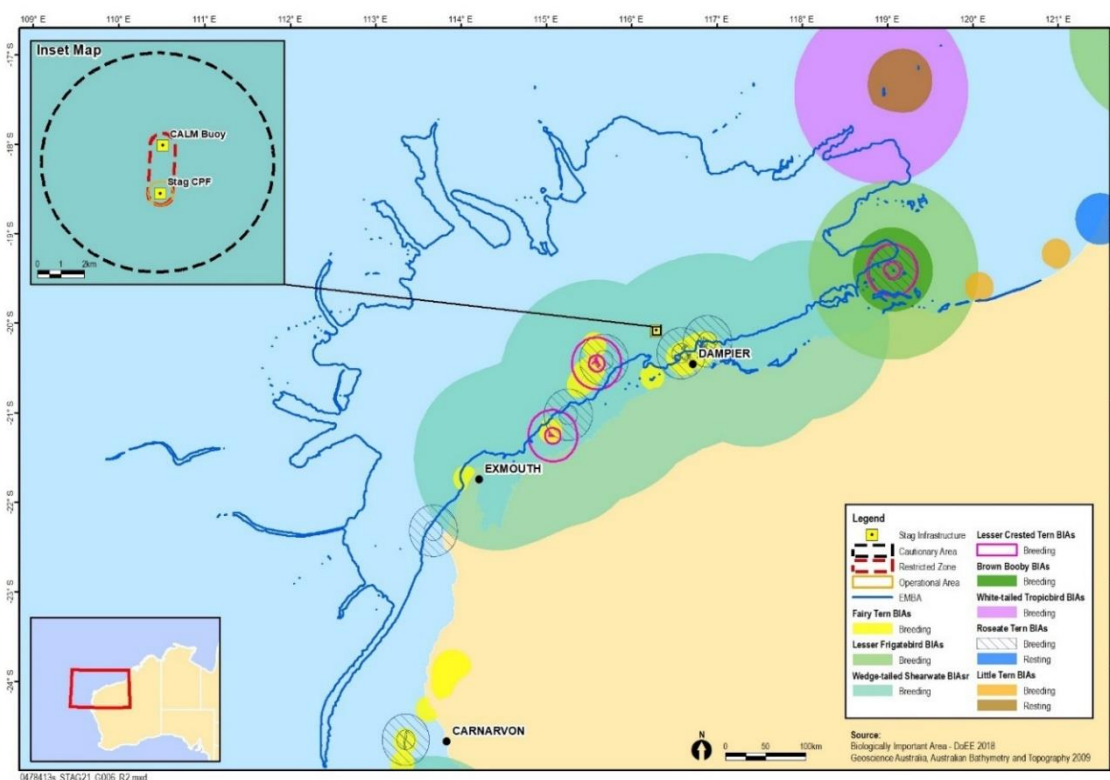


Figure 3-13: Biologically Important Areas for Seabirds within the EMBA

3.6.5.1 Shorebirds

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).

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).

Red knot

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. Non-breeding season is spent on tidal mudflats or sandflats where they feed on intertidal invertebrates, especially shellfish (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 and Lesser sand plover

The greater sand plover (Mongolian) and lesser sand plover are cogeners 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, while the lesser sand plover spends the non-breeding season along coasts from Taiwan to Australasia (Banford et al. 2008). Non-breeding birds occur along all Australian coasts, especially in the north for the greater sand plover (DoE 2014b) and in the east for the lesser sand plover (DoE 2014b).

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

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 (DoE 2014b).

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).

1.3.1.2 Seabirds

Southern giant petrel

The southern giant petrel is listed as endangered and migratory under the EPBC Act and is a highly migratory bird which have a large natural range. This species occurs from Antarctic to subtropical waters, so while this species may over-fly the Stag Facility from time-to-time in transit or for foraging, they do not use the area for breeding (August and September) or resting as there are no critical nesting (eggs hatch between October and November) or feeding areas within the EMBA.

Australian fairy tern

Within Australia, the fairy tern occurs along the coasts of Victoria, Tasmania, South Australia and Western Australia, occurring as far north as the Dampier Archipelago near Karratha. The fairy tern nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. The subspecies has been found in embayments of a variety of habitats including offshore, estuarine or lacustrine (lake) islands, wetlands and mainland coastline (Higgins and Davies, 1996; Lindsey, 1986a). The bird roosts on beaches at night (Higgins and Davies, 1996). The fairy tern predate on small bait-sized fish (Van de Kam et al., 2004) by diving in shallow waters.

A breeding BIA has been identified that overlaps the EMBA Figure 3-13.

Many of the islands and rocks in the Dampier Archipelago/Cape Preston region are known breeding grounds for a variety of seabirds, including wedge-tailed shearwaters (*Puffinus pacificus*), caspian terns (*Sterna caspia*), bridled terns (*Sterna anaethetus*) and roseate terns (*Sterna dougallii*). The small islands and islets such as Goodwyn Island, Keast Island and Nelson Rocks provide important, undisturbed nesting and refuge sites (CALM, 2005b).

One-third of the 144 bird species recorded on North-West Cape are seabirds, shorebirds and waders (resident and migratory). There are approximately 33 species of seabirds found in the Ningaloo Marine Park with the main rookeries at Mangrove Bay, Mangrove Point, Point Maud, the Mildura wreck site and Fraser Island. In addition, the Muiron and Sunday islands provide isolated rookeries (CALM, 2005a).

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 does not identify any BIAs for this species in the EMBA.

Australian painted snipe

The Australian Painted Snipe is a wading bird that has been recorded at wetlands in all states of Australia (Barrett et al., 2003; Blakers et al., 1984; Hall 1910b). It is most common in eastern Australia but has been recorded less frequently in Western Australia (Barrett et al., 2003; Blakers et al., 1984; Marchant and Higgins, 1993; Rogers et al., 2005).

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 (Marchant and Higgins 1993). Within the EMBA, the most likely habitat for this species, and therefore likelihood of occurrence, is the wetlands of Eighty Mile Beach and Roebuck Bay (Bennelongia, 2009; Hale and Butcher, 2009).

Soft-plumaged petrel

The soft-plumaged petrel is listed as vulnerable under the EPBC Act. As a mainly sub-Antarctic species they are usually seen in cooler seas but have been noted off southeast Australia between 9.8–21°C (Reid et al., 2002) and are widespread during winter and summer. As with the southern giant petrel, this species may occur foraging or flying over Operational Area waters, but there are no critical nesting or feeding areas known within 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 (DoEE, 2020). Abbott's Booby is a marine species. It spends much of its time at sea but needs to come ashore to breed. It is thought that they may travel up to 400 km to feeding grounds when they are breeding (Becking 1976). 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 does not identify any BIAs for this species in the EMBA.

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).

A breeding BIA has been identified that overlaps the EMBA Figure 3-13.

Albatross

A protected matters search of the waters in the area of interest identified four albatross species (Campbell, shy, black-browed and white-capped) that may occur in the area. All of the identified species predominantly occur in subantarctic to subtropical waters and breed on islands in the southern oceans (DoE 2014b).

The National Conservation Values Atlas (DAWE, 2022) and the National Recovery Plan for Albatrosses and Giant Petrels 2022 (DCCEEW 2022) do not identify any BIA for albatrosses within the EMBA.

Table 3-7: Seabird Biologically Important Areas that Overlap the EMBA

Species	BIA Location	Peak times
Australian Fairy Tern	Breeding: Pilbara coast incl. Dampier Archipelago and Barrow Island.	July to late September
Lesser Frigatebird	Breeding and 100 km foraging buffer: Bedout Island	March to September
White-tailed tropicbird	Breeding and foraging with 100 km buffer: Rowley Shoals	May to Oct
Wedge tailed shearwater	Foraging and breeding with 100 km buffer along Pilbara coastline and islands including: Dampier Archipelago, Passage Island, Montebello Islands, Lowendal Islands off Barrow Island and islands off Onslow	Mid Aug to April
Little tern	Breeding: Pilbara coastline along Eighty Mile Beach Resting: Rowley Shoals	June- July and Oct

Roseate tern	Breeding: Islands off Pilbara coast including Dampier Archipelago, Lowendal Is, Frazer I, Bedout Island and around Montebello Islands Resting: North Eighty Mile Beach	Mid-March to July
Brown booby	Breeding and foraging: Bedout Island	Feb to Oct, but mainly Autumn
Lesser Crested Tern	Breeding: islands off north and west Kimberley also Bedout Island, Lowendal Islands, Thevenard Island. This species is listed marine but is not identified as threatened or migratory.	March to June

Eighty Mile Beach is particularly significant for migrating shorebird species and is considered one of the most significant sites in Australia for migratory shorebirds (Hale and Butcher, 2009) as well as supporting a high diversity and abundance of wetland birds. Although many birds may then move further on their journey, many others remain at the site for the non-breeding period. Eighty Mile Beach is considered the most significant site (in terms of numbers of birds) in the South-East Asian Flyway for nine international migratory species; Bar-tailed Godwit; Terek Sandpiper, Grey-tailed Tattler, Great Knot, Red Knot, Curlew Sandpiper; Greater Sand Plover, Oriental Plover and Oriental Pratincole (Hale and Butcher, 2009). Further information on Eighty Mile Beach Ramsar Site is in Section 3.7.4.

Table 3-8: Summary of Environmental Sensitivities for Marine Fauna within the Operational Area and EMBA

Marine fauna		Operational Area	EMBA
Plankton	Plankton	Yes - Phytoplankton and zooplankton present within the operational area. Higher concentrations occurring during the winter months (June to August) during the activity and lower in summer months (December to March).	Yes - Phytoplankton and zooplankton present within the EMBA. Higher concentrations occurring during the winter months (June to August) and lower in summer months (December to March).
	Invertebrates		
	Benthic	Yes – primarily infaunal species	Yes – will contain both mobile and sessile epifauna and infaunal
	Pelagic	Yes – includes squid, salps and jellyfish	Yes – includes squid, salps and jellyfish
Fish	Demersal and/or pelagic fish	Yes – Both demersal and pelagic fish species present. Stag Facility infrastructure likely attracts a greater diversity and abundance of fishes than would naturally occur on the soft sediments within the Operational Area. Offshore soft sediment habitat generally supports a lower diversity than other benthic habitats that provide greater structure and feeding opportunities (e.g. rocky and coral reef, seagrass and macroalgae, mangroves)	Yes - Diverse assemblage of demersal and pelagic species distributed throughout the EMBA. Three KEFs within the EMBA likely to support high fish diversity and abundance: Glomar Shoals, Continental Slope Demersal Fish Communities and Mermaid Reef. Shallow water primary producer habitats close to mainland shorelines and offshore islands within the EMBA (e.g. seagrass, macroalgae, hard coral and mangroves) support high abundance and diversity of fishes.
	Grey nurse shark	Yes - Could occur as the Operational Area is within depth range (<200 m) but presence is unlikely since there is lack of natural structured habitat in the Operational Area. Operational area is flat bare sand.	Yes – Likely occurs as residents in some areas where habitat favorable (e.g. near inshore rocky and coral reefs between depths of 10–45 m)
	White shark	Yes - Could transit through the Operational Area although unlikely to be present for extended durations since white sharks are highly mobile species that follow seasonal feeding opportunities (e.g. whale migrations, pinniped colonies) in primarily coastal waters.	Yes – Likely to transit through and feed within the EMBA where feeding opportunities present (e.g. whale migrations, pinniped colonies) in primarily coastal waters.
	Whale shark	Yes - Could transit through the operational area, particularly around the time of aggregation at Ningaloo Reef (late March to June)	Yes - Will transit through and aggregate within the EMBA. Main period of the whale shark aggregation off Ningaloo Reef is late March to June, with the largest numbers generally recorded in April
	Sawfish	No - Given their preference for shallower estuarine and coastal waters, they are unlikely to be encountered within the Operational Area.	Yes - Could occur in estuaries and nearby coastal mangrove areas and shallow waters particularly the northern mainland coastline of the EMBA.
	Other shark/ ray species	Yes - Could transit through the operational area.	Yes - Could transit through the EMBA.

Marine mammals	Pygmy Blue whale	Yes - Northern migration in April-August and southern migration Oct - Dec. May transit through the Operational Area although migration routes believed to occur in deeper waters	Yes - EMBA overlaps migration routes in water depths of 500–1,000 m.
	Humpback whale	Yes - Peak northern migration around July. Peak southern migration around Aug/September. Greater likelihood of individuals during northern as opposed to southern migration May transit through the Operational Area as within depth range of migration routes	Yes - EMBA overlaps known migration routes and presence is reliable during migration season.
	Dugongs	No – Given their preference for shallower waters near seagrass meadows dugongs are unlikely to be encountered within the Operational Area	Yes-Dugongs occur within the EMBA associated with seagrass meadow habitat in coastal waters of the mainland or offshore islands.
	Cetacean – various whales and dolphins	Yes – A number of whale and dolphin species may transit the Operational Area. Whales are likely to be transiting during migrations while dolphins may be part of resident coastal populations.	Yes - Could occur transiting through the EMBA but not expected in large numbers as they are either infrequently recorded in Australian waters or primarily migrating through deeper waters. Dolphins may be feeding/ aggregating in shallow coastal waters of the mainland or offshore islands.
Marine Reptiles	Marine Turtles	Yes - May transit through the Operational Area although unlikely to be encountered in large numbers (with the exception of the flatback turtle, activity location is outside inter-nesting areas, ~ 35 km from nearest nesting beach at Dampier Archipelago)	Yes - For all species except Leatherback turtle nesting beaches and breeding/feeding areas occur within the EMBA either on the mainland coastline or offshore islands
	Sea snakes and kraits	No – Not likely to be encountered given the water depth and distance from shore	Yes - May be encountered in shallow waters habitats of EMBA where feeding habitat is found.
Avifauna	Wetland/ Shorebirds	No – Given the distance offshore, shorebirds or wetland birds are unlikely to be present within the Operational Area	Yes – May occur within the EMBA along shorelines and wetlands feeding or nesting. Areas of particular importance are the Ramsar wetland sites at Eighty-mile Beach. Shorebirds also use Montebello/Lowendal/Barrow Islands.
	Seabirds	Yes – May utilise the waters of the Operational Area for feeding and may be attracted to the Stag Facility by increased abundance of pelagic fish or as resting habitat.	Yes – May occur within the EMBA, either feeding, migrating or utilising coastal islands or mainland shores as nesting habitat.

3.7 Protected Areas

A search of the EPBC Act Protected Matters Database in December 2021 listed a number of areas that are considered matters of National Environmental Significance (NES) as well as other matters protected under the Act. Those with marine elements or potentially contacted in the event of a crude spill are outlined in

Table 3-9 and discussed in more detail in the following section; terrestrial protected areas or elements that are already included within existing protected areas (such as within a marine park) are not singled out. Section 3.8 addresses other sensitivities such as State Reserves.

Table 3-9: Summary of Protected Areas (marine) within the EMBA

Area type	Title
World Heritage Area	The Ningaloo Coast
National Heritage Properties	The Ningaloo Coast
	Dampier Archipelago (including Burrup Peninsula)
Commonwealth Heritage Place	Mermaid Reef - Rowley Shoals
	Ningaloo Marine Area - Commonwealth Waters
Wetland of International Importance (Ramsar)	Eighty Mile Beach
Wetlands of National Significance	Eighty Mile Beach System
	Mermaid Reef
Australian Marine Parks (AMP)	Argo-Rowley Terrace AMP
	Dampier AMP
	Eighty Mile Beach AMP
	Gascoyne AMP
	Mermaid Reef AMP
	Montebello AMP
	Ningaloo AMP
Key Ecological Features (KEF)	Ancient coastline at 125 m depth contour
	Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula
	Commonwealth Waters adjacent to Ningaloo Reef
	Continental Slope Demersal Fish Communities
	Exmouth Plateau
	Glomar Shoals
	Mermaid Reef and Commonwealth Waters
Threatened Ecological Communities	None Identified
State Marine Reserves	Barrow Island Marine Park
	Barrow Island Marine Management Area
	Eighty Mile Beach Marine Park
	Montebello Islands Marine Park
	Muiron Island Marine Management Area
	Ningaloo Marine Park
	Rowley Shoals Marine Park

3.7.1 World Heritage Properties

One World Heritage Property, The Ningaloo Coast, overlaps the EMBA. The Ningaloo Coast was granted World Heritage Status in June 2011. The World Heritage Area (WHA) encompasses an area of 7,050 km², including State and Commonwealth waters, extending 25 km offshore. The WHA is primarily comprised of the Ningaloo Marine Park (State waters and the adjoining Commonwealth waters section). Also included are the Muiron Islands MMA and Nature Reserve, the Bundegi and Jurabi coastal parks and the Cape Range National Park, plus crown, leasehold and freehold land. The Area is managed under the Ningaloo Coast Strategic Management Framework agreed by State and Commonwealth governments. Both state and commonwealth marine parks and reserves are managed on a day to day basis by the Department of Biodiversity, Conservation and Attractions (DBCA) on behalf of the respective authorities.

The Marine Parks and Reserves protect most of the Ningaloo Reefs, which stretch 290 km from North-West Cape south to Red Bluff comprising the 200 km long Ningaloo Barrier Reef enclosing a lagoon that varies in width from 200 m to 7 km, and extensive fringing reefs to the north and south of the barrier (Commonwealth of Australia 2010). Gaps that regularly intercept the main reef line provide channels for water exchange with deeper, cooler waters (CALM 2005a). The Ningaloo Coast WHA forms the backbone of the nature-based tourism industry in the Exmouth region.

Key features that supported the WHA listing of the Ningaloo Coast (UNESCO 2013; Commonwealth of Australia 2010) include:

- Landscapes and seascapes of the property are comprised of mostly intact and large-scale marine, coastal and terrestrial environments;
- Over 300 species of coral;
- Over 650 species of mollusc (clams, oysters, octopus, cuttlefish, snails);
- More than 1,000 species of fish including over 700 species of reef fish;
- 600 species of crustacean;
- 155 species of sponges;
- A high diversity of echinoderms (sea stars, sea urchins, sea cucumbers) including 25 new species; and
- Habitat for iconic species, including whales, dugong, whale sharks and turtles.

The Parks and Reserves included in the WHA are also important habitat for migratory seabirds and waders, including migratory wading birds listed in the CAMBA and JAMBA agreements (CALM 2005a).

3.7.2 National Heritage Properties

There are two National Heritage Properties that overlap with the EMBA:

- Ningaloo Coast (see Section 3.7.1); and
- Dampier Archipelago (including Burrup Peninsula)

Dampier Archipelago

Dampier Archipelago was included on the National Heritage List in July 2007. Approximately 36,860 ha at Dampier were listed; comprising parts of the Burrup Peninsula and surrounding islands (Figure 3-14). Reefs, shoals and islands of the Dampier Archipelago provide important habitat for many native plant and animals. The Burrup Peninsula has been nominated for UNESCO World Heritage listing (in June 2018) and includes Aboriginal rock art where engravings provide an outstanding visual record of Australia's history. The area

contains one of the densest concentrations of rock engravings in Australia with some sites containing thousands or tens of thousands of images. There is a high density of stone arrangements on the Burrup Peninsula including standing stones, stone pits and more complex circular stone arrangements (Commonwealth of Australia, 2007).

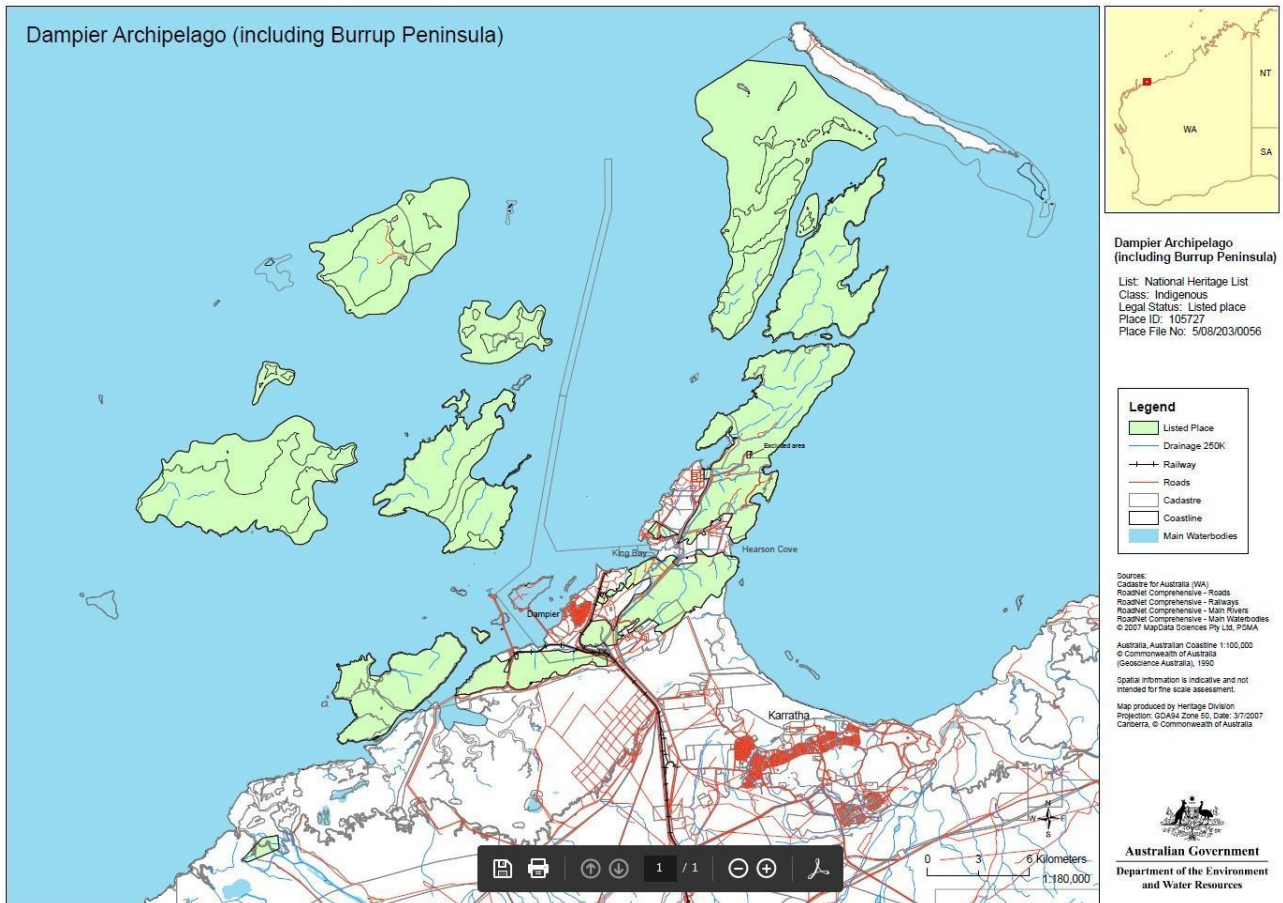


Figure 3-14: National Heritage Features of the Dampier Archipelago

3.7.3 Commonwealth Heritage Places

Two Commonwealth Natural Heritage Places were identified from the EPBC Act protected matters search of the EMBA area:

- Mermaid Reef – Rowley Shoals; and
- Ningaloo Marine Area – Commonwealth Waters.

Ningaloo Reef Area has been described in Section 3.7.1(‘The Ningaloo Coast’) and Mermaid Reef has been described in Section 3.7.6.5 (‘Mermaid Reef AMP’).

3.7.4 Ramsar Wetland Sites

A ‘declared Ramsar wetland’ is a wetland area of international importance that has been designated under Article 2 of the Ramsar Convention or declared by the Minister to be a declared Ramsar wetland under Section 16 of the EPBC Act. There is one declared Ramsar site within the EMBA: Eighty- mile Beach. Roebuck Bay Ramsar site is not overlapped by the EMBA and will not be affected by an unplanned hydrocarbon spill, and so is not discussed further.

Eighty Mile Beach

The Eighty Mile Beach Ramsar site comprises a 220km beach between Port Hedland and Broome with extensive intertidal mudflats and Mandora Salt Marsh, located 40 km east (Hale and Butcher 2009) totalling 175,487 ha. Eighty Mile Beach is characterised by extensive mudflats supporting an abundance of macroinvertebrates which provide food for large numbers of shorebirds.

Eighty Mile Beach is one of the most important sites for migratory shorebirds in the East Asian Australasian Flyway, with 42 migratory shorebird species recorded at this location. It is estimated that 500,000 shorebirds use Eighty Mile Beach as a migration terminus annually (Hale and Butcher 2009), and more than 472,000 migratory waders have been counted on the mudflats during the September to November period. The location of Eighty Mile Beach makes it a primary staging area for many migratory shorebirds on their way to and from Alaska and eastern Siberia (Hale & Butcher 2009). Although many birds move further on their journey, others remain at the site for the non-breeding period.

Eighty-mile Beach supports more than one per cent of the flyway population (or one per cent of the Australian population for resident species) of 21 waterbirds, including 17 migratory species and four Australian residents. It is one of the most important sites in the world for the migration of Great Knot.

Eighty Mile Beach also supports a high diversity and abundance of wetland birds. A total of 97 wetland bird species have been recorded within the beach portion of the Ramsar site (Hale & Butcher 2009). This includes 42 species that are listed under international migratory agreements CAMBA (38), JAMBA (38) and ROKAMBA (32) as well as an additional 22 Australian species that are listed under the EPBC Act. In addition, there is a single record for Nordmann's Greenshank (*Tringa guttifer*) from the beach, which is listed as endangered under the IUCN Red List.

The Mandora Salt Marsh area contains an important and rare group of wetlands (Lake Walyarta and East Lake), including raised peat bogs, a series of small permanent mound springs and the most inland occurrence of mangroves in WA (Hale and Butcher 2009). A small number of tidal creeks dissect the beach, including Salt Creek which is fed partly from groundwater and has permanent surface water. The Mandora Salt Marsh lakes fill predominantly from rainfall and runoff in the wet season then dry back to clay beds. The mound springs likely come from water deep within the Broome sandstone aquifer rising through fractures in the rock and resulting in permanent mostly freshwater surface water. Flatback turtles (*Natator depressus*), listed as vulnerable under the EPBC Act, regularly nest at scattered locations along Eighty Mile Beach.

Eighty Mile Beach is used for beach-based recreation, including four-wheel driving, motorcycling, fishing and shell collecting. Mandora Salt Marsh is mainly used for cattle grazing. The site is traditionally part of Karajarri Country in the north, Nyangumarta Country in the south and Ngarla Country in the southern end of Eighty Mile Beach. The site has artefacts such as middens, pinka (large baler shells used to scoop and carry water for drinking), wilura (used for sharpening spear heads), axes, and flakes, and kurtanyanu and jungari (grinding stones).

3.7.5 Nationally Important Wetlands

The PMST search highlighted two (2) Nationally Important Wetlands within the EMBA:

- Eighty Mile Beach System; and
- Mermaid Reef.

Eighty Mile Beach System

The site comprises Eighty Mile Beach between Cape Missiessy and Cape Keraudren and adjoining tidal mudflats; also, coastal plain with distinct swamps, immediately inland of the beach, mainly near Anna Plains Homestead. Eighty Mile Beach is a megascale (220 km) linear sand-coast; the beach is 100 m wide and includes several muddy, microscale irregular embayments. Adjoining tidal mudflats are 0.5-1 km wide.

The site is one of the most important migration stop-over areas for shorebirds in East Asia–Australasia, supporting more than 300,000 birds. Open-shrubland (mangrove) at the small embayments in perform

arrangement; open-tussock grassland in latiform arrangement on the coastal plain, and open-scrub in periform arrangement at the swamps. An outstanding example of a major beach with associated inter-tidal flats and coastal floodplain, located in the arid tropics.

More information on Eighty Mile Beach is presented above in Section 3.7.4.

Mermaid Reef

See Section 3.7.6.5 for relevant information.

3.7.6 Australian Marine Parks

Seven Australian Marine Parks (AMPs) overlap the EMBA (Figure 3-15) as outlined in Table 3-10.

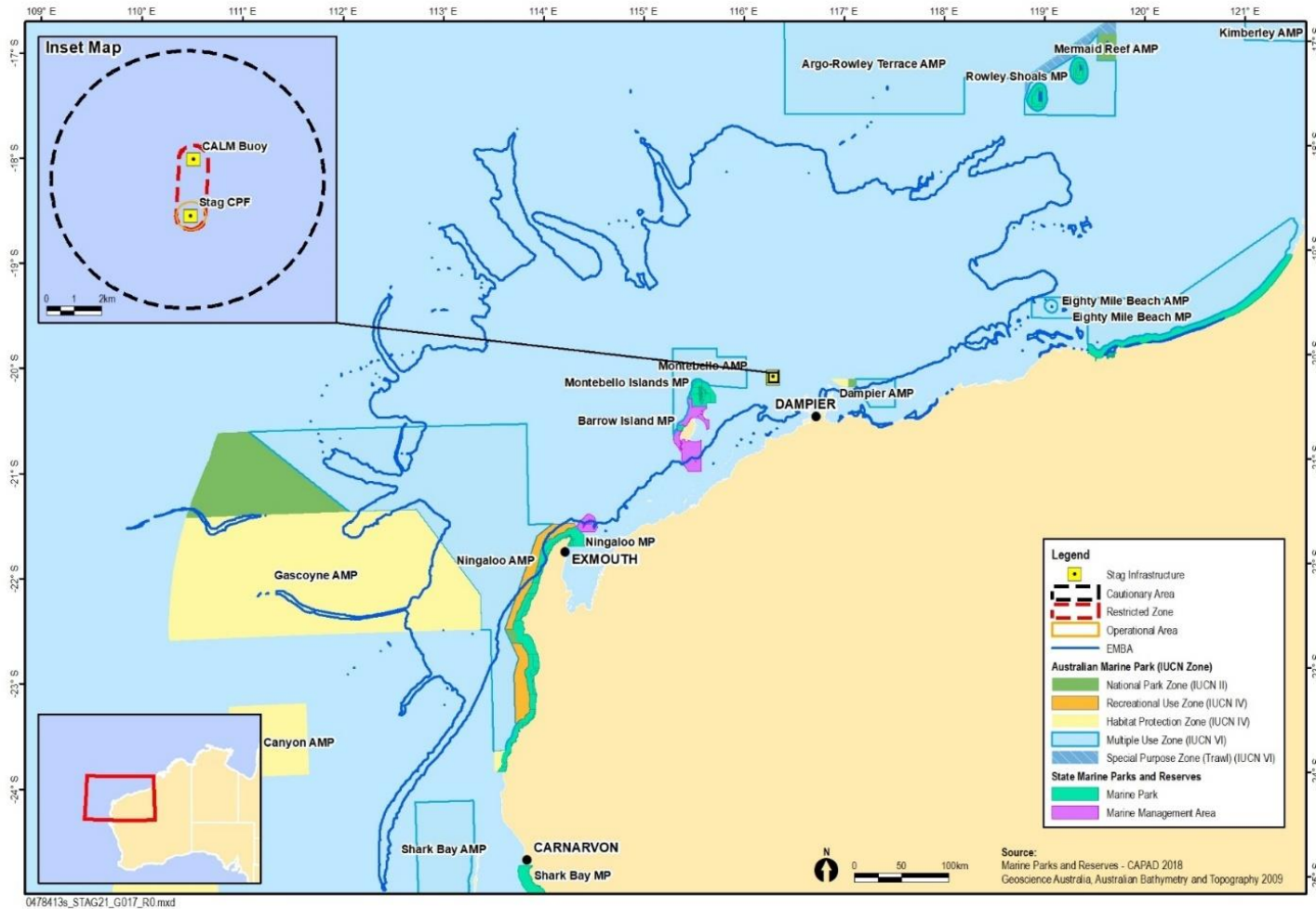


Figure 3-15: State Marine Reserves and Australian Marine Parks

Table 3-10: Australian Marine Parks within the EMBA

Australian Marine Parks	Distance from Stag Facility	IUCN Categories overlapped
Argo-Rowley Terrace AMP	290 km	Marine National Park Zone (IUCN II) Multiple Use Zone (IUCN VI)
Dampier AMP	60 km	Habitat Protection Zone (IUCN IV) Special Purpose Zone (ports) - IUCN Category VI Marine National Park Zone - IUCN Category II
Eighty Mile Beach AMP	280 km	Multiple Use Zone (IUCN VI)
Gascoyne AMP	270 km	Multiple Use Zone (IUCN VI) Marine National Park Zone (IUCN II) Habitat Protection Zone (IUCN IV)
Mermaid Reef AMP	80 km	Marine National Park Zone (IUCN II)
Montebello AMP	30 km	Multiple Use Zone - IUCN Category VI
Ningaloo AMP	260 km	Recreational Use Zone (IUCN IV)

The following descriptions of the major conservation values for each AMP are taken from the Department of the Environment and Energy website.

3.7.6.1 IUCN Principles

Existing and proposed AMPs are subject to the Australian IUCN reserve management principles as presented in Schedule 8 of the EPBC Regulations. Until management plans come into effect for any new proposed AMP in the NWMR, transitional arrangements apply, and there are no changes on the water for users of the new proposed reserves (DoE 2014c).

3.7.6.2 Argo-Rowley Terrace Marine Park

Based on modelling of the worst-case spill scenario, the EMBA overlaps the Argo Rowley Terrace Marine Park Multiple Use Zone IUCN VI but does not overlap the Marine National Park Zone IUCN II, which is ~50 km from its boundary. The AMP has the following major conservation values:

- Important foraging areas for migratory seabirds and the endangered loggerhead turtle;
- Important area for sharks, which are found in abundance around the Rowley Shoals relative to other areas in the region;
- The park provides protection for the communities and habitats of the deeper offshore waters of the region in depth ranges from 220 m to over 5,000 m;
- The park provides protection for many seafloor features including aprons and fans, canyons, continental rise, knolls/abyssal hills and the terrace and continental slope;
- Examples of the communities and seafloor habitats of the Northwest Transition and Timor Province provincial bioregions;
- The park provides 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 key ecological features (KEFs) are included in the reserve:

- The canyons linking the Argo Abyssal Plain with the Scott Plateau (unique seafloor feature with enhanced productivity and feeding aggregations of species); and
- Mermaid Reef and the Commonwealth waters surrounding Rowley Shoals (an area of high biodiversity with enhanced productivity and feeding and breeding aggregations).

3.7.6.3 Dampier Marine Park

The Dampier Marine Park (Marine National Park IUCN II and Habitat Protection Zone IV) is located ~60 km east of the Stag Facility and overlaps the EMBA. The AMP has the following major conservation values:

- Foraging areas adjacent to important breeding areas for migratory seabirds;
- Foraging areas adjacent to important nesting sites for marine turtles;
- Includes part of the migratory pathway of the humpback whale;
- The park provides a high level of protection for offshore shelf habitats adjacent to the Dampier Archipelago;
- The park provides high level protection for the shallow shelf with depths ranging from 15 m to 70 m; and
- Examples of the communities and seafloor habitats of the Northwest Shelf Province provincial bioregion as well as the Pilbara (nearshore) and Pilbara (offshore) meso-scale bioregions.

3.7.6.3 Eighty Mile Beach Marine Park

The Eighty Mile Beach Marine Park (Multiple Use Zone IUCN VI) overlaps the EMBA and is located 280 km east of the Stag Facility. The AMP has the following major conservation values:

- Foraging areas adjacent to important breeding areas for migratory seabirds;
- Foraging areas adjacent to important nesting sites for marine turtles;
- Includes part of the migratory pathway of the protected humpback whale;
- Adjacent to important foraging, nursing and pupping areas for freshwater, green and dwarf sawfish;
- The park provides protection for the shelf, including terrace and banks and shoal habitats, with depths ranging from 15 m to 70 m; and
- Examples of the communities and seafloor habitats of the Northwest Shelf Province provincial bioregion and the Canning, Northwest Shelf, Pilbara (nearshore), Pilbara (offshore) and Eighty Mile Beach meso- scale bioregions.

3.7.6.4 Gascoyne Marine Park

The EMBA overlaps all IUCN categories of the Gascoyne AMP which ranges in depth from ~15 m to 6,000 m. The Gascoyne AMP has the following major conservation values:

- Important foraging areas for:
 - Migratory seabirds,
 - The threatened and migratory hawksbills and flatback turtles,
 - The vulnerable and migratory whale shark.

- The park provides a continuous connectivity corridor from shallow depths around 15 metres out to deep offshore waters on the abyssal plain at over 5,000 m in depth;
- The park provides protection to many seafloor 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;
- Examples of the ecosystems of the Central Western Shelf Transition, the Central Western Transition and the Northwest province provincial bioregions as well as the Ningaloo meso-scale bioregion;
- Three key ecological features 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)
- The canyons 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; and
- The park therefore provides connectivity between the inshore waters of the existing Ningaloo Marine Park and the deeper waters of the area

3.7.6.5 Mermaid Reef Marine Park

The Mermaid Reef Marine Park (IUCN Category Ia - Strict Nature Reserve) overlaps the EMBA and is located 480 km northeast of the Stag Facility. The reserve has the following major conservation values:

- Mermaid Reef has national and international significance due to its pristine character, coral formations, geomorphic features and diverse marine life;
- Key area for over 200 species of hard corals and 12 classes of soft corals with coral formations in pristine condition;
- Important areas for sharks including the grey reef shark, the whitetip reef shark and the silvertip whaler;
- Important foraging area for marine turtles;
- Important area for toothed whales, dolphins, tuna and billfish;
- Important resting and feeding sites for migratory seabirds;
- The park, along with nearby Rowley Shoals Marine Park, provides the best geological example of shelf atolls in Australia; and
- Examples of the seafloor habitats and communities of the Northwest Transition

3.7.6.6 Montebello Marine Park

The Montebello Marine Park (Multiple Use Zone, IUCN Category VI) overlaps the EMBA and is located approximately 30 km west of the Stag Facility. The park has the following conservation values:

- Foraging areas adjacent to important breeding areas for migratory seabirds;
- Foraging areas for vulnerable and migratory whale sharks;
- Foraging areas adjacent to important nesting sites for marine turtles;
- Part of the migratory pathway of the humpback whale;
- Shallow shelf environments with depths ranging from 15 m to 150 m, including shelf and slope habitats, as well as pinnacle and terrace seafloor features;
- Examples of the seafloor habitats and communities of the Northwest Shelf Province, as well as the Pilbara (offshore) meso-scale bioregion; and
- One key ecological feature for the region being the Ancient Coastline (a unique seafloor feature that provides areas of enhanced biological productivity).

3.7.6.7 Ningaloo Marine Park

The EMBA overlaps the Ningaloo Marine Park (recreational use zone) located ~260 km southwest of the Stag Facility. Together with the Ningaloo Marine Park and Muiron Islands Management Area, both in State waters, the Ningaloo Marine Park forms the Ningaloo Coast World Heritage Area. The Ningaloo Marine Park has the following conservation values:

- Foraging areas for vulnerable and migratory whale sharks;
- Foraging areas and adjacent to important nesting sites for marine turtles;
- Includes part of the migratory pathway of the protected humpback whale;
- The park includes shallow shelf environments and provides protection for shelf and slope habitats, as well as pinnacle and terrace seafloor features; and
- Examples of the seafloor habitats and communities of the Central Western Shelf Transition.

3.7.6.8 Key Ecological Features

Seven marine key ecological features (KEFs) of the NWMR overlap the EMBA (refer Figure 3-16). These KEFs are considered to be of regional importance for either the region’s biodiversity or ecosystem function and integrity. Table 3-11 lists the KEFs together with their distance from the Stag Facility. Details on these KEFs are provided below.

Table 3-11: Distances from Stag Facility to Key Ecological Features within the EMBA

Key ecological feature (KEF)	Distance from Stag Facility
Ancient coastline at 125 m depth contour	~70 km
Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	~215 km
Commonwealth Waters adjacent to Ningaloo Reef	~260 km
Continental Slope Demersal Fish Communities	~110 km
Exmouth Plateau	~210 km

Glomar Shoals	~70 km
Mermaid Reef and Commonwealth Waters	~390 km

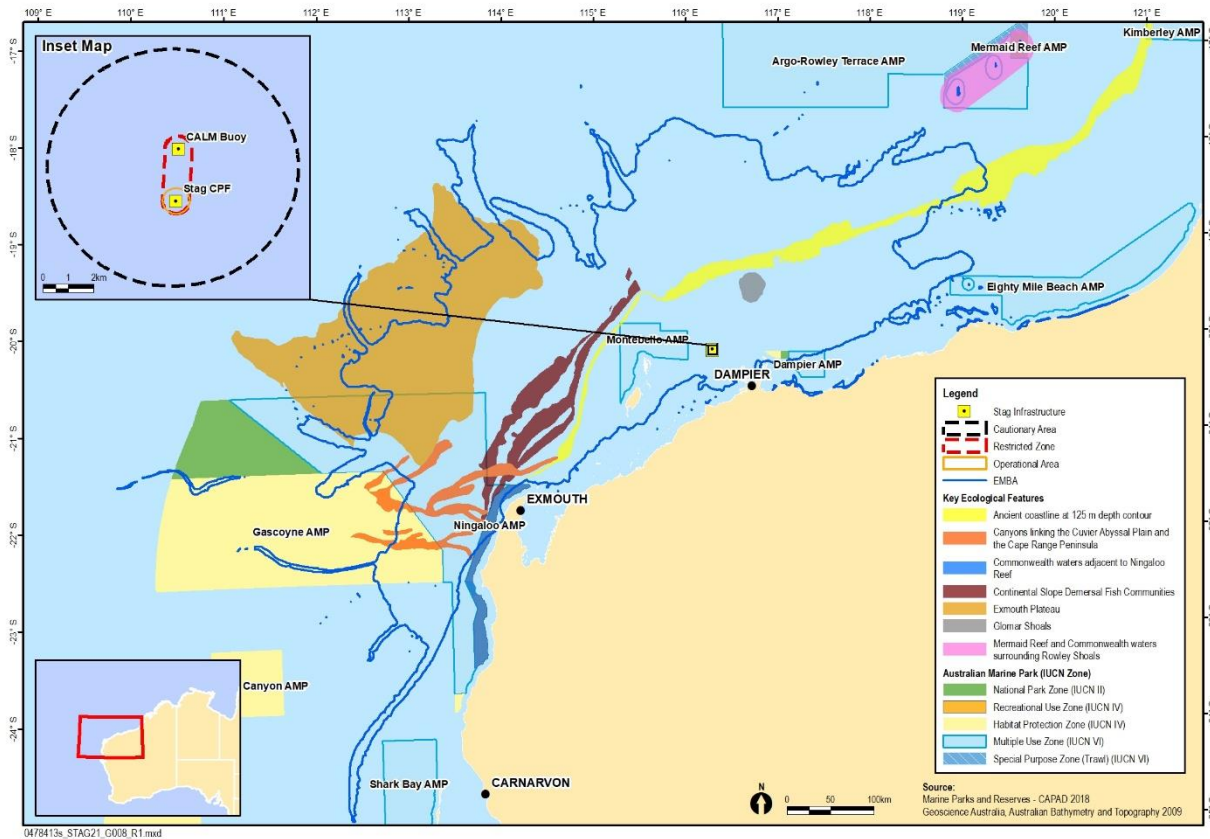


Figure 3-16: Key Ecological Features

Ancient coastline at 125 m depth contour

The shelf of the NWMR contains several terraces and steps, which reflect the gradual increase in sea level across the shelf that occurred during the Holocene. The most prominent of these occurs episodically as an escarpment through the Northwest Shelf Province and Northwest Shelf Transition, at a depth of approximately 125 m. Where the ancient submerged coastline provides areas of hard substrate it may contribute to higher diversity and enhanced species richness relative to soft sediment habitat.

The escarpment may facilitate increased availability of nutrients in particular locations off the Pilbara coast by disrupting internal waves thereby facilitating enhanced vertical mixing of water layers. Enhanced productivity may attract opportunistic feeding by larger marine life including humpback whales, whale sharks and large pelagic fish.

Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula

The canyons on the slope between the Cuvier Abyssal Plain and the Cape Range Peninsula include the Cape Range Canyon and the Cloates Canyon. They are believed to be associated with upwelling as they channel deep water from the Argo Abyssal Plain up onto the slope, where it mixes with the overlying water layers at the canyon heads. The upwelling zones at the canyon heads are sites of species aggregations such as sweetlip emperor fish. The soft bottom habitats within the canyons themselves are likely to support important assemblages of epibenthic species. 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.

Commonwealth waters adjacent to Ningaloo Reef

Ningaloo Reef is globally significant as the only extensive coral reef in the world that fringes the west coast of a continent and as a seasonal aggregation site for whale sharks. The Australian Commonwealth waters adjacent to Ningaloo Reef and associated canyons and plateau are interconnected and support the high productivity and species richness of Ningaloo Reef.

Refer Ningaloo AMP (Section 3.7.6.7) for further details on the values and sensitivities of the KEF.

Continental Slope Demersal Fish Communities

Demersal slope fish assemblages in the Timor Province, the Northwest Transition and the Northwest Province are characterised by high endemism and species diversity. The level of endemism of demersal fish species in these bioregions is high compared to anywhere else along the Australian continental slope. The Northwest Province, specifically the continental slope between North-West Cape and the Montebello Trough, has more than 500 fish species, 76 of which are endemic, making it the most diverse slope bioregion in Australia. The slope of the Timor Province and the Northwest Transition also contains more than 500 species of demersal fish, of which 64 are considered to be endemic, and is the second richest area for demersal fish species across the entire Australian continental slope.

Exmouth Plateau

The Exmouth Plateau covers an area of approximately 50,000 km² and consists of a generally rough and undulating surface at water depths of approximately 500 m to more than 5,000 m. The plateau is thought to be dotted with numerous pinnacles. It is an important geomorphic feature that modifies the flow of deep waters and has been identified as a site where internal waves are generated by internal tides. The plateau also receives settling detritus and other matter from the pelagic environment.

Glomar Shoals

The Glomar Shoals are regionally important for their high biological diversity and high localised productivity. The Glomar Shoals are in water depths of 26–70 m and are distinguished by highly fractured molluscan debris, coralline rubble and coarse carbonate sand (Baker et al., 2008). They are an important seafloor feature in Commonwealth waters as they are a raised feature on a relatively featureless continental shelf. They are characterised as a high-energy environment because of current action, thereby resulting in local enhancements in productivity (DSEWPaC, 2012c). Enhanced biological productivity supports significant populations of a number of commercially important fish species such as Rankin cod, brownstripe snapper, red emperor, crimson snapper and frypan bream.

Mermaid Reef and Commonwealth Waters

This key ecological feature is recognised because of its biodiversity (aggregations of marine life) and ecological functioning and integrity (high productivity) values, which apply to both the benthic and pelagic habitats within the feature.

The Rowley Shoals are a collection of three atoll reefs, Clerke, Imperieuse and Mermaid, which are located about 300 km northwest of Broome. This KEF encompasses Mermaid Reef AMP as well as waters from 3 nautical miles out to 6 nautical miles surrounding Clerke and Imperieuse reefs. Further information on the values and sensitivities of the Rowley Shoals are provided in Section 3.7.6.2.

The reefs provide a distinctive biophysical environment in the region as there are few offshore reefs in the northwest. They have steep and distinct reef slopes and associated fish communities. In evolutionary terms, the reefs may play a role in supplying coral and fish larvae to reefs further south via the southward flowing Indonesian Throughflow. Both coral communities and fish assemblages differ from similar habitats in eastern Australia (Done et al., 1994).

3.7.7 Summary of Values and Sensitivities for EPBC Act Protected Matters within the Operational Area and EMBA

Table 3-12 summarises the habitats that may be affected by routine events at the Stag Facility within the Operational Area as well as accidental events that may arise within a larger EMBA.

Table 3-12: Summary of Environmental Values and Sensitivities

Protected matter	Environmental value	Sensitivities overlapped	
		Operational Area	EMBA
World Heritage Areas			
The Ningaloo Coast	Extensive fringing reef and lagoonal system. Supports high diversity of corals, molluscs, fish, crustaceans and sponges. Important habitat for protected and iconic turtles (foraging and nesting), whales (migrating and resting) and whale sharks (feeding aggregations).	No	Yes – oil could potentially reach and coat shoreline habitats and coastal waters at this site.
National Heritage Properties			
The Ningaloo Coast	See WHA	No	Yes
Dampier Archipelago (including Burrup Peninsula)	Important site for indigenous rock painting and stone arrangements.	No	No – sites above high water mark and would not be impacted from any oil spill scenarios.
Commonwealth Heritage Place			
Mermaid Reef - Rowley Shoals	See Mermaid Reef AMP	No	Yes
Ningaloo Marine Area - Commonwealth Waters	See Ningaloo Coast WHA and AMP	No	Yes

Protected matter	Environmental value	Sensitivities overlapped	
		Operational Area	EMBA
Ramsar sites			
Eighty Mile Beach	This site comprises beach, extensive mudflats and wetlands for feeding/roosting of shorebird/wetland bird species and is an internationally important site for migratory shorebirds.	No	Yes – oil could potentially reach and coat shorelines and mudflats of this site.
Wetlands of National Significance			
Eighty Mile Beach System	See Ramsar Sites	No	Yes
Mermaid Reef	See Mermaid Reef AMP	No	Yes
Commonwealth Marine Parks			
Argo-Rowley Terrace AMP	Important foraging areas for migratory seabirds and the endangered loggerhead turtle. Important area for sharks. The reserve provides protection for many seafloor features including aprons and fans, canyons, continental rise, knolls/abyssal hills and the terrace and continental slope and provides connectivity between the existing Mermaid Reef Marine National Nature Reserve and reefs of the WA Rowley Shoals Marine Park and the deeper waters of the region.	No	Yes – sensitivity is for species (e.g. whales, turtles, seabirds and whale sharks) that use Surface waters within the reserve and therefore susceptible to oiling.
Dampier AMP	Contains foraging areas adjacent to important breeding/nesting areas for migratory seabirds and turtles and foraging areas for migratory whale sharks. Part of the migratory pathway of the humpback whale.	No	Yes – sensitivity is for species (e.g. whales, turtles and whale sharks) that use surface waters within the reserve and therefore susceptible to oiling.
Eighty Mile Beach AMP	Contains foraging areas adjacent to Important breeding/nesting areas for migratory seabirds and turtles and foraging areas for migratory whale sharks. Part of the migratory pathway of the humpback whale. Adjacent to important foraging, nursing and pupping areas for freshwater, green and dwarf sawfish.	No	Yes – sensitivity is for species (e.g. whales, turtles and whale sharks) that use surface waters within the reserve and therefore susceptible to oiling.
Gascoyne AMP	Contains important foraging areas for seabirds, hawksbill and flatback turtles and whale sharks. Includes seafloor features including canyon, terrace, ridge, knolls, deep hole/valley and continental rise and provides protection for sponge gardens in southwest of the reserve.	No	Yes – sensitivity is only for species (hawksbill and flatback turtles and whale sharks) that use surface waters within the reserve and therefore susceptible to oiling.

Protected matter	Environmental value	Sensitivities overlapped	
		Operational Area	EMBA
Mermaid Reef AMP	Mermaid Reef has national and international significance due to its pristine character, coral formations, geomorphic features and diverse marine life (e.g. hard coral). Important areas for sharks, toothed whales, dolphins, tuna and billfish. Important foraging habitat for turtles and important resting and feeding sites for migratory seabirds. One of the best geological example of shelf atolls in Australia.	No	Yes – sensitivity is for species (e.g. whales, turtles, seabirds and whale sharks) that use Surface waters within the Reserve and therefore susceptible to oiling.
Montebello AMP	Contains foraging areas adjacent to important breeding/nesting areas for migratory seabirds and turtles and foraging areas for migratory whale sharks. Part of the migratory pathway of the humpback whale.	No	Yes – sensitivity is for species (e.g. whales, turtles and whale sharks) that use surface waters within the reserve and therefore susceptible to oiling.
Ningaloo AMP	Values in Commonwealth waters are around feeding, migrating and aggregating areas for turtles, whales and whale sharks as well as diverse subtidal benthic habitats.	No	Yes – sensitivity is for species (e.g. whales, turtles and whale sharks) that use surface waters within the reserve and therefore susceptible to oiling.
Key Ecological Features			
Ancient coastline at 125 m depth contour	Where the ancient submerged coastline provides areas of hard substrate it may contribute to higher diversity and enhanced species richness relative to soft sediment habitat. May facilitate increased availability of nutrients in particular locations off the Pilbara coast. This enhanced productivity may attract opportunistic feeding by larger marine life including humpback whales, whale sharks and large pelagic fish.	No.	Yes – sensitivity is for species (e.g. whales, turtles, seabirds and whale sharks) that may be in high abundance above feature and therefore susceptible to oiling.
Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	Believed to be associated with upwelling. The upwelling zones at the canyon heads are sites of species aggregations such as sweetlip emperor fish. The soft bottom habitats within the canyons themselves are likely to support important assemblages of epibenthic species.	No.	Yes –Oil interacting with increased species in upwelled surface waters (e.g. plankton, fish, whale sharks).
Commonwealth waters adjacent to Ningaloo Reef	Sensitivities as for Ningaloo AMP	No.	Yes – As per Ningaloo Marine Reserve
Continental Slope Demersal Fish Communities	High endemism and diversity of demersal fish species	No	Yes – oil will not directly impact demersal fish species although may interact with demersal fish larvae and eggs over a larger area.

Protected matter	Environmental value	Sensitivities overlapped	
		Operational Area	EMBA
Exmouth Plateau	Plateau is thought to be dotted with numerous pinnacles. It is an important geomorphic feature that modifies the flow of deep waters.	No	No – oil will not directly impact this feature or increased benthic diversity associated with this feature.
Glomar Shoals	Regionally important for their high biological diversity and high localised productivity. Enhanced biological productivity supports significant populations of a number of commercially important fish species such as Rankin cod, brownstripe snapper, red emperor, crimson snapper and frypan bream.	No	Yes – oil could interact with increased productivity within surface waters (e.g. plankton, fish, whale sharks)
Mermaid Reef and Commonwealth Waters	Sensitivity as for Mermaid Reef AMP	No	Yes- as for Mermaid Reef AMP

3.8 State Marine Reserves

Seven State marine reserves have been identified within the EMBA as outlined in Figure 3-15 and Table 3-13.

Table 3-13: Distances from Stag Facility to State Marine Reserves within the EMBA

State Marine Reserve	Distance from Stag Facility
Barrow Island Marine Park	~110 km
Barrow Island Marine Management Area	~75 km
Eighty Mile Beach Marine Park	~340 km
Montebello Islands Marine Park	~65 km
Muiron Island Marine Management Area	~240 km
Ningaloo Marine Park	~260 km
Rowley Shoals Marine Park	~380 km

Further detail on these reserves is provided below and shown in Figure 3-17.

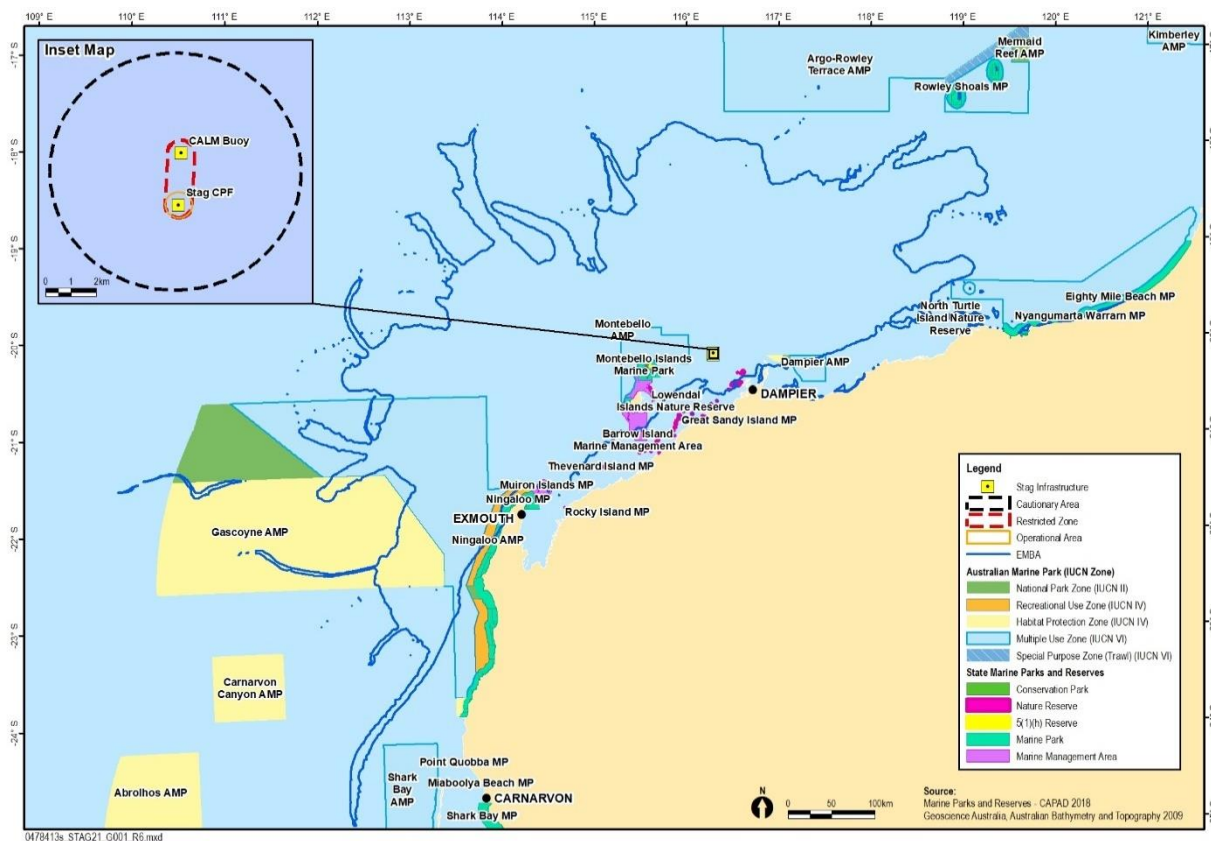


Figure 3-17: State Marine Reserves

3.8.1 Barrow Island Marine Park

The Barrow Island Marine Park covers 4,169 ha, all of which is zoned as sanctuary zone (the Western Barrow Island Sanctuary Zone) (DEC, 2007a). It includes Biggada Reef, an ecologically significant fringing reef, and Turtle Bay, an important turtle aggregation and breeding area (DEC, 2007a). Representative areas of seagrass, macroalgal and deep water habitat are also represented within the marine park (DEC, 2007a). Passive recreational activities (such as snorkelling, diving and boating) are permitted but extractive activities such as fishing and hunting are not.

3.8.2 Barrow Island Marine Management Area

The Barrow Island MMA is the largest reserve within the Montebello/Barrow Islands marine conservation reserves, covering 114,693 ha (DEC, 2007a). 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: 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, 2007a). Green, hawksbill and flatback turtles regularly use the island’s beaches for breeding, and loggerhead turtles are also occasionally sighted. The KPI for the marine park are summarised in Table 3-14.

3.8.3 Eighty Mile Beach Marine Park

The Eighty Mile Beach Marine Park covers an area of ~ 200,000 ha stretching for some 220 km from Cape Missiessy to Cape Keraudren, and includes sanctuary, recreation, general use and special purpose zones. The park is managed under the Eighty Mile Beach Marine Park Management Plan 2014-20124 (DBCA, 2014).

The listed ecological values of the Eighty Mile Beach Marine Park include the high sediment and water quality, the juxtaposition of the beach, coastal topography and seabed and the diverse and ecologically important habitats and marine/coastal flora and fauna. The listed values of the marine park are as follows:

- The intertidal sand and mudflat communities supporting a high abundance and diversity of invertebrate life and providing a valuable food source for shorebirds (including migratory species) and other fauna;
- The diverse subtidal filter-feeding communities;
- Macroalgal and seagrass communities providing habitat and feeding opportunities for fish, invertebrates and dugongs;
- High diversity intertidal and subtidal coral reef communities; and
- Mangrove communities and adjacent saltmarshes provide nutrients to the surrounding waters and habitat for fish and invertebrates.

The listed marine and coastal fauna values are as follows:

- A high diversity and abundance of nationally and internationally important shorebirds and waders (including migratory species) are found in the marine park;
- Flatback turtles are endemic to northern Australia and nest at Eighty Mile Beach;
- Dugongs and several whale and dolphin species inhabit or migrate through the marine park;
- A highly diverse marine invertebrate fauna provides an important food source for a variety of animals, including birds, fish and turtles, along with recreational and commercial fishing opportunities;
- A diversity of fish species provide recreational and commercial fishing opportunities; and
- A diversity of sharks and rays, including several protected species, are found in the park.

In addition to these natural values, the marine park contains land and sea important to traditional indigenous owners through identity and place, family networks, spiritual practice and resource gathering. The marine park also has a history of European activity including exploration, pastoralism and commercial fishing (e.g. the pearl oyster fishery). The park contains a historical WWII plane wreck (Dornier Do-24 X-36) and shipwrecks (two pearl luggers). The marine park provides tourism opportunity and recreational value through its remoteness, diversity and abundance of habitats and marine fauna and the pristine nature of the marine and coastal environment.

The marine park contains vast intertidal sand and mudflats that extend up to 4 km wide at low tide and provide a rich source of food for many species. Eighty Mile Beach Marine Park is one of the world's most important feeding grounds for small wading birds that migrate to the area each summer, travelling from countries thousands of kilometres away (DBCA 2014).

Further information on management zoning, cultural, ecological, social and economic values of the marine park are available in the Management Plan (DBCA 2014). The KPI for the marine park are summarised in Table 3-14.

3.8.4 Montebello/ Barrow Islands Marine Conservation Reserves

Montebello/Barrow Islands Marine Conservation Reserves encompasses three separate reserves: Barrow Island Marine Management Area; Barrow Island Marine Park; and Montebello Islands Marine Park.

As outlined in the Management Plan for the Montebello/Barrow Islands Marine Conservation Reserve 2007–2017 (DEC 2007), the strategic conservation objectives for Reserve are to:

- Maintain and enhance the marine biodiversity of the reserves; and
- Maintain the ecological integrity (i.e. ecosystem structure and function).

While macroalgae-dominated limestone reef and subtidal reef platform/sand mosaic are the main marine habitat types in the Montebello/Barrow islands region, coral reef, mangroves and subtidal sand and soft-bottom habitats are also common. Macroalgal communities, which are the major primary producer for the area, mainly comprise species of brown algae, particularly of the genera *Sargassum*, *Turbinaria* and *Pandina*, while green algae from the genera *Caulerpa* and *Cladophora* are also abundant. A wide range of invertebrate life is associated with this habitat. The subtidal coral reef communities in the reserves have a high diversity of invertebrates, with at least 150 species of hard corals recorded from fringing and patch coral reef areas. Sand habitats are generally unvegetated but may have seasonal vegetation or permanent patches of seagrass or macroalgae and a significant invertebrate fauna. Rocky shores are typically undercut, unvegetated, low limestone cliffs, which support a variety of mollusc species and other invertebrates. The six species of mangroves that occur in the reserves represent the unique offshore mangrove communities of the Pilbara, and are considered to be globally significant (Semeniuk, 1997 as cited in EPA 2001). Mangrove communities support a range of invertebrate fauna and provide nursery habitat for fishes and crustaceans. The benthic and shoreline habitats in the reserves are shown in Figure 3-4.

Five of the six species of marine turtle found in WA have been recorded in the reserves. Of these, green, hawksbill and flatback turtles regularly nest on the sandy beaches in the reserves, while occasional nesting by loggerheads has also been recorded on Barrow Island. The WA hawksbill turtle population is the only large population of this species remaining in the Indian Ocean. The nesting populations of green and flatback turtles in the reserves are large and significant. The northernmost breeding limit for loggerheads in WA is within the reserves.

Seven species of toothed whale and three species of baleen whale have been recorded from the Montebello/Barrow islands region. Humpback whales use the reserves as a resting area, and some whale migration paths pass through the reserves. Dugongs are found in the vicinity of the Montebello Islands, Lowendal Islands and Barrow Shoals, where they feed on seagrass and algae. The Montebello/Barrow islands region is a significant rookery for at least 15 seabird species, with the largest breeding colony of roseate terns in Western Australia found on the Montebello Islands.

The KPI for the marine park are summarised in Table 3-14.

3.8.5 Montebello Islands Marine Park

The Montebello Islands Marine Park (MP) is an 'A' Class reserve (DEC 2007a) and covers an area of ~ 58,300 ha (DEC 2007a). Zoning within the Montebello Islands MP is a combination of sanctuary, recreation, special purpose (benthic protection), special purpose (pearling) and general use (DEC 2007).

The Montebello Islands comprise over 100 islands, the majority of which are rocky outcrops. The rocky shore accounts for 81% of shoreline habitat (DEC 2007a). Other marine habitats within the marine park include coral reefs, mangroves, intertidal flats, extensive sheltered lagoonal waters and shallow algal and seagrass reef platforms extending to the south of the Montebello Islands to the Rowley Shelf. The complex seabed and island topography create a unique environment in which these diverse habitats occur in close proximity to each other.

Ecologically, the marine park's values include important turtle nesting sites, feeding and resting areas for migrating shorebirds, seabird nesting areas, dugong foraging areas, globally unique mangrove communities and highly diverse fish and invertebrate assemblages (DEC 2007a). Also, the sediment and water quality of the marine park are considered pristine (DEC 2007a) and are essential to the maintenance of the marine ecosystems and associated biota. The KPI for the marine park are summarised in Table 3-14.

Economic values within the Montebello Islands MP include commercial pearl culture, commercial line and trap fishing and an increasing recreational usage. Special purpose zones for pearling are established for the existing leaseholder to allow pearling to be the priority use of these areas (DEC 2007). 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.

3.8.6 Muiron Island Marine Management Area

The Marine Management Area for the Muiron Islands is located immediately adjacent to the northern end of the Ningaloo Marine Park. This is managed as an integrated area together with the Ningaloo Marine Park under the Management Plan for the Ningaloo Marine Park and Muiron Islands Marine Management Area 2005 - 2015 (DEC 2005).

Muiron Islands located 15 km northeast of North-West Cape (NWC) and 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 Marine Management Area (MMA) was WA's first marine management area, gazetted in November 2004. It covers an area of 28,616 ha and occurs entirely within state waters (CALM, 2005a).

3.8.7 Ningaloo Marine Park

The Ningaloo Marine Park was declared in May 1987 under the National Parks and Wildlife Conservation Act 1975 (Cmlth). 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 Australian Marine Park Network (5.7.6). The park covers an area of 263,343 km², including both State and Commonwealth waters, extending 25 km offshore. It is vested in the Marine Parks and Reserves Authority (MPRA) and managed by the WA Department of Biodiversity, Conservation and Attractions (DBCA) on behalf of the Commonwealth.

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; and
- Habitat for over 25 species of migratory wading birds listed in CAMBA and JAMBA.

The strategic conservation objectives for Ningaloo Marine Park and the Muiron Islands Marine Management Area are:

- Maintain the marine biodiversity of the reserves; and
- Maintain ecological processes and life support systems (i.e. key ecosystem structure and function).
- To attain these objectives, some of the social and ecological values are monitored as Key Performance Indicators (KPI) including, coral reef communities, water quality, coastal biological communities, finfish, mangrove communities, turtles, Intertidal sand and mudflat communities, Seascapes and Wilderness (Table 3-14).

3.8.8 Rowley Shoals Marine Park

The Rowley Shoals comprise three oceanic reef systems approximately 30–40 km apart, namely Mermaid Reef, Clerke Reef and Imperieuse Reef (DEC, 2007b). The Rowley Shoals Marine Park comprises the Clerke and Imperieuse Reefs which lie in State Waters. The Rowley Shoals Marine Park was originally gazetted on 25 May 1990 as a Class A reserve and on 10 December 2004 the boundary was amended to extend the Park to the State Waters limit (DEC, 2007b). The Park now covers approximately 87,632 ha (DEC, 2007b). Mermaid Reef lies in Commonwealth waters and comprises the Mermaid Reef Marine National Nature Reserve managed by the Commonwealth Department of Agriculture, Water and Energy (DAWE) (DEWHA 2008).

The Rowley Shoals Marine Park is characterised by intertidal and subtidal coral reefs, diverse marine fauna and high water quality. These attributes and the low level of use of the area contribute to the Park's unique wilderness qualities, which are a significant draw card for visitors. 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). The remoteness of the Shoals and low use have ensured that the marine environment of the Shoals is in a near natural state, particularly relative to other reefs in the Indo-West Pacific region which are subject to intense ongoing human pressures and destructive fishing practices.

Imperieuse Reef is 16 km x 8 km and includes a small sand cay ~3.7 m high and devoid of vegetation (Cunningham Islet) within the northern extremity of the reef. The south-eastern edge has coral boulders that rise 3 m above the water mark while large areas of the reef dry out at low water and there are two lagoons contain coral patches within. Clerke Reef lies 23 km north-west of Imperieuse Reef and is 15 km x 6 km in size. Near the northern end of the reef lies Bedwell Islet, a bare sand cay about 2 m high which is a nesting site for the red-tailed tropic bird (DEC 2007). On the eastern and western sides of the reef there are a number of boulders which fall dry. A narrow passage leads to a lagoon, with many detached coral patches within the reef.

The major habitats of the area include intertidal and subtidal reefs that comprise the typical coral atoll formation and are home to many reef-associated species. Surveys carried out by the Western Australian Museum identified 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. Many of these records were new to WA, reflecting the significant differences between the offshore Indo-Pacific fauna and inshore WA coastal fauna. 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 2007).

Sparse seagrass is found within subtidal coral reef communities of the Rowley Shoals but is not a major habitat type. 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) and there is nothing to suggest that it is unique within the Indo-Pacific (Huisman et al. 2009).

The Rowley Shoals are a known foraging area for migratory birds, foraging area for the green and hawksbill turtle, and provide habitat to numerous sharks.

The Rowley Shoals are of national and international significance and provide an important global benchmark for Indo-West Pacific reefs (DEC 2007). Further information is available in the Rowley Shoals Marine Park Management Plan 2007-2017 (DEC 2007). The KPI for the marine park are summarised in Table 3-14.

3.8.9 Summary of Values and Sensitivities for State Marine Reserves within the Operational Area and EMBA

Table 3-14: Summary of Environmental Values and Sensitivities for State Marine Reserves within the Operational Area and EMBA

State Marine Reserves	Environmental value	KPI's	Sensitivities within the Operational Area	Sensitivities within the EMBA
Barrow Island Marine Park	Includes Biggada Reef, an ecologically significant fringing reef, and Turtle Bay, an important turtle aggregation and breeding area. Includes representative areas of seagrass, macroalgal and deepwater habitat.	Coral reef communities Mangrove communities Macroalgae and seagrass Turtles Fin fish Water quality	No	Yes – oil could potentially reach and coat shoreline, intertidal and shallow subtidal habitats as well as marine species using these habitats (e.g. turtles)
Barrow Island Marine Management Area	Includes most of the waters around Barrow Island, the Lowendal Islands and the Barrow Island Marine Park. Includes Bandicoot Bay Conservation Area on the southern coast of Barrow Island created to protect benthic fauna and seabirds. It includes the largest intertidal sand/mudflat community in the reserves and is an important feeding area for migratory birds. Includes significant breeding and nesting areas for marine turtles, important coral reefs and unique mangrove communities.	Coral reef communities Mangrove communities Macroalgae and seagrass Turtles Fin fish Water quality	No	Yes – oil could potentially reach and coat shoreline, intertidal and shallow subtidal habitats as well as marine species using these habitats (e.g. turtles and migratory shorebirds)

<p>Eighty-mile Beach Marine Park</p>	<p>Contains Ramsar site and one of the world’s most important feeding grounds for migratory shorebirds and wetland birds. Also supports dugongs, inshore dolphins, sharks, rays, tropical fish, sponges, coral reefs and several threatened turtle species. Significant nesting population of flatback turtles within the park.</p>	<p>Intertidal sand and mudflat communities Mangrove communities and salt marshes Waterbirds including migratory species Marine turtles (also see species info on other tab) Scalefish Remote seascapes</p>	<p>No</p>	<p>Yes – oil could potentially reach and coat shoreline, intertidal and shallow subtidal habitats as well as marine species using these habitats (e.g. turtles, dugongs, dolphins and migratory shorebirds).</p>
<p>Montebello Island Marine Park</p>	<p>Comprise over 100 islands, with habitats including rocky shorelines, coral reefs, mangroves, intertidal flats, extensive sheltered lagunal waters, and shallow algal and seagrass reef platform. Contains important nesting/breeding and foraging sites for turtles, nesting and resting areas for migrating shorebirds, seabird nesting areas, dugong foraging areas, globally unique mangrove communities, and highly diverse fish and invertebrate assemblages.</p>	<p>Coral reef communities Mangrove communities Macroalgae and seagrass Turtles Fin fish Water quality</p>	<p>No</p>	<p>Yes – oil could potentially reach shoreline, intertidal and shallow subtidal habitats as well as Marine species using these habitats (e.g. turtles, seabirds, shorebirds, dugongs)</p>
<p>Muiron Island Marine Management Area</p>	<p>Adjacent to Ningaloo Marine Park around Muiron Island. Regionally significant loggerhead turtle nesting beaches. Contains coral reef and macroalgae habitat.</p>	<p>Coral reef communities Water quality Coastal biological communities Finfish Mangrove communities</p>	<p>No</p>	<p>Yes – oil could potentially reach and coat shoreline, intertidal and shallow subtidal habitats as well as marine species using these habitats (e.g. turtles) or aggregating/migrating offshore from these habitats (whale sharks and whales)</p>

		Turtles Seascapes Wilderness		
Ningaloo Marine Park	Extensive fringing reef and lagoonal system. Supports high diversity of corals, molluscs, fish, crustaceans and sponges. Important habitat for protected and iconic turtles (foraging and nesting), whales (migrating and resting) and whale sharks (feeding aggregations) as well as sea and shorebirds.	Coral reef communities Water quality Coastal biological communities Finfish Mangrove communities Turtles Seascapes Wilderness	No	Yes – oil could potentially reach and coat shoreline, intertidal and shallow subtidal habitats as well as marine species using these habitats (e.g. turtles and migratory shorebirds) or aggregating/migrating offshore from these habitats (whale sharks and whales)
Rowley Shoals Marine Park	Comprises the Clerke and Imperieuse Reefs. Characterised by intertidal and subtidal coral reefs, rich and diverse marine fauna and high water quality. Shoals are thought to provide a source of invertebrate and fish recruits for reefs further south and as such are regionally significant. The Rowley Shoals provide an important global benchmark for Indo- West Pacific reefs.	Water quality Intertidal coral reef communities Subtidal reef communities Invertebrates Fin fish Seascapes Wilderness	No	Yes – oil could potentially reach and coat shoreline, intertidal and shallow subtidal habitats as well as marine species using these habitats (e.g. turtles, seabirds, cetaceans)

3.9 Socio-Economic Environment

The Stag Field is approximately 60 km offshore from the Port of Dampier. Smaller coastal fishing and tourism settlements occur at Onslow, approximately 200 km to the south, and Point Samson, some 100 km to the southeast.

Dampier, Karratha and Port Hedland are the main service and population centres for the region. Although initially developed for the iron ore industry, these towns have expanded to service the oil and gas industry located on the NWS.

3.9.1 Commercial Fisheries and Aquaculture

Offshore and coastal waters in the NWS region support a valuable and diverse commercial fishing industry, dominated by Pilbara fisheries. The major fisheries in the Pilbara region target tropical finfish, large pelagic fish species, crustaceans (prawns and scampi) and pearl oysters (AFMA, 2011; Fletcher and Santoro, 2013). A summary of fisheries resources is provided in Table 3-15.

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. Commonwealth managed fisheries are permitted to operate within Stag Operational area (not including restricted zone) and EMBA, but effective fishing effort is either non-existent or of very limited nature (Table 3-17).

The North-West Slope Trawl Fishery (NWSTF) fishery is limited to waters deeper than 200 m isobath and so does not overlap the operational area, although it did have active fishing in 2014/2015 within the EMBA. It must be noted that only one vessel was active (CoA 2016).

The boundary of the Western Deepwater Trawl Fishery (WDTF) management area is more than 100 km from the operational area but is overlapped by the EMBA. However, no fishing was undertaken in the 14/15 season, and prior to that, effort was south off Shark Bay and limited to only three vessels (CoA 2016).

Other Commonwealth fisheries, such as the Western Tuna and Billfish Fishery (WTBF), Southern Bluefin Tuna Fishery (SBFTF) and the Skipjack Tuna Fishery (Western; WSTF), although licenced to fish in the region, have had no historical fishing effort reported near the Operational Area or within the EMBA (CoA 2016).

A summary of Commonwealth managed fisheries operating in the vicinity of the Stag Facility is provided in Table 3-17 and Figure 3-18.

State Fisheries

State fisheries are managed by the WA Department of Primary Industries and Regional Development (DPIRD) with specific management plans, regulations and a variety of subsidiary regulatory instruments under the Fish Resources Management Act 1994 (WA). The information provided on State managed fisheries has been derived from the State of Fisheries Report 2014/2015 (Fletcher and Santoro, 2015). Commercial fishery zones that have boundaries that overlap the Stag Facility Operational Area are listed below, presented in Figure 3-19 and summarised in Table 3-18.

North Coast Bioregion

- Onslow Prawn Managed Fishery (OPMF);
- Mackerel Managed Fishery (all areas) (MF);
- Pilbara Demersal Scalefish Fishery (Line, Trap and Trawl);
- Pearl Oyster Managed Fishery; and

- Pilbara Developing Crab Fishery.

Whole of State Fisheries

- Beche-de-mer Fishery;
- Marine Aquarium Fish Fishery; and
- Specimen Shell Managed Fishery.

While some fisheries have permitted fishing zones that overlap the Operational Area (Figure 3-19), not all have significant fishing effort in this (Table 3-17). The Stag location is too deep for any dive based fisheries (i.e. Pearl Oyster, Roe's Abalone, Beche-de-Mer, Marine Aquarium Fish, Specimen Shell Fishery), is too far offshore for the prawn Fisheries and does not contain seabed features or reef that attract target species within the Mackerel Fishery or Pilbara Trap Fishery. The Operational Area also represents a 500m restricted zone around Stag Facility infrastructure where fishing is prohibited.

Fisheries that do not overlap the operational area but are overlapped by the EMBA include:

North Coast Bioregion

- Nickol Bay Prawn Managed Fishery (NBMF);
- Broome Prawn Managed Fishery (BMF);
- The Kimberley Gillnet and Barramundi Managed Fishery (KGBF);
- Northern Demersal Scalefish Managed Fishery (NDSF);
- WA North Coast Shark Fishery; and
- Pilbara Developing crab Fishery.

Gascoyne Coast Bioregion

- Exmouth Gulf Prawn Fishery;
- Gascoyne Demersal Scalefish Fishery.

West Coast Bioregion

- Roe's Abalone Fishery; and
- West Coast Rock Lobster Managed Fishery.

Whole of State Fisheries

- West Coast Deep Sea Crab (Interim) Managed Fishery.

Aquaculture

The only aquaculture activity within the EMBA is pearl farming of pearl oysters (*Pinctada maxima*) in protected waters (Fletcher and Santoro, 2015). Pearl farm locations within the EMBA are at the Montebello Islands.

3.9.2 Recreational Fisheries

Recreational fisheries and charter boat operators are managed by the DPIRD; the area covered by the EMBA of this EP falls primarily within the North Coast Bioregion (NCB) (Fletcher and Santoro, 2012). Within the North Coast Bioregion, recreational fishing is experiencing significant growth, with a distinct seasonal peak in winter when the local population increases significantly from tourists visiting the Exmouth/Onslow area

and Dampier Archipelago (Fletcher and Santoro, 2012). Increased recreational fishing has also been attributed to those involved in the construction or operation of developments within the region. Offshore islands, coral reefs and continental shelf provide species of major recreational interest including saddletail snapper, red emperor, cods, coral and coronation trout, sharks, trevally, tuskfish, tunas, mackerels and billfish (Fletcher and Santoro, 2012). Advice received from DPIRD (pers. com. C. Telfer, in 2012) indicates that charter boat fishing effort in permit area WA-15-L has been recorded. Offshore shoals, such as Glomar Shoals and Rankin Bank attract occasional recreational and charter boat visitations, however these trips are generally of a short duration and sporadic. The distance of these destinations offshore means that only a limited number recreational fishing trips can be expected each year.

Within the Operational Area there are no known natural seabed features that would aggregate fishes and which are typically targeted by recreational fishers. However, the Stag CPF, pipeline, CALM buoy and associated vessels are likely to attract pelagic fish and therefore could also attract recreational fishers target pelagic species. Nevertheless, fishing in the immediate vicinity of the Stag facilities is not permitted since a 500 m Restricted Zone is in place. This could have an impact on requiring extra distance travelled when traversing the region, how this would be small compared to total distance travelled in any trip given the remoteness of the location.

Table 3-15: Fisheries Resources

<i>North Coast Bioregion</i>			
<i>Fishery or resource</i>	<i>Catch returns recorded in past 3 years (noting if any returns in NWS Bioregional province)</i>	<i>Are breeding stocks/ effort for target species in fishery acceptable?</i>	<i>Permitted fishing method</i>
North Coast Prawn Managed Fisheries (including Onslow Prawn Managed Fishery; Nickol Bay Prawn Managed Fishery; Broome Prawn Managed Fishery and Kimberley Prawn Managed Fishery)	Yes (including NWS)	Yes	Otter trawl
North Coast Nearshore and Estuarine Fishery resource (including Kimberley Gillnet & Barramundi Managed Fishery)	Yes	Yes	Gill net
North Coast Demersal Fisheries (including Pilbara Fish Trawl (Interim) Managed Fishery, Pilbara Trap and Line Managed Fishery and Northern Demersal Scalefish Managed Fishery)	Yes (including NWS)	Yes	Hand/ dropline, fish traps
Mackerel Managed Fishery	Yes (including NWS)	Yes	Trolling, jig or handline
Pearl Oyster Managed Fishery	Yes (including NWS)	Yes	Hand collection
Beche-de-mer Fishery	Yes (including NWS)	Yes	Hand collection
North Coast Crab Fishery (including Kimberley Developing Mud Crab Fishery and Pilbara Developmental Crab Fishery)	Yes (including NWS)	Yes	Baited traps, trawl
North-West Slope Trawl	Yes	Not reported	Trawl
Northern Prawn Fishery	Yes (note limited extent of fishery in Area of Interest)	Yes	Trawl
Skipjack Tuna Fishery			
Small Pelagic Fishery			
Southern Bluefin Tuna Fishery			
The Western Deepwater Trawl	Yes	Yes	Trawl

Western Tuna and Billfish Fishery (WTBF)	Yes	No (Striped Marlin overfished)	Longline
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3.9.3 Oil and Gas Industry

The surrounding waters are also used for petroleum exploration and development. The nearest production activities to the Stag Facility include:

- Wandoo Production Platforms located in Exploration Permit WA-14-L, ~ 20 km northeast; and
- Gas pipelines run from the Reindeer platform (~ 29 km north) to the mainland (north to south). To the east (~ 6 km), another gas pipeline runs east to west, ~ 10 km north of the Stag Facility.

3.9.4 Commercial Shipping

Commercial shipping moves through the offshore waters en route to or from the marine terminals at Thevenard, Barrow and Varanus Islands. Shipping using NWS waters includes iron ore carriers, third-party tankers and other vessels proceeding to or from the ports of Dampier, Cape Preston, Port Walcott and Port Hedland; however, these are predominantly heading north from these ports. Large cargo vessels carrying freight bound or departing from Fremantle, transit along the WA coastline heading north and south in deeper waters. Shipping activities in relation to the Stag Operational Area are illustrated in Figure 3-20. The Stag platform is located 3.1 nautical miles (5.7 km) north-west of a shipping fairway that experiences heavy concentrations of commercial traffic as vessels transit into and out of Cape Preston and Barrow Island.

3.9.5 Tourism

Aquatic recreation such as boating, diving and fishing occurs near the coast and islands off the Pilbara and Ningaloo coast and to a lesser extent the Rowley Shoals. These activities are concentrated in the vicinity of the population centres such as Exmouth, Dampier and Onslow

Water-based tourism activities undertaken across NWS include:

- Whale watching;
- Recreational boating;
- Charter fishing;
- Snorkelling/diving;
- Surfing; and
- Recreational fishing.

In the waters immediately surrounding the Stag Facility, tourism activities are limited due to its distance from the mainland and island shorelines.

3.9.6 Native Title

Within the EMBA any shoen or impact on environmental values may impact the associated cultural values or use. Within the EMBA the following have been identified (NTT 2017):

- Schedule of Native Title Determination Applications;
- Register of Native Title Claims;
- Native Title Determinations;
- Register of Indigenous Land Use Agreements; and
- Notified Indigenous Land Use Agreements.

Native title determinations within the EMBA are summarised in Table 3-16.

Table 3-16: Native title determinations

Native Title Determinations	
Karajarri People (Area A)	Native title exists (exclusive)
Karajarri People (Area B)	Native title exists (non-exclusive)
Ngarluma/Yindjibarndi	Native title exists (non-exclusive)
Rubibi Community	Native title exists
Ngarla and Ngarla #2 (Determination Area A)	Native title exists (non-exclusive)
Registered Native Title Claims	
Yaburara & Mardudhunera People	Accepted for registration
Gnulli	Accepted for registration
Kariyarra People	Accepted for
Jabirr Jabirr	Accepted for registration
Goolarabooloo People	Accepted for registration
Bindunbur	Accepted for registration
Indigenous Land Use Agreements	
Yawuru Prescribed Body Corporate ILUA - Broome	ILUA registered
Yawuru Area	ILUA
RTIO Ngarluma Indigenous Land Use Agreement (Body Corporate Agreement)	ILUA registered
Kuruma Marthudunera and Yaburara and Coastal Mardudhunera Indigenous Land Use Agreement	ILUA registered
Anketell Port,	ILUA registered
Cape Preston Project Deed (YM Mardie ILUA)	ILUA registered
Yawuru Nagulagun / Roebuck Bay Marine Park ILUA	ILUA registered
FMG – Kariyarra Land Access ILUA	ILUA accepted for notification

3.9.7 Aboriginal Heritage

A search of the DPLH database indicates there are 109 Registered Aboriginal sites, 101 Other Heritage sites and 85 Heritage surveys within the EMBA. Through ongoing engagement with indigenous groups, Jadestone continues to seek further information on relevant cultural values for this activity.

Jadestone understands that First Nations peoples have deep connections to, and concerns about the protection of Sea Country, also referred to as Saltwater Country, and is viewed the same way they view their onshore Country, without separation.

Sea Country is an important part of First Nations peoples culture and whilst the many coastal and island First Nations groups around Australia have different languages and their own unique belief systems, ceremonies and relationships with Country, they all regard the estuaries, beaches, bays and marine areas, or Sea Country, as essential parts of their traditional estates.

First Nations groups who reside along the coasts or on islands believe that Sea Country contains the evidence of creation stories, about animals, plants and people, as well as the creation of landscape features such as islands and reefs. Coastal and island communities held cultural responsibilities to ensure Sea Country is cared for and Sea Country was managed very carefully, and they are playing an increasingly important role in the management of their Sea Country, through formalised roles and programs that work alongside various State and Commonwealth government structures.

Values and sensitivities regarding Sea Country may include different features such as:

- Historic and contemporary cultural harvesting of marine fauna and flora
- Sea and landscape features that hold dreamtime and creation stories, such as offshore islands; and
- Different marine and avian species that hold deep connections to lore and represent spiritual emblems.

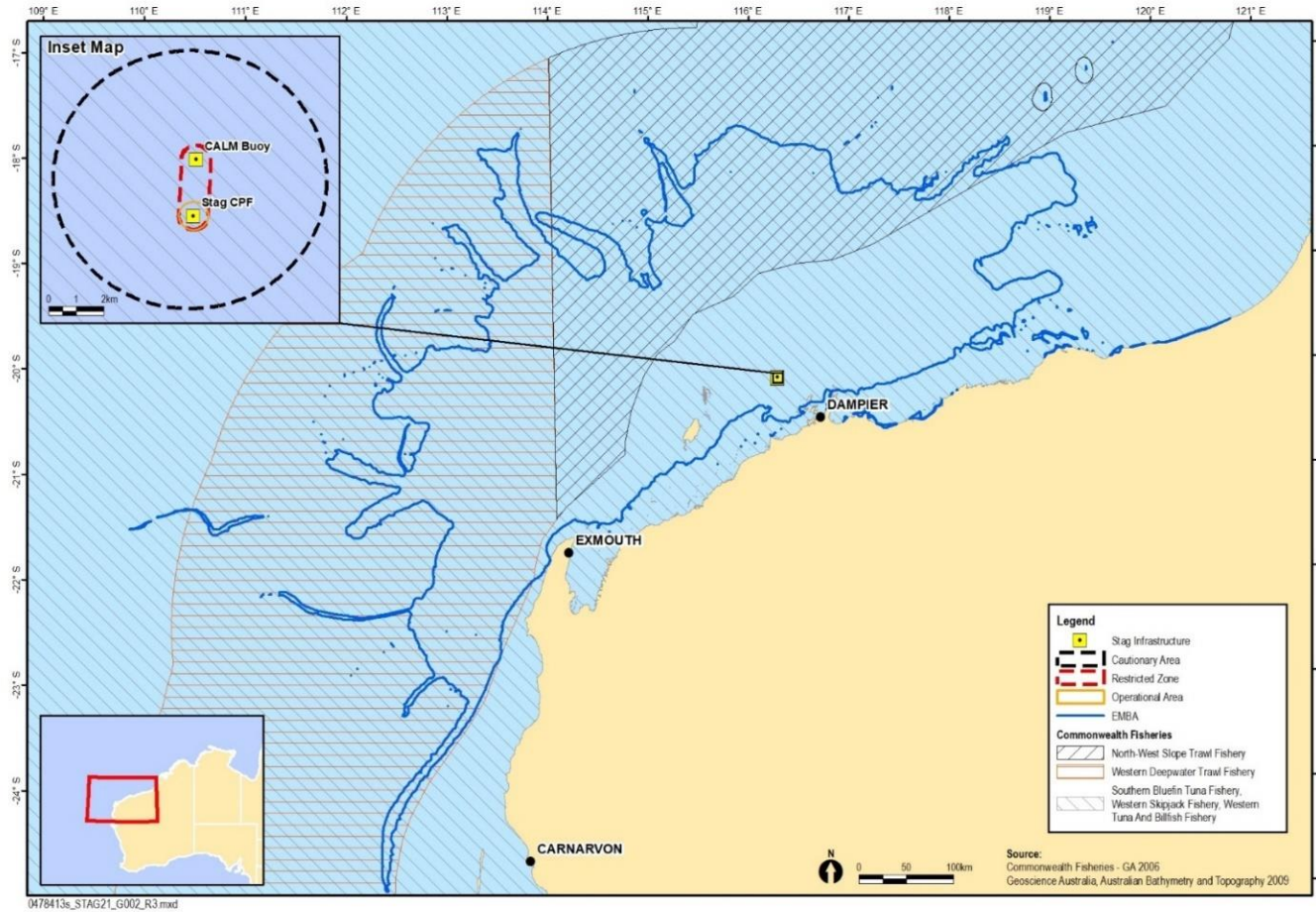


Figure 3-18: Commonwealth Commercial Fishing Zones in the vicinity of the Stag facility

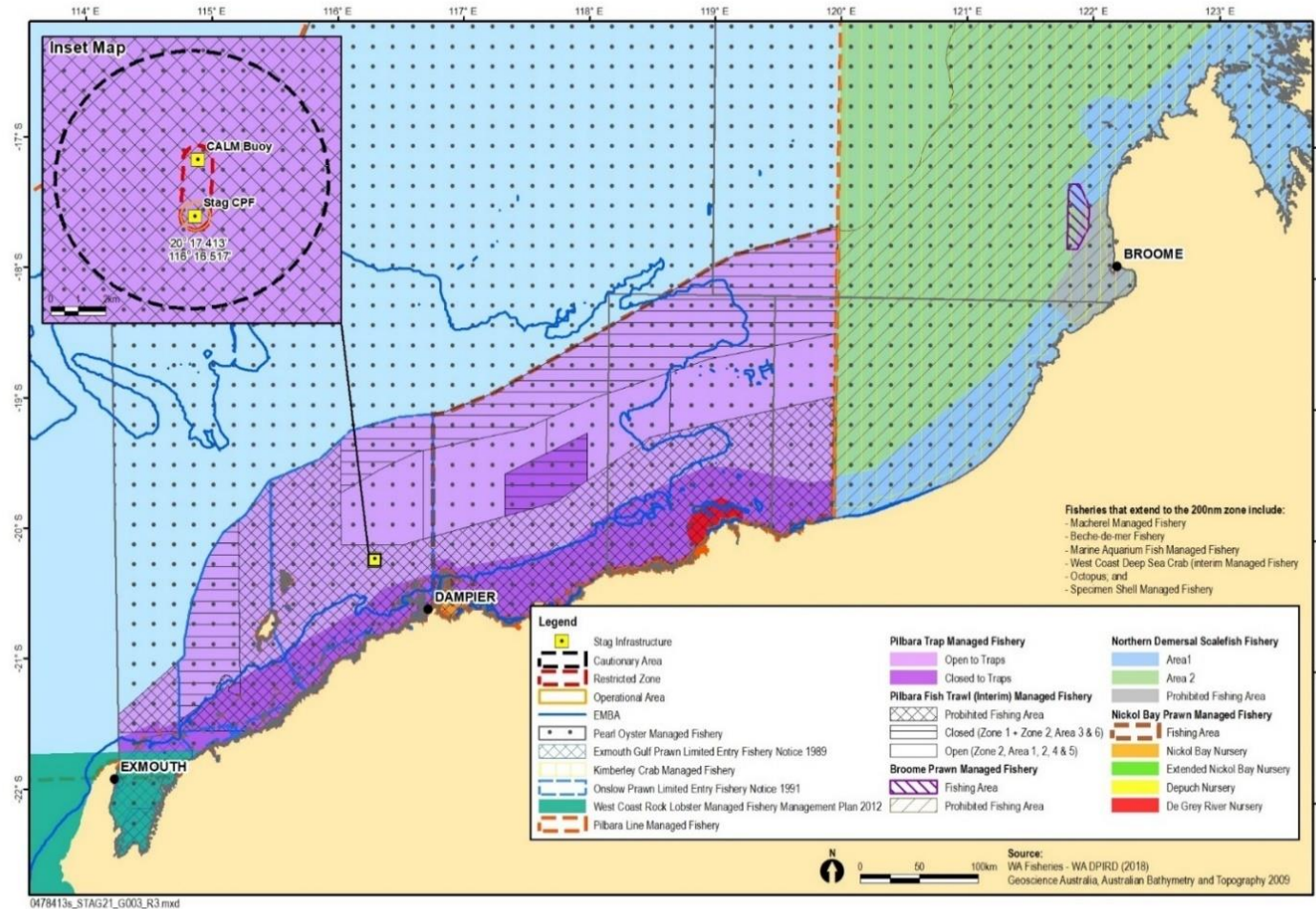


Figure 3-19: State Commercial Fishing Zones in the Vicinity of the Stag Facility

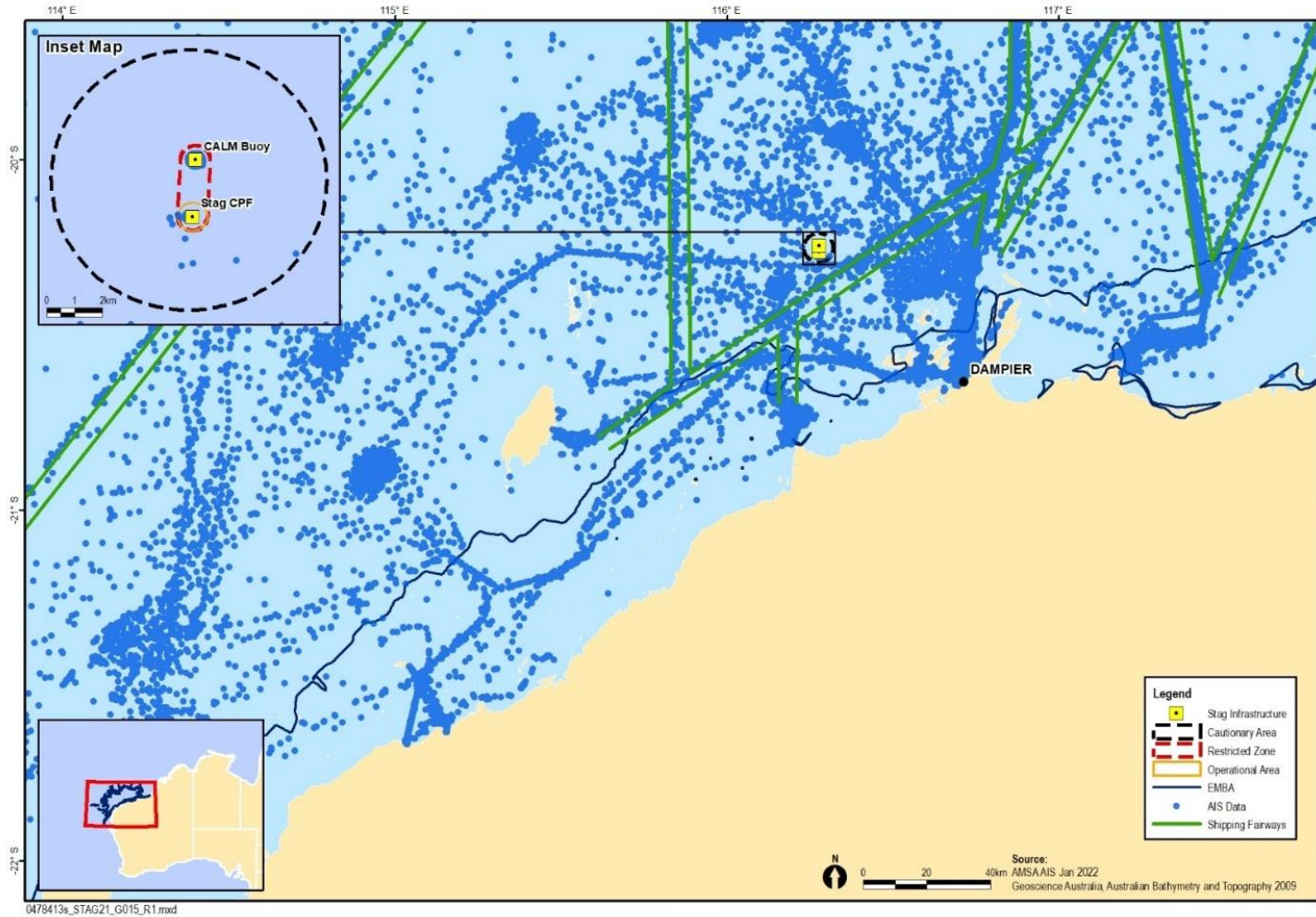


Figure 3-20: AMSA shipping records and designated shipping routes in the vicinity of the Operational Area

Table 3-17: Summary of Commercial Fisheries licences to fish in the vicinity of the Stag Facility Operational Area or EMBA

Fishery	Target Species	Fishing Method and Area
Commonwealth-managed Fisheries		
North-West Slope Trawl	Scampi (crayfish): primarily Australian (<i>Metanephrops australiensis</i>), with smaller quantities of velvet scampi (<i>M. velutinus</i>) and Boschmas scampi (<i>M. boschmai</i>). A quantity of prawns (Giant scarlet, red carid, red, red-striped and royal red prawns) is harvested each season, and squids are becoming an increasingly significant component of the catch Mixed snappers (Lutjanidae) and redspot emperor (Lethrinus lentjan) have also been important components of the catch historically.	Demersal trawl operates in north-western Australia from 114°E to 125°E, seaward of the 200m isobath, but no current effort in vicinity of the operational area and limited effort within EMBA. 6 vessels operated in 2019-20 season (4 in 2018-19).
Western Deepwater Trawl	Deepwater bugs (<i>Ibacus</i> spp). and ruby snapper (<i>Etelis</i> sp) dominating recent catches.	Demersal trawl seaward of the 200m isobath, and west of North-West Cape – does not overlap operational area, but small overlap of EMBA. Effort in recent years has been localized in the area offshore and slightly south of Shark Bay and limited to only three vessels.
Western Skipjack	Skipjack tuna (<i>Katsuwonus pelamis</i>) is the only target species. Landings of species other than skipjack (may include bigeye (<i>Thunnus obesus</i>), and yellowfin tuna (<i>T. albacares</i>).	Purse seine November to June. A small amount of pole and line effort is also used. Historically fishing limited to waters off SA and not WA. No fishing effort since 2008-2009 (CoA 2016)
Western Tuna and Billfish	Bigeye tuna (<i>Thunnus obesus</i>), yellowfin tuna (<i>T. albacares</i>), albacore (<i>T. alalunga</i>) and swordfish (<i>Xiphias gladius</i>). Striped marlin (<i>Kajikia audax</i>) is a minor component of the catch but remains an important species for management due to historically higher catches.	Pelagic longline year-round with low-levels of minor-line fishing. In recent years, fishing effort has concentrated off south-west Western Australia, with occasional activity off South Australia. No current effort on the NWS.
Southern Bluefin Tuna	Southern bluefin tuna (<i>Thunnus maccoyii</i>).	Most of the Australian catch is taken by purse-seine vessels in the Great Australian. No current effort on the NWS.
State-managed Fisheries		

Fishery	Target Species	Fishing Method and Area
Onslow Prawn Managed Fishery	Western king prawn (<i>Penaeus latisulcatus</i>), brown tiger prawns (<i>Penaeus esculentus</i>) and endeavour prawns (<i>Metapenaeus</i> spp.)	Low-opening otter trawls used within the boundaries of the OPMF being 'all the Western Australian waters between the Exmouth Prawn Fishery and the Nickol Bay prawn fishery between 114°39.9' east and 116°45' on the landward side of the 200m depth isobath. One boat fished in the OPMF in 2019 whilst the other operators chose to fish elsewhere where catches were likely to be more profitable One vessel fished for 28 days in 2019.
Nickol Bay Prawn Managed Fishery	Primarily targets banana prawns (<i>Penaeus merguensis</i>)	High opening otter trawls used within the boundaries of the NBPMF being 'all the waters of the Indian Ocean and Nickol Bay between 115°26' east longitude and 120° east longitude on the landward side of the 200m isobath. 9 vessels fished intermittently in 2021 as per DPIRD catch data.
Broome Prawn Managed Fishery	Western king prawns (<i>Penaeus latisulcatus</i>) and coral prawns (a combined category of small penaeid species)	Low opening otter trawls used within the boundaries of the BPF being 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 200m isobath. Only one vessel undertook trial fishing in 2019.
The Kimberley Gillnet and Barramundi Managed Fishery (KGBF)	Primarily Barramundi (<i>Lates calcarifer</i>), king threadfin (<i>Polydactylus macrochir</i>) and blue threadfin (<i>Eleutheronema tetradactylum</i>). Small quantities of Elasmobranchs (sharks and rays), black jewfish (<i>Protonibea diacanthus</i>) and tripletail (<i>Lobotes surinamensis</i>) are also landed.	It encompasses the taking of any fish by gillnet in inshore waters and the taking of barramundi (<i>Lates calcarifer</i>) by any means. Operates in the nearshore and estuarine zones of the North Coast Bioregion (NCB) from the WA/NT border (129°E) to the top end of Eighty Mile Beach, south of Broome (19°S). Access to the KGBF is limited to four licences. Commercial fishing is now prohibited between Roebuck Bay and the northern end of Eighty Mile Beach to 19°S as well as within three nautical miles of the high water mark and around major town sites and recreationally important fishing locations.

Fishery	Target Species	Fishing Method and Area
Northern Demersal Scalefish Managed Fishery (NDSF)	The main species landed by this fishery are red emperor and goldband snapper and saddletail snapper.	Demersal traps are used within waters off the north coast of Western Australia east of longitude 120°E. These waters extend out to the edge of the Australian Fishing Zone.
Mackerel Managed Fishery	Spanish (<i>Scomberomorus commerson</i>) and grey mackerel (<i>S. semifasciatus</i>).	Trolling or handline year-round in all waters to the 200-nautical mile AFZ between 114° E to 121°. Catch data was requested from DPRID for the last 5 years (2016-2021) for the 10x10nM reporting grid (block 201161) in which the operational area sits. During this time less than 3 vessels in the Mackerel Managed Fishery were active in this grid (catch not able to be reported due to the low numbers).
Pilbara Demersal Scalefish Fishery (Line, Trawl and Trap)	Variety of demersal scalefish landed including goldband snapper (<i>Pristipomoides multidentis</i>), red emperor (<i>Lutjanus sebae</i>) and bluespotted emperor (<i>Lethrinus punctulatus</i>) and rankin cod (<i>Epinephelus multinotatus</i>).	<p>Fishing within waters off the north coast of Western Australia west of longitude 120°E. Across the whole of PDSF the commercial catches for 2019 were demersal trawl (72%), trap (23%) and line (5%). This fishery operates across various zones and year-round. The trawl sector of the fishery is closed within operational area, but trap fishing is permitted.</p> <p>Although 5 vessels operated within the 10x10nM block in the PDSF trawl fishery (total catch 50,599kg over 5 years), as the operational area is part of a closed area for this fishery (the closure boundary runs through the middle of this block) it is known that this catch was not from the area of the proposed activity. In the broader 60x60nM block 3 vessels were active in the Trap Fishery (241,412kg catch over 5 years); and 6 vessels in the line fishery (19,748kg catch over 5 years).</p>
Pearl Managed Oyster Fishery	Silver-lipped pearl oyster (<i>Pinctada maxima</i>)	Drift diving restricted to shallow divable depths generally less than 35 m In 2019 catch was taken from Zones 2 only with no fishing in Zones 1 or 3

Fishery	Target Species	Fishing Method and Area
WA North Coast Shark Fishery	Sandbar (<i>Carcharhinus plumbeus</i>), blacktip (<i>Carcharhinus</i> spp.), tiger (<i>Galeocerdo cuvier</i>) and lemon (<i>Negaprion acutidens</i>) sharks	Area between North-West Cape and a line of longitude at 120° E and all waters south of latitude 18° S has been closed indefinitely to protect shark stocks.
Pilbara Crab Managed Fishery	Blue swimmer crab (<i>Portunus armatus</i>)	Hourglass traps used in inshore waters from Onslow through to Port Hedland with most commercial and activity occurring in and around Nickol Bay. 3 vessels were used in 2020.
Exmouth Gulf Prawn Fishery	Target western king prawns (<i>Penaeus latisulcatus</i>), brown tiger prawns (<i>Penaeus esculentus</i>), blue endeavour prawns (<i>Metapenaeus endeavouri</i>) and banana prawns (<i>Penaeus merguensis</i>).	Otter trawls used within Exmouth Gulf. In 2020, 6 boats trawled.
Gascoyne Demersal Scalefish Fishery	A range of demersal species including pink snapper (<i>Pagrus auratus</i>), goldband snapper (<i>Pristipomoides</i> spp., mainly <i>P. multidens</i>), red emperor (<i>Lutjanus sebae</i>), emperors (Lethrinidae, includes spangled emperor, <i>Lethrinus nebulosus</i> , and redthroat emperor, <i>L. miniatus</i>), cods (Serranidae), ruby snapper (<i>Etelis carbunculus</i>), pearl perch (<i>Glaucosoma burgeri</i>), mullo way (<i>Argyrosomus japonicus</i>), amberjack (<i>Seriola dumerili</i>) and trevallies (Carangidae).	The GDSF licensed vessels fish throughout the year with mechanised handlines in the waters of the Indian Ocean and Shark Bay between latitudes 23°07'30"S and 26°30'S. Peak fishing period for pink snapper is June-July when the oceanic stock aggregates to spawn. In 2019, 9 vessels actively fished.
West Coast Rock Lobster Managed Fishery	Western rock lobster (<i>Panulirus cygnus</i>)	Baited pots fished along the west coast of Australia. between Latitudes 21°44' to 34°24' S
Beche-de-mer (Sea Cucumber) Managed Fishery	Sandfish (<i>Holothuria scabra</i>) and deepwater redfish (<i>Actinopyga echinites</i>).	Hand-harvest fishery, animals caught principally by diving (restricted to diving depths) and a smaller amount by wading. 3 vessels operated in 2021 as per DPIRD catch data.
Marine Aquarium Fish	Fish, coral, algae, live rock	Dive based fishery operating all year throughout WA waters, but restricted by diving depths. The fishery is typically more active in waters south of Broome with higher levels of effort around the

Fishery	Target Species	Fishing Method and Area
Managed Fishery		Capes region, Perth, Geraldton, Exmouth, Dampier and Broome. 7 vessels operated in 2021 as per DPIRD catch data.
Specimen Shell Managed Fishery	Shells (cowries, cones)	Dive based fishery operating all year throughout WA waters, but restricted by diving depths. 3 vessels operated in 2021 as per DPIRD catch data.
West Coast Deep Sea Crustacean Managed Fishery	Crystal (Snow) crabs (<i>Chaceon albus</i>), Giant (King) crabs (<i>Pseudocarcinus gigas</i>) and Champagne (Spiny) crabs (<i>Hypothalassia acerba</i>)	Baited pots in waters lying north of latitude 34° 24' S (Cape Leeuwin) and west of the Northern Territory border on the seaward side of the 150m isobath out to the extent of the Australian Fishing Zone, mostly in 500 to 800 m of water. Year round. 4 Vessels operated in 2019.

Notes:

Data for Commonwealth- managed fisheries was taken from 2021 Fisheries Status Reports where possible.

Data for State managed fisheries was taken from the most recent Fisheries Status Reports or where available, catch data was requested from DPRID for the last 5 years (2016-2021) in a 10x10nM reporting grid (block 201161) in which the operational area sits. Some fisheries such as the PDSF (non-trawl sectors) only report against the larger 60 x 60nM grid in this area (block 20160) so the DPIRD FishCube data was also examined for this.

3.9.8 Summary of Values and Sensitivities of the Socio-Economic Environment within Operational Area and EMBA

Table 3-18 outlines those socioeconomic values that may be affected by routine events at the Stag Facility within the Operational Area as well as unplanned events that may arise within a potentially larger area (EMBA).

Table 3-18: Summary of Socio-economic values and sensitivities

Socio-economic value		Sensitivities within Operational Area	Sensitivities within EMBA
Commonwealth fisheries	North-West Slope Trawl	No – Not within Operational Area, restricted to depths >200 m	Yes – Limited effort within EMBA seaward of 200 m isobaths. Oil could disrupt fishing activity and potentially contact eggs and larvae of target species although no direct contact with target species.
	Western Deepwater Trawl Fishery	No – Not within Operational Area, restricted to depths >200 m and south of Operational Area	Yes – Limited effort within EMBA seaward of 200 m isobaths, unlikely that area of EMBA would be fished. Oil could disrupt fishing activity and potentially contact eggs and larvae of target species although no direct contact with target species.
	Western Skipjack	No - No effort on the NWS	No - No effort on the NWS
	Western Tuna and Billfish	No - No effort on the NWS	No - No effort on the NWS
	Southern Bluefin Tuna	No - No effort on the NWS	No - No effort on the NWS
State fisheries	Onslow Prawn Managed Fishery	No - Effort within coastal areas	Yes – oil may reach shallow coastal waters and shorelines (most likely in Area 3 of fishery) affecting fishery habitat and fishing activity
	Nickol Bay Prawn Managed Fishery	No - Effort within coastal areas	Yes – oil may reach shallow coastal waters and shorelines affecting fishery habitat and fishing activity
	Broome Prawn Managed Fishery	No - Effort within coastal areas	Yes – oil may reach shallow coastal waters and shorelines affecting fishery habitat and fishing activity
	The Kimberley Gillnet and Barramundi Managed Fishery	No - Effort within coastal areas	Yes – oil may reach shallow coastal waters and shorelines affecting fishery habitat and fishing activity
	Northern Demersal Scalefish Managed Fishery	No – No overlap with fishing zones	Yes – Oil may enter Area 1 and 2 of the fishery. Oil may interact with demersal fish, eggs and larvae within the plankton assemblage. Oil may interfere with fishing activities.

Socio-economic value		Sensitivities within Operational Area	Sensitivities within EMBA
	Mackerel Managed Fishery	Yes - Area 2 overlaps Operational Area but interaction unlikely as fishery targets coastal reefs and headlands <40 m and 500 m restricted zone exists around Stag Facility.	Yes – Areas 1, 2 and 3 may be impacted by oil. Adult fish unlikely to be impacted due to depth of their habitat but eggs and larvae within plankton assemblage and shallow coastal juvenile fish habitat may be contacted by oil.
	Pilbara Demersal Scalefish Fishery (Line, Trap and Trawl)	Yes – Trap fishing zone only overlaps Operational Area but interaction unlikely as fishery targets reef areas (no reef areas exist near Operational Area) and 500 m restricted zone exists around Stag Facility.	Yes – Trawl, Trap and Line fishing activities may be disrupted by an oil spill. Adult demersal fish unlikely to be impacted due to depth of their habitat but eggs and larvae within plankton assemblage and shallow coastal juvenile fish habitat may be contacted by oil.
	Pearl Oyster Managed Fishery	No – Zone 1 overlaps Operational Area but collection of pearl oysters is performed by diving and Operational Area is beyond diveable depths for the fishery. A 500 m restricted zone also exists around Stag Facility.	Yes – Fishing activity in Zones 1, 2 and 3 could be disrupted by an oil spill. Shallow water habitats and pearls could be directly impacted by oil but most likely would remain underneath floating oil.
	WA North Coast Shark Fishery	No – Shark fishery closed in vicinity of the Operational Area	No – fishery has been closed since 2009.
	Pilbara Developing Crab Fishery.	No – Fishing occurs in coastal waters inshore of the Operational Area	Yes - Fishing activity between Onslow and Port Hedland could be disrupted by an oil spill and oil could contact the shallow coastal habitats used by blue swimmer crabs.
	Exmouth Gulf Prawn Fishery	No – Fishing occurs within Exmouth Gulf only	Yes – EMBA boundaries indicate small degree of overlap only possible with the fishery. Fishing activity could be disrupted by an oil spill and oil could contact prawn eggs and larvae in upper water column.
	Gascoyne Demersal Scale Fishery	No – Restricted to Gascoyne waters and so permitted fishery management area does not overlap operational area.	Yes – EMBA boundaries indicate small degree of overlap possible with the fishery. Fishing activity could be disrupted by an oil spill and oil could contact demersal fish eggs and larvae in upper water column although no direct contact with target species.

Socio-economic value		Sensitivities within Operational Area	Sensitivities within EMBA
West Coast Rock Lobster Fishery		No – Restricted south of North-West Cape	Yes – EMBA boundaries indicate small degree of overlap possible with the fishery if fishing occurs off Ningaloo coastline. Fishing activity could be disrupted by an oil spill and oil could contact lobster eggs and larvae in upper water column although benthic juveniles and adults are unlikely to be contacted.
Beche-de-mer Managed Fishery		No – Restricted to shallow diveable depths or wading depths	Yes - Fishing activity between could be disrupted by an oil spill and oil could contact the shallow coastal habitats used by beche-de-mer, marine aquarium fish and specimen shell species.
Marine Aquarium Fish Managed Fishery			
Specimen Shell Fishery			
West Coast Deep Sea Crustacean Managed Fishery		No – Fishery extends from 150 m contour therefore no overlap with Operational Area.	Yes – Fishing activities may be disrupted by an oil spill. Adult crabs unlikely to be impacted due to depth of their habitat but eggs and larvae within plankton assemblage may be contacted by oil.
Recreational fishery		No – Usually closer to land	Yes - Fishing activities may be disrupted by an oil spill. Target species and habitat or target species may be directly impacted by oil. Eggs and larvae of target species within the plankton community may also be contacted by oil.
Aquaculture		No - None within Operational Area	Yes – Pearl farming occurs within the EMBA at Montebello Islands. Oil could interfere with the production process or impact on pearl oysters directly through reduced water quality.
Oil and Gas		No - None within Operational Area	Yes - oil and gas activities within the EMBA could be disrupted by an oil spill.
Shipping		Yes - No designated shipping route within operational area with nearest located ~ 5 km northwest, other vessels may wish to transit the area although shipping traffic excluded from the Operational Area	Yes - Shipping routes are located within the EMBA. Shipping activities could be disrupted by an oil spill.

Socio-economic value	Sensitivities within Operational Area	Sensitivities within EMBA
Tourism	No - None within operational area.	Yes - Tourist activities within coastal areas of EMBA could be disrupted and long term impact to tourism could occur if tourist areas (e.g. coral reefs, beaches) are impacted by oil.
Cultural Heritage	No - None within or near the Operational Area	Yes –oil entrained oil could potentially contact the subsea <i>Tryal</i> shipwreck at Trial Rocks NW of the Montebello islands

4. CONSULTATION

4.1 Consultation Background

Jadestone Energy (Jadestone) has a Stakeholder Management Plan (SMP) (JS-70-PR-I-00034) that guides its stakeholder consultation responsibilities and activities for both of its Australian operations – Montara and Stag.

The SMP has been written to assist in consistently engaging with relevant persons across its approvals. This provides a strategic and systemic approach to relevant person consultation, aiming to foster an environment where ongoing, open dialogue and two-way communication is undertaken to build positive relationships. This approach is in line with the International Association for Public Participation (IAP2) spectrum.

Stag is an existing facility that has been in operation since 1998. The previous operator had a Consultation Strategy that incorporated providing regular updates of Stag related activities to relevant persons. As a result, the identified relevant persons have been informed and consulted on a regular basis for some time.

Relevant persons were originally identified and classified according to criteria outlined in a consultation plan based on their interest / activity / function for the operations activity in 2016. A review of the originally identified and classified relevant persons was undertaken in June 2020 when the operations activity was planned to change from having a floating storage and offtake vessel in the field, to a third-party tanker. Relevant persons were again identified as part of previous drilling scopes in 2021 and 2022, and as part of this EP revision in 2022 and 2023.

The SMP has now been further updated for the purpose of complying with the decision of the Federal Court in *Tipakalippa v National Offshore Petroleum Safety and Environment Management Authority (No 2)* (the Tipakalippa Decision), the outcome of the subsequent unsuccessful appeal against the Decision, and the NOPSEMA *Guideline Consultation in the course of preparing an environment plan* (N-04750-GL2086 A900179) published on 15 December 2022.

4.2 Consultation Purpose

Notwithstanding the consultation described in Section 4.1 above, Jadestone is well advanced in the planning for and the arrangements for further consultation, including with recently identified additional relevant persons, for the purpose of ensuring its consultation satisfies the applicable Regulations and full compliance with the Tipakalippa Decision, the appeal outcome and the NOPSEMA Guideline.

Jadestone also undertakes consultation for the purpose of compliance with its internal policies and procedures, and in recognition of its broader corporate responsibilities.

4.3 Applicable regulations

The OPGGS (E) Regulations 2009 stipulate several requirements in relation to consultation associated with an EP (Table 4-1).

Table 4-1: Applicable regulatory requirements

Legislation	Summary	Requirement
OPGGS Act S 280	No interference	A person carrying out activities in an offshore permit area should not interfere with other users of the offshore area to a greater extent than is necessary for the reasonable exercise of the rights and performance of the duties of the first person.

<p>OPGGS(E)R 13</p>	<p>Environment description</p>	<p>Description of the environment</p> <p>(2)The environment plan must:</p> <p>(a)describe the existing environment that may be affected by the activity; and</p> <p>(b)include details of the particular relevant values and sensitivities (if any) of that environment.</p> <p>Note: The definition of environment in regulation 4 includes its social, economic and cultural features.</p> <p>(3)Without limiting paragraph (2)(b), particular relevant values and sensitivities may include any of the following:</p> <p>(a)the world heritage values of a declared World Heritage property within the meaning of the EPBC Act;</p> <p>(b)the national heritage values of a National Heritage place within the meaning of that Act;</p> <p>(c)the ecological character of a declared Ramsar wetland within the meaning of that Act;</p> <p>(d)the presence of a listed threatened species or listed threatened ecological community within the meaning of that Act;</p> <p>(e)the presence of a listed migratory species within the meaning of that Act;</p> <p>(f)any values and sensitivities that exist in, or in relation to, part or all of:</p> <p>(i)a Commonwealth marine area within the meaning of that Act; or</p> <p>(ii)Commonwealth land within the meaning of that Act.</p>
<p>OPGGS(E)R 11A(1)</p>	<p>Relevant persons</p>	<p>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):</p> <p>(a) each Department or agency of the Commonwealth to which the activities to be carried out under the environment plan, or the revision of the environment plan, may be relevant;</p> <p>(b) each Department or agency of a State or the Northern Territory to which the activities to be carried out under the environment plan, or the revision of the environment plan, may be relevant;</p> <p>(c) the Department of the responsible State Minister, or the responsible Northern Territory Minister;</p> <p>(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, being limited to the conduct of the activity that is authorised under the environment plan and not extending to a hypothetical, remote or speculative consequence from an activity such as a major oil spill;</p>

		(e) any other person or organisation that the titleholder considers relevant.
OPGGS(E)R 11A(2)	Sufficient information	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.
OPGGS(E)R 11A(3)	Reasonable period	The titleholder must allow a relevant person a reasonable period for consultation.
OPGGS(E)R 11A(4)	Sensitive information	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.
OPGGS(E)R 9(8)	Sensitive information	All sensitive information (if any) in an environment plan, and the full text of any response by a relevant person to consultation under regulation 11A 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.
OPGGS(E)R 14(9)	Ongoing consultation	The implementation strategy of the environment plan must provide for appropriate consultation with: (a) Relevant authorities of the Commonwealth, a State or Territory; and (b) Other relevant interested persons or organisations.
OPGGS(E)R 16(b)	Consultation report	The environment plan must contain: A report on all consultations between the titleholder and any relevant person, for regulation 11A, that contains: (i) A summary of each response made by a relevant person; (ii) An assessment of the merits of any objections or claim about the adverse impact of each activity to which the environment plan relates; (iii) A statement of the titleholder's response, or proposed response, if any, to each objection or claim; and (iv) A copy of the full text of any response by a relevant person.
OPGGS(E)R 10A	Measures adopted from consultations are appropriate	For regulation 10, the criteria for acceptance of an environment plan are that the plan: (g) demonstrates that: (i) the titleholder has carried out the consultations required by Division 2.2A; and (ii) the measures (if any) that the titleholder has adopted, or proposes to adopt, because of the consultations are appropriate.
OPGGS(E)R 27	Storage of records	<ul style="list-style-type: none"> • Records must be stored in a way that makes retrieval reasonably practicable; • Records must be kept for five years; and

		<ul style="list-style-type: none"> Records generated through preparation of the environment plan, demonstrating environmental performance, incidents, emissions and discharges, calibration and maintenance, and in relation to the implementation strategy arrangements must be kept.
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4.4 Applicable case law and guidance

The OPGGS(E) Regulations are the legal basis for undertaking offshore operations in the oil and gas industry. These Regulations are administered by NOPSEMA who are responsible for ensuring compliance.

A judicial review of a NOPSEMA decision to accept the Barossa Development Drilling and Completions Environment Plan was undertaken by Justice Bromberg. Justice Bromberg found in favour of the Applicant (Dennis Murphy Tipakalippa), that NOPSEMA could not be reasonably satisfied that all relevant persons were consulted as is required under regulations 10A and Division 2.2A, and set aside the accepted EP (*Tipakalippa v National Offshore Petroleum Safety and Environmental Management Authority (No. 2) [2022] FCA 1121*).

Santos NA Barossa Pty Ltd appealed the Decision made by Justice Bromberg, with a hearing held 15–16 November 2022. Justices Kenny, Mortimer and Lee reviewed the Decision and found in favour of the Applicant and confirmed that the Santos EP should be set aside (*Santos NA Barossa Pty Ltd v Tipakalippa [2022] FCAFC 193 (the Appeal)*).

Based on these findings NOPSEMA developed a Guideline “*Consultation in the course of preparing an environment plan Doc No N-04750-GL2086 A900179*” to assist titleholders in comply with their obligations to consult relevant persons.

That guidance being:

1. The representative bodies (Land Councils and Prescribed Body Corporates (PBCs) remain relevant persons.
2. Traditional Owner Clans are also relevant persons, i.e. they need to be actively consulted, and therefore through that process need to be given every encouragement to respond, formally through their representative spokesperson/s, i.e. the Clan leaders, generally identified as Elders.
3. The residents of the Indigenous lands are to be consulted, although those residents are not required to be individually identified and consulted directly. Rather providing reasonable means for those residents to become aware of a project, and its associated potential impacts and remedies, with a reasonable means to respond to the titleholder and a reasonable time to respond, is likely to be sufficient.

Consequently, Jadestone has sought to:

1. Identify each relevant Traditional Owner Clan and the persons who can be regarded as their representative spokesperson/s.
2. Ensure every reasonable effort is made to provide the project information in a way that is clear and able to be understood by the Clan, and that the Clan (through their representative spokesperson/s) provide a response to Jadestone, even if a considered ‘no response’.
3. Decide on the reasonable means by which residents are to become aware of a project,

similarly in a way that is clear and able to be understood by residents, and their response opportunities.

Jadestone has taken particular care in gaining an understanding of the construct of a Traditional Owner Clan. That is, Native Title holders associated with a Prescribed Body Corporate (generally an Aboriginal Corporation) as a result of a Native Title Determination.

Jadestone notes also that the Decision and the Appeal has implications also for consultation with the fishing industry, i.e., how individual fishery licence holders are to be regarded.

This Decision must be applied as law and has been thoroughly considered and applied in the development of this EP, including but not limited to the following (extracts from the Decision, emphasis added):

- 138 *For the exercise of identifying the universe of relevant persons falling within the description in reg 11A(1)(d), the titleholder will have to be faithful to that description. The titleholder will need to properly understand its proposed activity and at least broadly understand the extent of the physical environment that may be affected, the values and sensitivities in that physical environment and thus the functions, interests or activities of each person or each category of persons that may intersect with that physical environment.*
- 139 *The exercise of identifying the universe of relevant persons within the description in reg 11A(1)(d) is capable of being described person by person, category by category, or alternatively, by the titleholder describing the methodology utilised in terms which, as stated above, demonstrate an understanding of the considerations that have to be and which were taken into account in order for the exercise to be faithfully consistent with the description of relevant person in reg 11A(1)(d) (a methodological demonstration). A critical aspect of such a demonstration would be the identification of the totality of the sensitivities and values considered relevant and how each was evaluated to discover their possible intersection with the functions, interests and activities of particular people or organisations.*
- 140 *If that were done in an environment plan, NOPSEMA could then properly arrive at the foundational conclusion for the remainder of its tasks in relation to the consultation criteria, that the environment plan demonstrates that the universe of relevant persons was identified by the titleholder consistently with the description of a relevant person provided by reg 11A(1).*

4.5 Relevant Persons Identification Methodology

4.5.1 Relevant person methodology workflow

To ensure that all relevant persons for Stag are identified (self-identifying relevant persons excepted) Jadestone has now carried out, with regard to the Regulations and the applicable case law summarised in **Section 4.4**, a methodological approach to identification has been adopted (**Figure 4-2**). This builds on the historical consultation already undertaken.

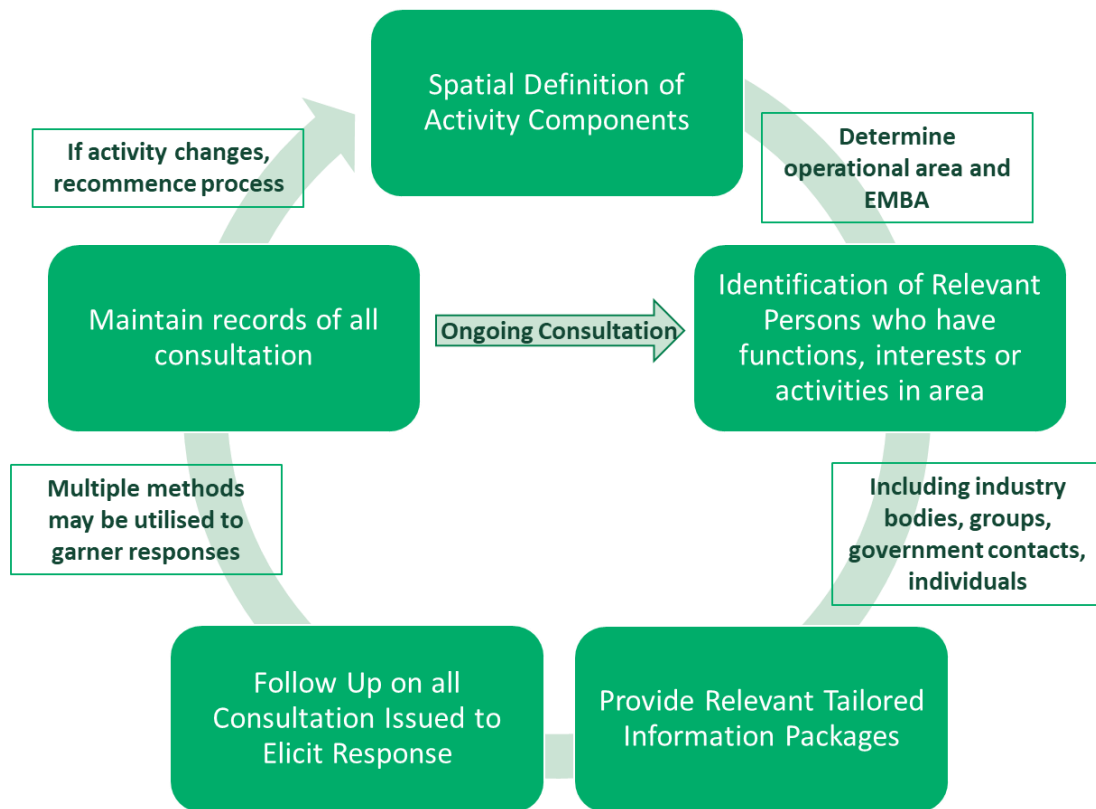


Figure 4-1: Relevant Person Identification and Consultation Process

4.5.2 Approach to identifying organisations and people

Organisations and people within each relevant person category were identified using the following steps and resources:

- Jadestone’s stakeholder database for Stag contains a list of organisations and people identified since 1998. Following the methodology applied to identify relevant person categories the database was reviewed for the purpose of identifying potential gaps in relevant persons;
- Jadestone has also contracted consultants with experience in stakeholder consultation in the Australian petroleum industry, including the identification of relevant persons, and also consultation and negotiation with Indigenous peoples in those coastal areas of Western Australia adjacent to the Stag EMBA.

As a result of the above, and also as a consequence of the Decision, the Appeal and the NOPSEMA Guideline, Jadestone identified gaps in relevant persons that had not been consulted, being a number of individual commercial fishery licence holders in both Commonwealth and Western Australian fisheries that intersect with the EMBA, and the Traditional Owner Clans with coastline, near shore and sea country interests within or immediately adjacent to the EMBA, and cruise, charter and dive operators operating in waters off of the Mid-West and Pilbara coast of Western Australia.

4.5.3 Approach to identifying Commercial Fishers

Jadestone has access to lists of all the individual commercial fishery licence holders in the Commonwealth and Western Australian fisheries that intersect with the EMBA and for the purpose of consultation will now undertake the approach described below for those that have not yet been consulted with on the Stag:

1. Initially, all licence holders in the relevant Commonwealth and Western Australian commercial fisheries were consulted, noting that the number of individual licence holders is significant, but the designated areas of many of the fisheries are over large areas of the Australian coast. Examination of the postal addresses of the individual licence holders suggests that many of those licence holders do not fish at any time within the EMBA.
2. The initial consultation included a request that those individual licence holders that do fish within the EMBA indicate that in return correspondence.

It is anticipated that analysis of the responses including, as appropriate, follow up communication, will therefore enable future consultation activities to be with only those individual licence holders that have been identified through the analysis as relevant persons.

The peak bodies representing the individual licence holders in each commercial fishery will continue to be consulted as relevant persons.

4.5.4 Approach to identifying First Nation Peoples

The Decision, the Appeal and the NOPSEMA Guideline has led to a significant change to the approach now required for identifying and consulting with Indigenous stakeholders. The past wide-spread practice of consulting only with the Land Councils and the Prescribed Body Corporates (PBCs) (the Aboriginal Corporations representing Traditional Owner Clans), and not the Traditional Owner Clans themselves, is no longer appropriate. If a Traditional Owner Clan is identified as a relevant person, consultation is required to be with the Clan, and wherever possible face-to-face on country.

Given the Sea Country values and sensitivities (refer Section 3.9.7) Jadestone acknowledges that First Nations peoples will be relevant persons in relation to the activities set out in this EP.

Nevertheless, legislative requirements mean working through the Land Councils and the PBCs is generally the required means by which the consultation with the Traditional Owners Clans is to be facilitated.

Therefore, Jadestone has engaged with the Yamatji Marlpa Aboriginal Corporation (YMAC), to seek:

- details of the Traditional Owner Clans with coastline, near shore and sea country within the EMBA.
- advice on the most appropriate and effective means of consulting directly with those Clans.

Additionally, Jadestone has requested the assistance of YMAC to consult with those Clans. YMAC will continue to be identified as a relevant person.

4.5.5 Non-Government Environment Groups

Jadestone Energy has also now carried out a review to identify the groups that may have interests in the environment of the area within the EMBA and more broadly and added in those groups as relevant persons.

4.5.6 Self-identified relevant persons

Promulgation of project information, by whatever means, may result in the addition of additional relevant persons through self-identification.

4.6 Project Activities

Chapter 3 of this EP details the activity description including the location, timing, infrastructure, vessels, and each relevant on-going Stag activity.

4.7 Environment, Values and Sensitivities

4.7.1 Spatial extent of the environment that may be affected

Section 3 of the EP sets out a detailed description of the environment that commences with the spatial extent of the EMBA, different zones and thresholds within the area, enabling the first step in identification of relevant person categories.

4.7.2 Totality of environmental values and sensitivities

The totality of the defined activities, the EMBA, the relevant values and sensitivities of that environment, identification and assessment of risks and impacts, have been re-assessed to identify where a person's or organisation's functions, interests or activities may be affected by the activities to be carried out in the EP.

Consistent with the description of relevant person provided by Regulation 11A(1), to be affected means the functions, interests or activities of a person or organisation would be changed by activities to be carried out under the EP, including the totality of the environment values and sensitivities considered relevant.

4.7.3 Relevant persons Categories – regulation 11A (1)(a), (b), (c), (d) and (e)

Table 4-2 outlines the government departments and agencies that have been identified as relevant within Regulation 11A (1)(a), (b), (c), (d) and (e).

Table 4-2: Assessment of Relevance of Identified Stakeholders

Relevant person	Relevance to the Activity	Functions, interest or activities
Commonwealth government department or agency		
Australian Fisheries Management Authority (AFMA)	Considered relevant persons under Regulation 11A(1)(a)	<p>AFMA is the Australian Government agency responsible for the efficient management and sustainable use of Commonwealth fish resources on behalf of the Australian community.</p> <p>AFMA manages and monitors commercial Commonwealth fishing to ensure Australian fish stocks and the Australian fishing industry is viable now and in the future.</p> <p>Relevant when the activity has the potential to impact on fisheries resources in AFMA-managed fisheries.</p>
Australian Hydrographic Office (AHO)	Considered relevant persons under Regulation 11A(1)(a)	<p>AHO is part of the Department of Defence, responsible for providing Australia’s national charting service under the terms of SOLAS and the Navigation Act 2012 (Cth).</p> <p>Role includes provision of nautical charting (including charts in electronic form) and associated services in support of maritime safety.</p> <p>Responsible for the publication and distribution of nautical charts and other information required for the safe shipping and navigation in Australian waters.</p> <p>Relevant when the activity may impact operational requirements and where nautical products and other maritime safety and information is required to be updated, including Notice to Mariners.</p>
Australian Maritime Safety Authority (AMSA)	Considered relevant persons under Regulation 11A(1)(a)	<p>AMSA is the statutory authority established under the Australian Maritime Safety Act 1990.</p> <p>Principal functions are promoting maritime safety and protection of the maritime environment, preventing and combating ship-sourced pollution in the marine environment, providing infrastructure to support safety of navigation in Australian waters, and providing national search and rescue service to the maritime and aviation sectors.</p>

Relevant person	Relevance to the Activity	Functions, interest or activities
Clean Energy Regulator (CER)	Considered relevant persons under Regulation 11A(1)(a)	<p>The Clean Energy Regulator administers schemes legislated by the Australian Government for measuring, managing, reducing or offsetting Australia's carbon emissions, determined by climate change law.</p> <p>The Regulator has administrative responsibilities for the National Greenhouse and Energy Reporting Scheme, the Emissions Reduction Fund, the Renewable Energy Target and the Australian National Registry of Emissions Units.</p> <p>As an economic regulator, the Regulator does not have any direct role or powers under our legislation to enforce work health and safety, environmental protection, or planning laws.</p>
Department of Agriculture, Fisheries & Forestry (DAFF)	Considered relevant persons under Regulation 11A(1)(a)	<p>Department responsible for managing biosecurity for incoming goods and conveyances.</p> <p>Activities such as seismic surveys, drilling, exploration, geotechnical surveys, construction and installation of sub-sea infrastructure have the potential to affect commercially important fish species, their prey and habitats, and the business activities of commercial fishers.</p> <p>Relevant due to the potential for the transfer of marine pest between MODU, vessels and the mainland</p>
Department of Defence (DOD)	Considered relevant persons under Regulation 11A(1)(a)	<p>Responsible for Australian defence activities.</p> <p>Relevant when the activity encroaches on known training areas and /or restricted airspace.</p>
Department of Industry, Science & Resources (DISR)	Considered relevant persons under Regulation 11A(1)(a)	<p>DISR is responsible for development and reform of policy relating to the resources sector, including oil and gas.</p> <p>Relevant due to influence on Commonwealth Government sector policy.</p>
Director of National Parks Parks Australia, part of the Department of Climate Change, Energy, the Environment and Water (DCCEEW)	Considered relevant persons under Regulation 11A(1)(a)	<p>Parks Australia supports the Director of National Parks who has responsibility under federal environment law for six Commonwealth national parks, the Australian National Botanic Gardens and 60 Australian Marine Parks.</p> <p>Relevant when activities undertaken outside of an Australian Marine Park may impact on the values within a Marine Park.</p>

Relevant person	Relevance to the Activity	Functions, interest or activities
Maritime Border Command (MBC), part of Australian Border Force (ABF), part of the Department of Home Affairs (DHA)	Considered relevant persons under Regulation 11A(1)(a)	MBC is enabled by ABF and the Australian Defence Force (ADF), supporting the whole of government effort to protect Australia's national interests by responding with assigned maritime and air assets for civil maritime security operations. Relevant when the activity may impact on border protection activities (e.g. vessel patrols).
National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA)	Considered relevant persons under Regulation 11A(1)(a)	NOPSEMA is Australia's independent expert regulator for health and safety, structural (well) integrity and environmental management for all offshore oil and gas operations and greenhouse gas storage activities in Commonwealth waters, and in coastal waters where regulatory powers and functions have been conferred.
National Offshore Petroleum Titles Administrator (NOPTA)	Considered relevant persons under Regulation 11A(1)(a)	NOPTA is responsible for the day-to-day administration of petroleum & greenhouse gas titles in Commonwealth waters in Australia.
WA government department of agency		
Department of Biodiversity, Conservation and Attractions (DBCA)	Considered relevant persons under Regulation 11A(1)(b)	Manage State marine parks and reserves and protected marine fauna and flora. Relevant when activities undertaken outside of a marine park may impact on the values within a marine park.
Department of Mines, Industry Regulation and Safety (DMIRS)	Considered relevant persons under Regulation 11A(1)(b)	The mission of DMIRS is to support a safe, fair and responsible future for the Western Australian community, industry and resources sector. The DMIRS Resource and Environmental Regulation Group is responsible for regulating one of Western Australia's largest industry sectors, and plays a critical role in building Western Australia's economy while ensuring the State's resources are developed in a sustainable and responsible manner.
Department of Planning, Lands & Heritage (DPLH)	Considered relevant persons under Regulation 11A(1)(b)	Protect aboriginal heritage, assist with compliance with the Aboriginal Heritage Act 1972 and provide access to heritage information. Relevant if the activity results in impacts to Aboriginal heritage.

Relevant person	Relevance to the Activity	Functions, interest or activities
Department of Primary Industries and Regional Development (DPIRD)	Considered relevant persons under Regulation 11A(1)(b)	A primary responsibility of the Department of Primary Industries and Regional Development is to conserve, sustainably develop and share the use of Western Australia's aquatic resources and their ecosystems for the benefit of present and future generations, through managing fisheries and aquatic ecosystems, assessment and monitoring of fish stocks, enforcement and education, biosecurity management and licensing commercial and recreational fishing activity, including commercial aquaculture.
Department of Transport (DOT)	Considered relevant persons under Regulation 11A(1)(b)	In accordance with the Western Australian Emergency Management Act 2005 (the Act) and Emergency Management Regulations 2006 (the Regulations), the WA DoT is the Hazard Management Agency (HMA) for the Marine Oil Pollution (MOP) hazard in State waters. The MOP hazard is prescribed in the Regulations as an; 'actual or impending spillage, release or escape of oil or an oily mixture that is capable of causing loss of life, injury to a person or damage to the health of a person, property or the environment'.
Department of Water & Environmental Regulation (DWER)	Considered relevant persons under Regulation 11A(1)(b)	The Department is responsible for managing and regulating the state's environment and water resources
Local Government Authorities		
City of Karratha	Considered relevant persons under Regulation 11A(1)(d)	Local government area in the Pilbara region.
Shire of Ashburton	Considered relevant persons under Regulation 11A(1)(d)	Local government area in the Pilbara region.
Shire of Exmouth	Considered relevant persons under Regulation 11A(1)(d)	Local government area in the Gascoyne region.
Oil and Gas Industry		
Australian Maritime Oil Spill Centre (AMOSC)	Considered relevant persons under Regulation 11A(1)(d)	AMOSC operates the Australian oil industry's major oil spill response facility. AMOSC's stockpile of oil spill response equipment includes oil spill dispersant and containment, recovery, cleaning, absorbent and communications equipment. Relevant due to the immediate availability of support in recovering from an oil spill event.

Relevant person	Relevance to the Activity	Functions, interest or activities
Oil Spill Response Limited (OSRL)	Considered relevant persons under Regulation 11A(1)(d)	OSRL is the largest international industry-funded oil spill response cooperative, and provides preparedness, response and intervention services anywhere in the world. Relevant due to the immediate availability of support in recovering from an oil spill event.
WA Commercial fishers and fishing associations		
Gascoyne Demersal Scalefish Fishery	Considered relevant persons under Regulation 11A(1)(d)	Consultation through mail-out of Invitation for Consultation, follow-up mail-out and through WAFIC. Relevant when the activity could impact on commercial fishing activity.
Mackerel Managed Fishery	Considered relevant persons under Regulation 11A(1)(d)	Consultation through mail-out of Invitation for Consultation, follow-up mail-out and through WAFIC. Relevant when the activity could impact on commercial fishing activity.
Marine Managed Aquarium Fishery	Considered relevant persons under Regulation 11A(1)(d)	Consultation through mail-out of Invitation for Consultation, follow-up mail-out and through WAFIC. Relevant when the activity could impact on commercial fishing activity.
Nickol Bay Prawn Fishery	Considered relevant persons under Regulation 11A(1)(d)	Consultation through mail-out of Invitation for Consultation, follow-up mail-out and through WAFIC. Relevant when the activity could impact on commercial fishing activity.
Northern Demersal Scalefish Fishery	Considered relevant persons under Regulation 11A(1)(d)	Consultation through mail-out of Invitation for Consultation, follow-up mail-out and through WAFIC. Relevant when the activity could impact on commercial fishing activity.
Pilbara Crab Fishery	Considered relevant persons under Regulation 11A(1)(d)	Consultation through mail-out of Invitation for Consultation, follow-up mail-out and finished WAFIC. Relevant when the activity could impact on commercial fishing activity.
Pilbara Demersal Scalefish Fishery	Considered relevant persons under Regulation 11A(1)(d)	Consultation through mail-out of Invitation for Consultation, follow-up mail-out and through WAFIC. Relevant when the activity could impact on commercial fishing activity.
Onslow Prawn Managed Fishery	Considered relevant persons under Regulation 11A(1)(d)	Consultation through mail-out of Invitation for Consultation, follow-up mail-out and through WAFIC. Relevant when the activity could impact on commercial fishing activity.
Specimen Shell Managed Fishery	Considered relevant persons under Regulation 11A(1)(d)	Consultation through mail-out of Invitation for Consultation, follow-up mail-out and through WAFIC. Relevant when the activity could impact on commercial fishing activity.

Relevant person	Relevance to the Activity	Functions, interest or activities
Western Australian Fishing Industry Council (WAFIC)	Considered relevant persons under Regulation 11A(1)(d)	Peak industry body representing the interests of the Western Australian commercial fishing, pearling and aquaculture sectors. Relevant when the activity could impact on commercial fishing activity.
Commonwealth Commercial fishers and fishing associations		
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	Considered relevant persons under Regulation 11A(1)(d)	Peak body representing Southern Bluefin Tuna companies in Australia. The SBTF overlaps the EMBA.
North West Slope Trawl Fishery	Considered relevant persons under Regulation 11A(1)(d)	Consultation through mail-out of Invitation for Consultation and follow-up mail-out. Relevant when the activity could impact on commercial fishing activity.
Southern Bluefin Tuna Fishery	Considered relevant persons under Regulation 11A(1)(d)	Consultation through mail-out of Invitation for Consultation. ASBTIA subsequently confirmed there is no Southern Bluefin Tuna fishing effort within or adjacent to the EMBA. Relevant when the activity could impact on commercial fishing activity.
Western Deepwater Trawl Fishery	Considered relevant persons under Regulation 11A(1)(d)	Consultation through mail-out of Invitation for Consultation and follow-up mail-out. Relevant when the activity could impact on commercial fishing activity.
Western Skipjack Fishery	Considered relevant persons under Regulation 11A(1)(d)	Consultation through mail-out of Invitation for Consultation and follow-up mail-out. Relevant when the activity could impact on commercial fishing activity.
Western Tuna and Billfish Fishery	Considered relevant persons under Regulation 11A(1)(d)	Consultation through mail-out of Invitation for Consultation and follow-up mail-out. Relevant when the activity could impact on commercial fishing activity.
Commonwealth Fisheries Association (CFA)	Considered relevant persons under Regulation 11A(1)(d)	The peak body representing the collective rights, responsibilities and interests of a diverse commercial fishing industry in Commonwealth regulated fisheries. Relevant when the activity could impact on commercial fishing activity.

Relevant person	Relevance to the Activity	Functions, interest or activities
Seafood Industry Australia (SIA)	Considered relevant persons under Regulation 11A(1)(d)	<p>Seafood Industry Australia is committed to ensuring there is appropriate consultation between the Australian seafood industry and oil and gas companies on matters including impact, access, regulation and the long-term impacts to fish-stocks from petroleum-related activities.</p> <p>To that end, SIA has facilitated a series of frank conversations between the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) and interested parties on what adequate consultation with oil and gas companies means, and how it can be done better.</p> <p>SIA is a member of the NOPSEMA Transparency Taskforce Steering Committee and recently chaired a reinvigorated Seafood and Petroleum Industry Roundtable.</p> <p>Relevant when the activity could impact on commercial fishing activity.</p>
Recreational fishing associations		
Recfishwest (WA)	Considered relevant persons under Regulation 11A(1)(d)	<p>Peak body representing recreational fisheries in Western Australia.</p> <p>Relevant when the activity could impact on recreational fishing activity.</p>
First Nations peoples and representative bodies		
Buurabalayji Thalanyji Aboriginal Corporation	Considered relevant persons under Regulation 11A(1)(d)	<p>Relevant person and representative of Traditional Owners whose lands include coastline adjacent to the EMBA.</p> <p>Relevant when the activity could impact on the coast, near shore waters and sea country.</p>
Kariyarra Aboriginal Corporation	Considered relevant persons under Regulation 11A(1)(d)	<p>Relevant person and representative of Traditional Owners whose lands include coastline adjacent to the EMBA.</p> <p>Relevant when the activity could impact on the coast, near shore waters and sea country.</p>
Malgana Aboriginal Corporation	Considered relevant persons under Regulation 11A(1)(d)	<p>Relevant person and representative of Traditional Owners whose lands include coastline adjacent to the EMBA.</p> <p>Relevant when the activity could impact on the coast, near shore waters and sea country.</p>
Nanda Aboriginal Corporation	Considered relevant persons under Regulation 11A(1)(d)	<p>Relevant person and representative of Traditional Owners whose lands include coastline adjacent to the EMBA.</p>

Relevant person	Relevance to the Activity	Functions, interest or activities
		Relevant when the activity could impact on the coast, near shore waters and sea country.
Nganhurra Thanardi Garrbu Aboriginal Corporation	Considered relevant persons under Regulation 11A(1)(d)	Relevant person and representative of Traditional Owners whose lands include coastline adjacent to the EMBA. Relevant when the activity could impact on the coast, near shore waters and sea country.
Ngarluma Aboriginal Corporation	Considered relevant persons under Regulation 11A(1)(d)	Relevant person and representative of Traditional Owners whose lands include coastline adjacent to the EMBA. Relevant when the activity could impact on the coast, near shore waters and sea country.
Nyangumarta Karajarri Aboriginal Corporation	Considered relevant persons under Regulation 11A(1)(d)	Relevant person and representative of Traditional Owners whose lands include coastline adjacent to the EMBA. Relevant when the activity could impact on the coast, near shore waters and sea country.
Nyangumarta Warrarn Aboriginal Corporation	Considered relevant persons under Regulation 11A(1)(d)	Relevant person and representative of Traditional Owners whose lands include coastline adjacent to the EMBA. Relevant when the activity could impact on the coast, near shore waters and sea country.
Wanparta Aboriginal Corporation	Considered relevant persons under Regulation 11A(1)(d)	Relevant person and representative of Traditional Owners whose lands include coastline adjacent to the EMBA. Relevant when the activity could impact on the coast, near shore waters and sea country.
Wirrawandi Aboriginal Corporation	Considered relevant persons under Regulation 11A(1)(d)	Relevant person and representative of Traditional Owners whose lands include coastline adjacent to the EMBA. Relevant when the activity could impact on the coast, near shore waters and sea country.
Yamatji Marlpa Aboriginal Corporation (YMAC)	Considered relevant persons under Regulation 11A(1)(d)	Native title representative body for the Yamatji and Pilbara regions of WA, YMAC is a not-for-profit Aboriginal corporation. Relevant when the activity could impact on the coast, near shore waters and sea country.

Relevant person	Relevance to the Activity	Functions, interest or activities
Yinggarda Aboriginal Corporation	Considered relevant persons under Regulation 11A(1)(d)	<p>Relevant person and representative of Traditional Owners whose lands include coastline adjacent to the EMBA.</p> <p>Relevant when the activity could impact on the coast, near shore waters and sea country.</p>
eNGOs		
Australian Marine Conservation Society (AMCS)	Considered relevant persons under Regulation 11A(1)(d)	Australian national independent charity dedicated solely to protecting ocean wildlife and working for healthy seas with representation in Western Australia.
Conservation Council of Western Australia (CCWA)	Considered relevant persons under Regulation 11A(1)(d)	CCWA is WA's foremost not for profit, non-government conservation and environment organisation. A current active campaign of the CCWA is Say No to Scarborough Gas. Relevant due to in principle opposition to the extraction and use of fossil fuels. Would have the potential to delay but not prevent the Project going ahead.
Greenpeace	Considered relevant persons under Regulation 11A(1)(d)	Independent campaigning organisation that uses peaceful protest and creative confrontation to expose global environmental problems and promote solutions that are essential to a green and peaceful future.
The Wilderness Society (WA)	Considered relevant persons under Regulation 11A(1)(d)	<p>Public company that works to support the living world.</p> <p>They take on transnational corporations, rogue operators, and the armies of lobbyists and politicians who defend them in relation to projects that could affect the environment.</p> <p>They have been active in Western Australia in the past.</p>
World Wildlife Fund (WWF)	Considered relevant persons under Regulation 11A(1)(d)	Independent conservation organisation for the protection of wildlife in Australia and around the world.
Other Associations		

Relevant person	Relevance to the Activity	Functions, interest or activities
Australian Council of Prawn Fisheries	Considered relevant persons under Regulation 11A(1)(d)	Is made up of membership from local industry bodies and companies that deal with wild prawns or the prawn industry
Exmouth Game Fishing Club	Considered relevant persons under Regulation 11A(1)(d)	Is a non-profit organisation that is run by volunteers to promote and encourage recreational fishing in all its form. Relevant when the activity could impact on coastal waters and coastlines.
Karratha and Districts Chamber of Commerce and Industry	Considered relevant persons under Regulation 11A(1)(d)	A non-for-profit organisation delivering a unique range of services and representation to the Karratha business community.
King Bay Game Fishing Club	Considered relevant persons under Regulation 11A(1)(d)	The King Bay Game Fishing Club operates out of the Dampier Archipelago. Relevant when the activity could impact on coastal waters and coastlines.
Marine Tourism Association of Western Australia (MTWA)	Considered relevant persons under Regulation 11A(1)(d)	Represents the tourism industry in Western Australia (in the context of this project the fishing charter sector). Association currently has one Kimberley member. Relevant when the activity could impact on coastal waters and coastlines.
Nickol Bay Sportsfishing Club	Considered relevant persons under Regulation 11A(1)(d)	The Nickol Bay Sportsfishing Club is a division of the Hampton Harbour Boat and Sailing Club and is one of Western Australia's most successful Sportfishing Clubs. Relevant when the activity could impact on coastal waters and coastlines.
Port Authorities		
Pilbara Ports Authority	Considered relevant persons under Regulation 11A(1)(d)	Pilbara Port Authority encompasses the Port of Ashburton, Dampier, Port Hedland and Varanus Island. Relevant when the activity could impact on Port infrastructure and operations.
Academic and Research Organisations		
Australian Institute of Marine Science (AIMS)	Considered relevant persons under Regulation 11A(1)(d)	Organisation concerned with conservation and research outcomes in the area.

4.8 Consultation methodology

The approach Jadestone is undertaking for consultation in this EP is outlined below:

- Identify relevant persons (as per section 4.5);
- Provide detailed information sheet and area map to commence the consultations via various avenues such as consultation packages and the Jadestone website;
- Provide a table of risks and management measures for those seeking additional information;
- Respond to requests for additional information from relevant persons who have concerns or interests and offer direct consultation with relevant technical staff where applicable;
- Advertise and offer information sessions;
- Allow a reasonable period of time for the relevant person to review and respond to any information provided, at least four weeks;
- Follow up with relevant persons whose functions, interests, or activities may be affected by the activities of the EP, via phone, email/s or in person to ensure they have received the information and verify if they have remaining questions or concerns;
- Ensure relevant persons were informed about the consultation process and how their feedback, questions and concerns were considered in the EP, including the management of sensitive information.

A number of communication methods may be used to exchange information during consultation:

- Written documentation or information provided in person or remotely by methods such as post, email, via website or social media; and/ or
- Verbal communication during telephone calls (pre-emptory or in response / follow up), targeted meetings, focus groups, workshops, information sessions; and/or
- Other means as recommended, particularly in relation to cultural heritage values and sites.

Regardless of the method applied, the information provided to the relevant person has been targeted as much as possible to reduce the information burden on the relevant person, to reduce the possibility of confusion or misinformation, and to improve the likelihood of receiving valuable feedback from the consultation process. The methods Jadestone is using are listed below. The method/s adopted will depend on the nature and scale of an activity and advice on the most appropriate method as advised by each relevant person at the time of the initial consultation.

- Email
- Post
- Phone calls
- Public meetings, including by way of webinars
- For Traditional Owner Clans, presentations face-to-face on country
- Newspaper advertisements
- Social media
- Community noticeboards
- Liaison with other titleholders to collaborate in undertaking consultation and thereby reduce stakeholder fatigue.

4.9 Follow-up

Jadestone has adopted a number of strategies for following up its invitation for consultation actions.

4.9.1 General

Jadestone has developed a procedure (Figure 4-2) for follow-up with Commonwealth and State/Territory Government Departments, agencies and authorities, with Local Governments, with representative peak industry bodies, with other petroleum title holders, and with businesses, including tourism businesses. It should be noted that timeframes for follow up may change depending on the nature and scale of changes to activities and information provided to relevant persons.

Prior to the distribution of the tailored information packages determine the periods of time that trigger each phase of the follow up procedure.
 Excluding Fishery Licence Holders and First Nations Stakeholders

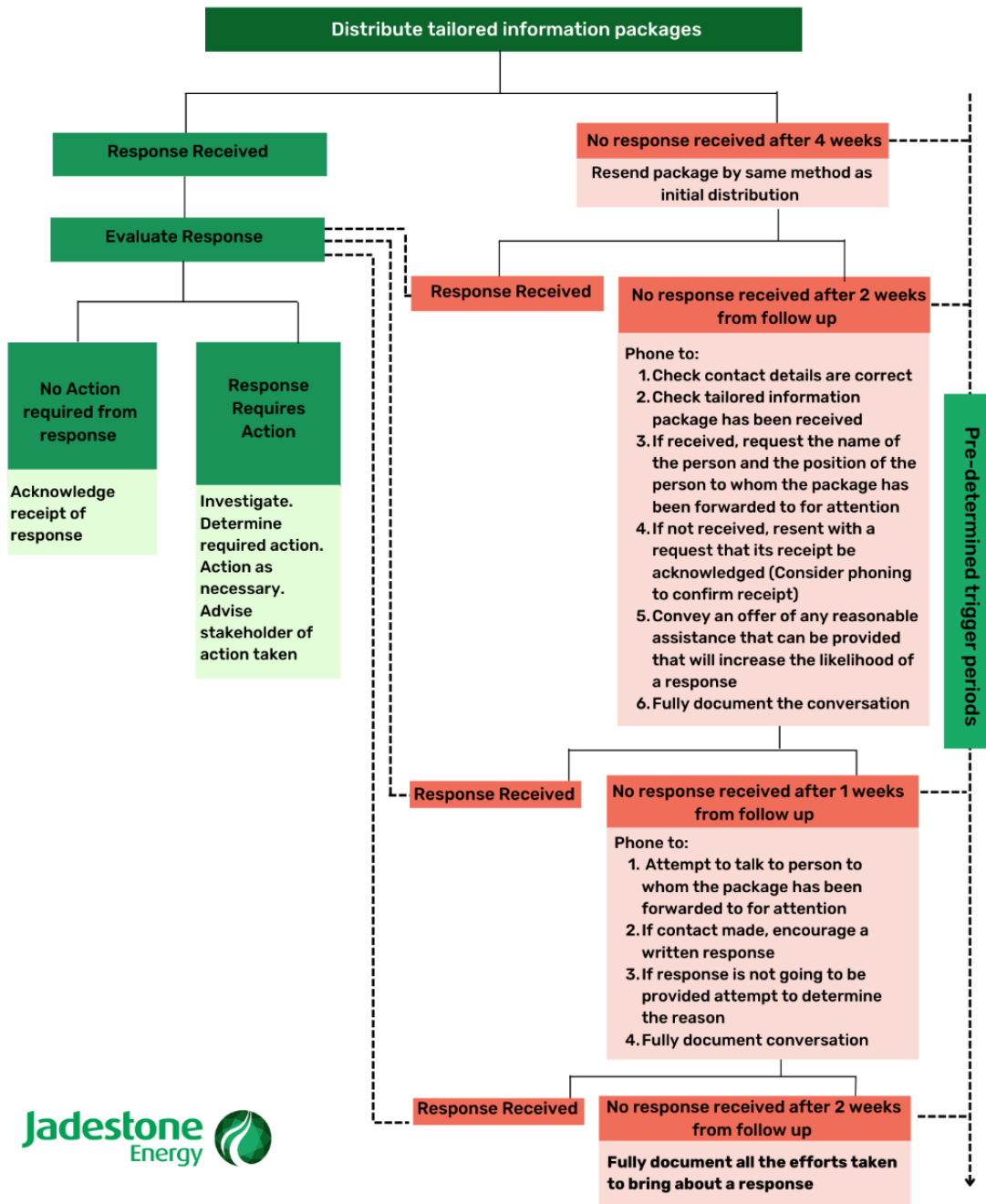


Figure 4-2: No response follow-up flowchart

4.9.2 Commercial Fishery Licence Holders

Initially, all 202 licence holders in the relevant Commonwealth and Western Australian commercial fisheries are consulted by an initial mail-out with Invitation for Consultation document, noting that the number of individual licence holders is significant, but the designated zones of many of the fisheries extend over large areas of the Australian coast. A review of the postal addresses of the individual licence holders suggests that many of those licence holders do not fish at any time within the EMBA. The initial consultation included a request that those licence holders that do fish within the EMBA indicate that in return correspondence.

The details of the no responders to the initial mailout are to be referred to the Western Australian Fishing Industry Council (WAFIC) and the Australian Southern Bluefin Tuna Industry Association (ASBTIA), with a request for assistance in identifying those licence holders that are known or believed not to fish in the portion of the fishing zone within or adjacent to the project EMBA.

A search is undertaken to identify an email address for each licence holder.

Based on analysis of the addresses of licence holders, and the advice of WAFIC and ASBTIA, follow-up correspondence (mailout or email) is sent to all no responders that are known or believed to fish in the portion of the fishing zone within or adjacent to the project EMBA.

ASBTIA has indicated that no commercial Southern Bluefin Tuna fishing effort is undertaken within or adjacent to the EMBA, so these licence holders have been removed from the follow-up mail out.

Jadestone anticipates that analysis of the responses including, as appropriate, through follow up communication, future consultation activities to be with only those licence holders that have been identified as relevant persons.

4.9.2 Newspaper Adverts

To assist relevant persons to self-identify display adverts inviting consultation were placed in a number of newspapers (**Appendix E**):

- The Australian (25/03/2023)
- The West Australian (25/03/2023)
- North West Telegraph (22/03/2023)
- Koori Mail (22/03/2023)
- Pilbara News (22/03/2023)
- MidWest Times (22/03/2023)

4.10 Provision of Information

- The OPGGS(E) Regulations require titleholders to give each relevant person sufficient information to allow the relevant person to make an informed assessment of potential effects on their functions, interests or activities from the activities in the EP. Provision of information is responsive and adaptive to the individual needs and circumstances of the relevant person seeking the information.

Updates on the Stag project, and advice about future activities have been provided via email and published on the Jadestone website. Copies of these emails (and responses from relevant persons) have and consultation specific to this EP revision has been included in **Appendix E** and the Sensitive Information Report submitted to NOPSEMA.

4.11 Management of Objections and Claims

Objections or claims raised by relevant persons during consultation will be assessed and substantiated, as appropriate, by evidence, such as publicly available credible information and/or scientific data, including fishing data.

Where the objection or claim is substantiated, it will be assessed against Jadestone’s risk assessment process and, where appropriate, controls applied to manage impacts and risks to ALARP and an acceptable level. Relevant persons will be provided with feedback as to how their objection or claim has been assessed and if any controls were put in place to manage the risk or impact or risk to ALARP and an acceptable level. If the objection or claim is raised after the EP is accepted and triggers a revision of the EP this will be managed in accordance with Jadestone’s Management of Change processes and the relevant person will be advised of the process.

4.12 Ongoing consultation with relevant persons

Jadestone will continue to consult with relevant persons by providing project updates as information becomes available, including updates in relation to specific activities and broader project information, via emails and the provision of information on the Jadestone website. **Table 4-3** outlines the ongoing consultation (and timing) requirements for the activity. Records of ongoing relevant person engagement are maintained in Jadestone’s electronic Data Management System (eDMS).

Table 4-3: Standard Consultation Actions

Activity	Frequency and method	Responsibility
Provisions of updates on activity progress	Updates to Jadestone website on the Stag Operations activity provided as needed	HSE Manager
Notification of Australian Hydrographic Office	No less than four weeks prior to any significant change to operations commencing email AHO (datacentre@hydro.gov.au) for the promulgation of related notices to mariners.	HSE Manager
Notification of AMSA Joint Rescue Coordination Centre (JRCC)	To notify AMSA’s JRCC (rccaus@amsa.gov.au Ph 1800 641 792) 24-48 hrs prior to operations commencing with following details regarding the unit: <ul style="list-style-type: none"> • Name • Call sign • Maritime mobile service identity (MMSI) • Satellite communications details (including INMARSAT-C and satellite telephone) • Area of operation • Requested clearance from other vessels • Operations start and end. 	HSE Manager

Activity	Frequency and method	Responsibility
Notification of DPIRD (Fisheries)	No less than 4 weeks prior to operations commencing notify DPIRD (Fisheries) of actual commencement date and any change to proposal.	HSE Manager
Notification of updates to Recfishwest on progress and changes to intended operations and commencement and cessation of activity	Notification as required (aaron@recfishwest.org.au)	Environment Lead
Notification of Director National Parks	No less than 4 weeks prior to operations commencing notify DNP of actual commencement date and any change to proposal.	HSE Manager
Close out of communication commitments made during pre-start consultation including: <ul style="list-style-type: none"> Notification of NOPSEMA EP approval to stakeholders that have requested 	Email stakeholder contact within 3 months of EP approval	HSE Manager
Review of relevant persons list	Annually unless triggered earlier	General Manager
Provide response organisations with a copy of the OPEP	Email response organisations within 3 months of acceptance	ER Lead
Notification of commencement activity to NOPSEMA	Acceptance of the EP is taken to be the notification of commencement of the activity	Environment Lead
Notification of updates to JRCC on progress and changes to intended operations	Notification as required	Environment Lead

Any new relevant persons or changes to existing relevant persons will be identified through ongoing consultation through the EP review processing in accordance with Section 4.5. Where new relevant persons are identified, they will be contacted and provided information about the activity relevant to their functions, interests or activities. Any objections or claims will be managed as per **Section 4.11**.

Jadestone will undertake additional triggered consultation as outlined below, should an unplanned event occur (refer to **Table 4-4**).

Table 4-4: Triggered Consultation Actions

Trigger	Action	Responsibility
Feedback received from relevant person	Follow consultative process outlined in of the Stakeholder Management Plan.	General Manager

Deviation to Stag operations from those originally provided in consultation	Notification to relevant persons via email. Email DPIRD stakeholder contact a minimum of 4 weeks prior to commencement of any varied activity. Notify AMP Director General any change to risk within AMPs.	General Manager
Change to risk profile in operational area	Notification to relevant persons via email Re-engage for consultation if quantum of risk change significant.	General Manager
Change to risk profile in EMBA	Notification to relevant persons via email.	General Manager
Loss of Well Control event	Trigger separate Loss of Well control consultation process. Notification to response agencies and government agencies as per OPEP. Attempt to electronically notify all relevant persons within 72 hours of spill. Notify AMP Director General of spill response activities within AMP (prior to response activities within a MP) on 0419 293 465. To include titleholder details, time and location of the incident, proposed response arrangements and locations as per the OPEP, confirmation of providing access to relevant monitoring and evaluation reports when available and contact details for the response coordinator.	IMT Lead
Biosecurity incident: suspected marine pest or disease	Notification of DPIRD via Aquatic.Biosecurity@dpird.wa.gov.au or 1800 815 507 within 24 hours.	HSE Manager
Change to Offshore Petroleum Greenhouse Gas Storage (Environment) Regulations 2009 consultative requirements	Review of Stakeholder Management Plan.	HSE Manager
Change to Stag's operating jurisdiction such that other legislative instruments stipulate new or additional consultative requirements	Review of Stakeholder Management Plan.	Country Manager
An element of Jadestone's continuous improvement process identifies the procedure needs to be amended	Review of Stakeholder Management Plan.	Country Manager
AMP access	Notify AMP Director General of SMP (or other response activities) within AMP 10 days prior to entering (where possible) and at the cessation of activities in AMPs.	IMT Leader

Change to infrastructure that affects exclusion zone	Notify the Australian Hydrographic Service of activities and infrastructure for inclusion in Marine Notices.	Operations Manager
SMP activation and termination	Notify relevant persons of SMP commencement 10 days prior to and at the cessation of activities.	HSE Manager

4.13 Engagement Process

4.13.1 Historical engagement

Stag is an existing facility that has been in operation since 1998. The previous operator had a Consultation Strategy that incorporated updates to relevant persons of Stag related activities. As a result, relevant persons identified for Stag have been informed and consulted on a regular basis for some time.

Jadestone Energy purchased the existing Stag Facility from Quadrant Energy in 2016 and had already been in contact with many stakeholders regarding their intended review of the Operations Environment Plan. This included engaging WAFIC to consult with the relevant Western Australian managed commercial fisheries and fishing associations.

Following the completion of the purchase updates on the Stag project, and advice about future activities were provided via email to stakeholders and posted on the Jadestone website. Key notices were issued in February 2018, when an email with drilling update fact sheet (general and fisheries) was sent to relevant persons and in January 2019 a commencement of drilling notification email was sent to relevant persons. In March 2020 an email with fact sheet was sent to relevant persons notifying them that Jadestone was preparing an EP for ongoing drilling operations over the coming 5 years.

4.13.1 Additional Consultation – Stag 50H and 51H Drilling EP

Additional consultation was undertaken as part of the Stag 50H and 51H Drilling EP (GF-70-PLN-I-00008), including:

- December 2021 – Email with factsheet (general and fisheries package) sent to relevant persons notifying them of two EPs at Stag facility – ongoing production and maintenance at the Stag facility over the next 5 years and plug and abandonment of two production wells and then drilling of two new production wells at the Stag Facility
- July 2022 – commencement of drilling notification email sent to WAFIC, DMIRS and Recfishwest (as detailed in Table 9.1 of the EP) (NOPSEMA, AMSA & AHO / JRCC contacted by Jadestone directly)

A summary log is included in Table 1, Appendix E and associated emails in the Sensitive Information Report.

4.13.2 Consultation – Current

Table 4-5: provides a summary of consultation undertaken for this revision of the EP and Table 4-6 provides a status of current consultation. A summary log of current consultation is included in Table 2 of **Appendix E**.

Table 4-5: Information provided to relevant persons

Format	Description
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Consultation document	An Invitation for Consultation document was prepared and distributed. The document was prepared with sub-regulation 11A(2) and associated guidance in mind to ensure it adequately described the activity, including the risks associated with the activities. The document can be found in Appendix E.
Individual Responses	Jadestone provided written responses to all written enquires received from stakeholders to address their specific concerns throughout the duration of EP development. A separate sensitive information report submitted to NOPSEMA contains all individual responses provided to stakeholders as part of this process.
Mail-outs, emails and phone calls	Mail-outs, emails and phone calls were used to consult with relevant persons as part of the development of the EP. The sensitive information report contains all of the mail-out correspondence, emails and phone call details, captured as part of relevant person consultation.

Table 4-6: Current status of consultation (April 2023)

Stakeholder	Key dates and information	Next steps
All relevant persons excluding commercial fishing licence holders and First Nations peoples	22 December 2022 – information package emailed 17 February 2023 – follow up email sent Follow up phone calls commenced and ongoing	If two weeks later no response had been received, Jadestone commenced follow up phone calls to determine if the contact details were correct and if the information package had been received. If not received, the information package was sent to other contact details provided on the call. This process is still being undertaken and evidence detailed in the stakeholder log, Appendix E.
Commercial fishing licence holders Details of licence holders consulted as part of the initial mailout provided in the Sensitive Information Report	9 January 2023 – Hard copy information package posted To date no responses have been received Follow-up mailout due to be issued in May 2023.	Jadestone are currently working through the follow-up approach detailed in Section 4.8.2 and will then conduct follow up mail out including attempts to confirm incorrect addresses. To minimise stakeholder fatigue, the correspondence is issued with information on other Jadestone activities at the same time. The follow-up mailout is undergoing review prior to issue following Jadestone’s broad understanding of stakeholder expectations of package content.
YMAC	4 April 2023	Following meeting and advice from YMAC initial contact has been made with 11 Aboriginal Corporations seeking the first available opportunity to make presentations to their directors. Currently awaiting responses.

4.14 Reasonable period

Recipients of the information sheet were encouraged to provide comment within a six-week period. Comments provided outside of this time were still considered and incorporated into the approvals process wherever practicable.

The Stag EP includes emergency response plans. Pursuant to the environment regulations, Commonwealth and State government departments, agencies and authorities have been, and will continue to be, consulted on response preparedness for an uncontrolled discharge of oil from vessels or the well.

4.15 Assessment of relevant persons objections and claims

Prior to engaging with relevant persons, Jadestone reviewed the comments, objections and claims raised through the previous Stag Operations EPs.

For all responses received by Jadestone during the engagement, the merit of each of these responses was assessed. Assessment of merit for the historical Stag 50H and 51H drilling EP is found in **Table 4-7** (as it is considered relevant to the ongoing operations activity subject to this EP) and the assessment or merit for current consultation (post the Decision) in

Table 4-8.

The summary provides details of the information sent to relevant persons and others, and any responses received. It also details the assessment undertaken of any objection or claims. Consultation undertaken prior to this time has been reported in other EPs prepared for the Stag Project, along with all of Jadestone's and previous Stag titleholders accepted EPs and can be viewed on the NOPSEMA website.

Where an objection or claim was raised by relevant person, they were provided feedback as to how it was assessed, whether the objection or claim was substantiated and, if so, if additional controls were put in place to manage the impact or risk to ALARP and an acceptable level.

Where an objection or claim was substantiated by evidence such as publicly available credible information and/or scientific data, including fishing data, this was assessed as per the risk assessment process detail in **Section 5** and controls applied where appropriate to ensure impacts and risks are mismanaged to ALARP and an acceptable level.

Copies of the full text of any responses by relevant person have been provided to NOPSEMA as a Sensitive Information Appendix under regulation 9(8) of the OPGGS(E).

Table 4-7: Assessment of Merit – Historical Drilling EP

Stakeholder	Stakeholder Concern, Objection or Claim	Jadestone Assessment of merit	Jadestone Response
<p>Australian Maritime Safety Authority</p>	<p>Stakeholder Engagement</p> <p>To notify AMSA’s Joint Rescue Coordination Centre (JRCC) (rccaus@amsa.gov.au, Ph 1800 641 792) 24-48 hrs prior to operations commencing and at cessation of operations.</p> <p>Australian Hydrographic Office (datacentre@hydro.gov.au) to be contacted no less than 4 working weeks prior to operations commencing for the promulgation of related notices to mariners.</p> <p>To plan to provide updates to both the Australian Hydrographic Office and the JRCC on progress and, importantly, any changes to the intended operations.</p>	<p>Jadestone considers this comment has merit and has been actioned through changes to the EP.</p>	<p>Item included in Table 4-3</p>
<p>Australian Fisheries Management Authority (AFMA)</p>	<p>Unable to comment on individual proposals but noting resources for consultation with representative bodies or licence holders.</p>	<p>Comment has merit and has been actioned.</p>	<p>In accordance with this guidance, as part of Jadestone’s standard approach to consultation the representative bodies for Commonwealth fisheries have been engaged with during the development of the EP.</p>
<p>Australian Hydrographic Office (AHO)</p>	<p>Acknowledged and noted will be included in charting information.</p>	<p>Noted</p>	<p>No further action required.</p>

<p>Department Transport (DoT)</p>	<p>Comments received on Revision 0 of the OPEP in relation to:</p> <ul style="list-style-type: none"> responsibility of response activities as defined in the State Hazard Plan – MEE Clarification on “no dispersant” zones Further details on the role of the Environmental & Scientific Coordinator for providing advice and dispersant testing details of a media plan or consultation and involvement of indigenous communities Arrangements for cost recovery 	<p>Comment has merit and has been actioned through changes to the OPEP.</p>	<p>DoT were issued Revision 0 of the OPEP upon submission to NOPSEMA. Responses to DoT comments have been incorporated into Revision 1 of the OPEP and a response to comment issued to DoT. A summary is provided below:</p> <ul style="list-style-type: none"> Changes have been made throughout the OPEP, amending use of HMA to the SMPC where relevant. Section 5.3 of Appendix A7 has also been amended to reflect the role of the HMA versus the SMP Section 10.7 of the OPEP does provide criteria for where dispersant must not be applied. A new Section 10.9 has been added that provides guidance on use of dispersant in State Waters when DoT is required to provide consent. In seeking the consent of the HMA/SMPC to use dispersants in State waters, the Incident Commander is expected to have had the option assessed by a panel formed within the IMT. This panel should be chaired by the Incident Controller and include the participation of the State Environmental Scientific Coordinator (ESC). The involvement of the CSIRO or other subject matter experts on the panel should also be considered. Appendix A7, Section 9 of the OPEP outlines under Notifications and Media Strategy that the IMT Leader will work with the Media Team to ensure a media holding statement is prepared. Deputy Public Information Officer’s role has been updated to include (Table A7-9 of Appendix A7) - Advise on appropriate Aboriginal engagement and management strategies in the event of potential exposure of Aboriginal heritage sites, lands or waters to hydrocarbon spills, or for the potential access of responders to Aboriginal heritage sites or land.
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			<ul style="list-style-type: none"> A 'Cost Recovery' section has been added to Appendix A7, Section 8.4 of the OPEP, and includes the following statement: As required under Section 571(2) of the OPGGS Act 2006, Jadestone has financial assurances in place to cover any costs, expenses and liabilities arising from carrying out its petroleum activities, including major oil spills. This includes costs incurred by relevant control agencies (e.g. DoT) and third-party spill response service provider.
Department of Mines (DMIRS)	<p>Stakeholder Engagement</p> <p>To provide DMIRS (petroleum.environment@dmirs.wa.gov.au) with pre-start notification confirming the start date of the proposed activity and a cessation notification to inform DMIRS upon completion of the activity</p> <p>Ensure the EP includes information about the reporting of environmental incidents that could potentially impact on any land or water in State jurisdiction, including that any notifications or reports are to be sent to petroleum.environment@dmirs.wa.gov.au.</p>	Jadestone considers this comment has merit and has been actioned through changes to the EP.	Item included in implementation section of EP (Table 4-3) Item included in 'Routine and incident reporting requirements'
Department of Primary Industry and Regional Development (Fisheries Branch)	<p>Stakeholder Engagement</p> <p>Suggested changes/ additions to current mitigation and management measures for IMS:</p> <ul style="list-style-type: none"> changing the wording from "if required" to "as required" Notification of potential detection of IMS in WA waters is made to DPIRD within 24 via Fishwatch (ph 1800 815 507) or by email to Aquatic.Biosecurity@dpiird.wa.gov.au and 	Jadestone considers these comments to have merit and they have been addressed in the EP.	<p>ID73& 74 in Section 7.1.3 of the EP states the following requirement for Environmental Performance:</p> <p>Management control: Vessels comply with Australian Ballast Water Management Requirements (DAWE 2020). Performance standard: All vessels discharging ballast water within the Operational Area are to maintain Ballast Water Records as per (DAWE 2000) requirements.</p>

	<p>will follow subsequent advice provided by Aquatic Biosecurity</p> <p>Use the online tool Vessel Check to manage the biosecurity risk for vessels entering WA waters https://www.vessel-check.com</p>		<p>Measurement criteria: Ballast Management Plans and Ballast record books</p> <p>DPIRD notification already included in Table 8.2.</p> <p>Email address has been updated throughout the EP.</p> <p>Jadestone has a Marine Biosecurity Manual (JS-70-MN-G-00001) which applies to vessels (including third party tanker at Stag Field) and mobile offshore drilling units (MODUs) under contract by Jadestone, and to all marine vessel operations in Jadestone Operational Areas with the exception of offtake tanker activities at Montara.</p> <p>This manual has also been inspected by NOPSEMA and deemed to meet EP requirements.</p> <p>All vessels engaged by Jadestone are to be subject to biofouling risk evaluation and management procedures in a manner consistent with Australian national (i.e. Commonwealth) policies and regulations, and relevant State and NT regulations, as applicable.</p> <p>The manual includes a comprehensive vessel risk assessment using tailored risk evaluation tools for international and domestic vessels and MODUs.</p>
<p>Director of National Parks (DNP)</p>	<p>Stakeholder Engagement</p> <p>Confirmed no authorisation required as outside AMP</p> <p>When preparing the EP avoiding impacts on migratory species should be considered such as the use of low power and shut down zones and timing of the activity – with particular attention to managing the risk to turtle foraging and interenesting locations.</p>	<p>Jadestone considers these comments to have merit and they have been addressed in the EP.</p>	<p>EP has been drafted to include information on the AMPs in 3.7.6 With no AMP in the operational area there is not expected to be any impact from planned activities on any AMPs.</p> <p>EP has been drafted to include information on managing risk to turtle foraging and interesting, in particular in relation to light (Section 6.1) low power and shut down zones are not relevant to the drilling activity (applicable to seismic or VSP surveys only).</p>

	<p>When preparing the EP AMP values and representativeness should be considered and all impacts and risks to AMPs identified and shown to be managed to acceptable level and ALARP.</p> <p>Consistency with the management plans should also be included.</p> <p>Confirmed DNP do not need any further notification on progress unless change of activity results in overlap with or new impact to a marine park or for emergency responses.</p> <p>DNP should be made aware of oil/gas pollution incidences which occur with 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 0419293465. Notification should include:</p> <ul style="list-style-type: none"> • Titleholder details • Time and location of the incident (including name of marine park likely to be effected) • Proposed response arrangement as per the Oil Pollution Emergency Plan • Confirmation of providing access to relevant monitoring and evaluation reports when available, and • Contact details for the response coordinator. 		<p>Triggered consultation item included to notify AMP DG if any change to planned activity that results in change in risk to AMP (Table 4-4).</p> <p>Notification of DNP in the event of an oil or gas pollution incident has been included in Table 4-4 of the EP.</p>
Department of Water and Environmental	No comments on the activity	Noted	No action required.

Regulation (DWER)			
Recfishwest	<p>Suggested Jadestone contact the two main fishing clubs in Karratha.</p> <p>Would like to be updated on the project going forward</p>	<p>Jadestone considers these comments to have merit and they have been addressed in the EP.</p>	<p>King Bay Game Fishing Club and Nickol Bay Sportsfishing Club have both been contacted and Jadestone are awaiting response.</p> <p>Item included in Table 4-3 to ensure notification to Recfishwest on commencement and cessation of activity.</p>
Western Australian Fishing Industry Council (WAFIC)	<p>WAFIC asked for information on the following:</p> <ul style="list-style-type: none"> • Baseline scientific data on aquatic organisms and the aquatic environment • Detailed post spill scientific monitoring of aquatic organism and aquatic environment • Communication strategy that considers the commercial fishing industry in the event of a spill event • Support to the commercial fishing industry with regards to traceability of fish products to manage tainting risks, if required. • Financial assistance to the commercial fishing industry in the event of a spill event. 	<p>Comment has merit and has been actioned.</p>	<p>Response was issued to WAFIC on 18 January 2022. Summary of responses below, no changes have been made to the EP or OPEP:</p> <ul style="list-style-type: none"> • Baseline scientific data on aquatic organisms and the aquatic environment <p>There are a number of existing baseline data sources that Jadestone uses including Industry-Government Environmental Metadata System (I-GEMS), Australian Ocean Data Network (AODN), Oil Spill Response Atlas (OSRA) and The Atlas of Living Australia (ALA).</p> <ul style="list-style-type: none"> • Detailed post spill scientific monitoring of aquatic organism and aquatic environment <p>Jadestone has a comprehensive Framework for Scientific Monitoring that includes post-spill monitoring of the following marine receptors: Water Quality, Sediment Quality, Intertidal Mudflats, Sandy Beaches and Rocky Shores, Mangroves, Benthic Habitats, Marine Fauna, Seafood Quality, Fisheries and Aquaculture, Fish and Invertebrates.</p> <ul style="list-style-type: none"> • Communication strategy that considers the commercial fishing industry in the event of a spill event

			<p>In the event of a spill, Jadestone has a defined process for conducting notifications to regulatory authorities and support organisations. Section 17.2 of the OPEP includes an initial action outlining this, and references Appendix A6 (Regulatory Notifications). Appendix A6 includes a requirement for Jadestone to contact AFMA and DPIRD (Fisheries) within 8 hours. From this notification, Jadestone will liaise with those agencies and contact the relevant active commercial fisheries.</p> <ul style="list-style-type: none"> • Support to the commercial fishing industry with regards to traceability of fish products to manage tainting risks, if required. <p>This is included in SMP 7 – Seafood Quality, Fisheries and Aquaculture. In the event of a significant hydrocarbon spill event that triggers scientific monitoring, the aim of SMP 7 is to identify potential health risks due to the presence of hydrocarbons in the flesh of targeted fish/ fisheries/ aquaculture species.</p> <ul style="list-style-type: none"> • Financial assistance to the commercial fishing industry in the event of a spill event <p>As required under Section 571(2) of the OPGGS Act, the titleholder must, at all times while the title is in force, maintain financial assurance sufficient to give the titleholder the capacity to meet costs, expenses and liabilities arising in connection with, or as a result of the carrying out of the petroleum activity.</p> <p>Further details on each of these bullet points is provided in email correspondence in the SIR.</p>
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Table 4-8: Assessment of Merit – Current consultation 2022/2023 (post-Tipakalippa decision)

Stakeholder	Stakeholder Concern, Objection or Claim	JSE Assessment of merit	JSE Response
Australian Fisheries Management Authority (AFMA)	<p>No objection, concern or claim Noted the importance of consulting with all fishers who have entitlements to fish within proposed area, either through the relevant fishing industry associations or directly with fishers</p>	Comment has merit and has been actioned.	In accordance with this guidance, as part of Jadestone’s standard approach to consultation the relevant fishing industry associations and/or individual fishers have been engaged with during the development of the EP.
Australian Hydrographic Office (AHO)	<p>No objection, concern or claim Acknowledged and noted will be included in charting information.</p>	Noted	No further action required.
Australian Maritime Oil Spill Centre (AMOSC)	<p>No objection, concern or claim Requested a copy of EP and OPEP.</p>	Noted	Stag OPEP and relevant risk scenarios from Stag EP sent as requested.

Stakeholder	Stakeholder Concern, Objection or Claim	JSE Assessment of merit	JSE Response
Australian Maritime Safety Authority (AMSA)	<p>No objection, concern or claim</p> <p>Stakeholder Engagement</p> <ul style="list-style-type: none"> Australian Hydrographic Office (datacentre@hydro.gov.au) to be contacted no less than 4 working weeks prior to operations commencing for the promulgation of related notices to mariners. Notify AMSA's Joint Rescue Coordination Centre (JRCC) (rccaus@amsa.gov.au, Ph 1800 641 792) 24-48 hrs prior to operations commencing and at cessation of operations. Plan to provide updates to both the Australian Hydrographic Office and the JRCC on progress and, importantly, any changes to the intended operations. 	JSE considers these comments have merit and have incorporated these into the EP.	<ul style="list-style-type: none"> Item included in Table 4-3 to ensure notification 4 working weeks prior to commencement. Item included in Table 4-3 to ensure notification 48 hrs prior to operations commencing and at cessation. Item included in Table 4-3 to ensure notification to AHO and JRCC.
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	<p>No objection, concern or claim</p> <p>Correspondence in relation to commercial Southern Bluefin Tuna fishing effort within the EMBA.</p>	Noted	No action required.
City of Karratha	<p>No objection, concern or claim</p> <p>No comments on the proposed activity.</p>	Noted	No action required.
Clean Energy Regulator (CER)	<p>No objection, concern or claim</p> <p>No comments on the proposed activity.</p>	Noted	No action required.

Stakeholder	Stakeholder Concern, Objection or Claim	JSE Assessment of merit	JSE Response
Commonwealth Fisheries Association (CFA)	<p>No objection, concern or claim</p> <p>CFA are not resourced to give feedback. Advised to direct enquiries to the associations that represent the directly affected fisheries/fishers. May need to engage on a fee for service basis.</p>	Comment has merit and has been actioned.	In accordance with this guidance, as part of Jadestone's standard approach to consultation the representative bodies for Commonwealth fisheries have been engaged with during the development of the EP.
Department of Biodiversity, Conservation and Attractions (DBCA) (WA)	<p>* Requested baseline data</p> <p>* Request for amendment to incident and emergency response notification requirements in OPEP</p>	Jadestone considers these comments to have merit and they have been addressed in the OPEP.	Baseline data summary for SMPs sent to DBCA and notification requirements amended in A6 of OPEP and EPS added
WA Department Transport (DoT)	<p>No objection, concern or claim</p> <p>Provided guidance note.</p>	Noted	No action required
Director of National Parks (DNP)	<p>No objection, concern or claim</p> <p>Stakeholder Engagement</p> <ul style="list-style-type: none"> Confirmed no authorisation required as outside AMP and no objections or claims at this time Link to guidance note on Marine Parks provided When preparing the EP AMP values and representativeness should be considered and all impacts and risks to AMPs identified and shown to be managed to acceptable level and ALARP. Consistency with the management plans should also be included Notification details in the event of an incident provided DNP should be made aware of oil/gas pollution incidences which occur with a marine park or are likely to impact on a 	Jadestone considers these comments to have merit and they have been addressed in the EP	<p>Guidance note is referenced in EP (Table 2-2).</p> <p>EP has been drafted to include information on the AMPs in Section 5.4.4. With no AMP in the Operational Area there is not expected to be any impact from planned activities on any AMPs.</p> <p>Triggered consultation item included to notify AMP DG if any change to planned activity that results in risk to AMP (Table 8-2).</p>

Stakeholder	Stakeholder Concern, Objection or Claim	JSE Assessment of merit	JSE Response
	<p>marine park as soon as possible. Notification should be provided to the 24 hour Marine Compliance Duty Officer on 0419 293 465.</p> <ul style="list-style-type: none"> • Notification should include: <ul style="list-style-type: none"> ○ Titleholder details ○ Time and location of the incident (including name of marine park likely to be effected) ○ Proposed response arrangement as per the Oil Pollution Emergency Plan ○ Confirmation of providing access to relevant monitoring and evaluation reports when available, and ○ Contact details for the response coordinator. 		<p>Item included in Implementation section of the EP (Table 8-2) to ensure DNP notification in event of an oil/gas pollution incident.</p>
<p>Department of Defence (DOD)</p>	<p>No objection, concern or claim</p> <p>Activity is located outside any Defence Training Areas and restricted airspace.</p> <p>Advised of risk of UXOs.</p> <p>Continued liaison with AHS for Notice to Mariners required.</p>	<p>Jadestone considers these comments to have merit and they have been addressed in the EP.</p> <p>JSE considers this comment to have merit and have incorporated these into the EP.</p>	<p>Item included in Implementation section of the EP (Table 8-1) to ensure AHS notification three weeks prior to commencement of activities.</p>
<p>Department of Water and Environmental Regulation (DWER) (WA)</p>	<p>No objection, concern or claim</p> <p>No comments on the proposed activity.</p>	<p>Noted</p>	<p>No action required.</p>
<p>Greenpeace</p>	<p>Requested information on emissions, spill modelling and spill response plan as well as information on how Jadestone have identified relevant persons and why Greenpeace is considered a relevant person.</p>	<p>Comment has merit and has been actioned.</p>	<p>Response sent with information detailing how relevant persons have been identified, as well as requested information on emissions, spill modelling and spill response plans.</p>

Stakeholder	Stakeholder Concern, Objection or Claim	JSE Assessment of merit	JSE Response
King Bay Game Fishing Club (KBGFC)	No objection, concern or claim No comments on the proposed activity.	Noted	No action required.
National Offshore Petroleum Titles Administrator (NOPTA)	No objection, concern or claim No comments on the proposed activity.	Noted	No action required.
Pilbara Port Authority	No objection, concern or claim No comments on the proposed activity.	Noted	No action required.
Recfishwest	No objection, concern or claim Requested to be added to the EP incident notifications.	Comment has merit and has been actioned.	Item included in Implementation section of the EP (Table 8-2) to ensure Recfishwest notification in event of an oil/gas pollution incident.
Shire of Ashburton (SOA)	No objection, concern or claim Risk of impact to Montebello Islands, Barrow Island and further afield should a hydrocarbon spill occur.	Comment has merit and has been actioned.	Confirmation that EP includes appropriate measures to mitigate environmental impacts should a spill occur. The Montebello Islands and Barrow Island are listed as protection priorities for spill response in the Stag OP and OPEP.
Western Australian Fishing Industry Council (WAFIC)	No objection, concern or claim Ongoing correspondence in relation to advice on identifying commercial fishing licence holders.	Noted	No action required.
Yamatji Marlpa Aboriginal Corporation (YMAC)	No objection, concern or claim Discussions seeking guidance and parties to contact for fair and meaningful consultation process.	Noted	No action required.

4.16 Environmental Performance

Hazard		Stakeholder consultation		
Performance outcome		Relevant persons are kept informed of activities		
ID	Management controls	Performance standards	Measurement criteria	Responsibility
001	Stakeholder Management Plan (JS-70-PR-I-00034)	Relevant persons identified according to current Regulatory requirements.	Consultation records	General Manager
002		Relevant persons provided a minimum 4-week period to respond to stakeholder information issued on the proposed planned activities and followed up in accordance with the plan.		
003		If there is a potential change in the risks or impacts to relevant persons due to planned activities relevant persons are to be consulted prior to the activity commencing.		

5. EVALUATION OF ENVIRONMENTAL IMPACTS AND RISKS

As required by Regulation 13(5) of the Environment Regulations, this section of the EP provides an outline of Jadestone’s methodological approach to evaluate impacts and risks due to an activity (**Section 5.1**), and the outcomes of the impact and risk assessment undertaken for the Stag Facility operational activities (**Section 5.6**).

5.1 Impact and Risk Assessment Methodology

The environmental impacts and risks associated with operational activities of the Stag Facility within permit WA-15-L have been assessed using the Jadestone Risk Management Framework and methods consistent with HB 203:2012 and AS/NZS ISO 31000:2018.

Impact is evaluated in terms of the extent, duration, severity and certainty pertaining to the effect that will or may occur in the environment due to a planned or accidental event associated with the activity.

Risk is evaluated in terms of likelihood and consequence, where likelihood is defined as the probability or frequency of the event occurring, while consequence, like impact, is defined as the extent, duration, severity and certainty pertaining to the effect that will or may occur in the environment due to a planned or accidental event associated with the activity.

The assessment methodology provides a framework to demonstrate:

- That the identified impacts and risks are reduced to as low as reasonably practicable (ALARP) (Regulation 10A(b)); and
- The impacts and risks are acceptable (Regulation 10A(c)).

The impact and risk management process is shown in **Figure 5-1**.

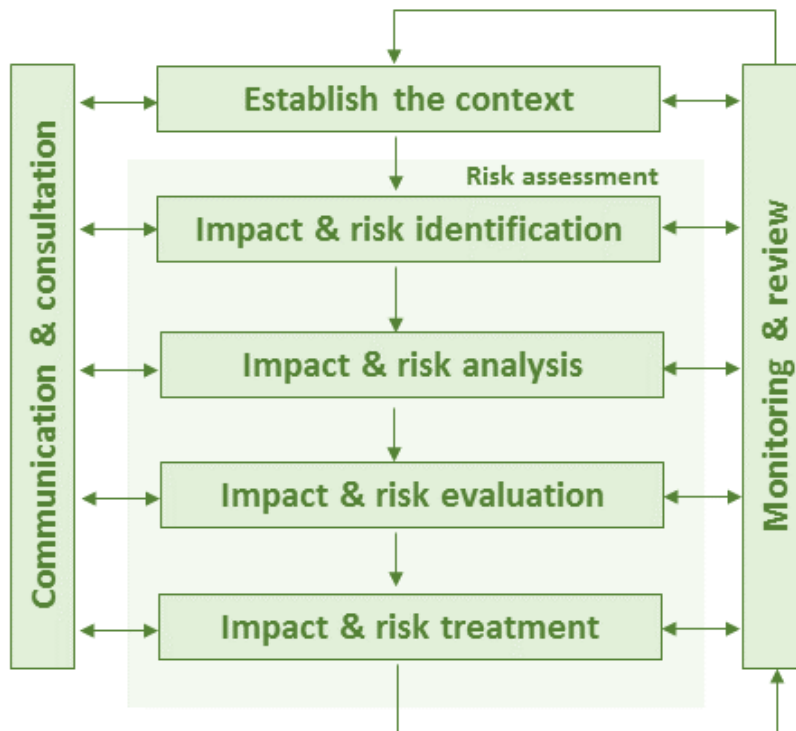


Image source: NOPSEMA (GN0165 Risk Assessment Rev 5 2017)

Figure 5-1: Impact and Risk Evaluation Process

Further detail on the steps involved in the impact and risk evaluation process is provided below.

5.2 Risk Assessment

The assessment process evaluates impacts and risks associated with planned and accidental events that will or have the potential to impact the environment. Impacts and risks are identified through a number of activities:

- Workshopping process attended by team that includes relevant technical knowledge and experience in the activities being assessed;
- Information relating to previous operational performance relevant to the activity being assessed such as findings of audits and inspections, incident investigations, performance reports;
- Feedback from relevant persons; and
- Industry related information of exploration and production activities relevant to the activity being assessed.

Analysis of the impacts and risks identified for the activity includes a number of steps intended to treat the impacts and risks to levels that are acceptable and ALARP for the business. The steps are:

- Identification of appropriate control measures (preventative and mitigative) to treat likelihood and consequence/ impact (below); and
- Determination of the residual risk rankings (Section 5.6).

5.2.1 Identification of control measures

The following framework tools are applied, as appropriate, to assist with identifying control measures:

- **Legislation, Codes and Standards** – identifies the requirements of legislation, codes and standards which are to be complied with for the activity;
- **Good Industry Practice** – identifies further engineering control standards and guidelines which may be applied over and above that required to meet the legislation, codes and standards;
- **Professional Judgement** – uses relevant personnel with the knowledge and experience to identify alternative controls. When formulating control measures for each environmental impact or risk, the ‘Hierarchy of Controls’ philosophy (see below), which is a system used in the industry to minimise or eliminate exposure to impacts or risks, is applied;
- **Risk Based Analysis** – assesses the results of probabilistic analyses such as modelling, quantitative risk assessment and/or cost benefit analysis to support the selection of control measures identified during the risk assessment process;
- **Company Values** – identifies values referenced in Jadestone’s HSE Policy; and
- **Societal Values** – identifies the views, concerns and perceptions of relevant stakeholders and addresses relevant stakeholder concerns as gathered through consultation.

In addition, Jadestone applies a hierarchy of control measures to help evaluate potential management controls to ensure reasonable and practicable solutions have not been overlooked:

- **Elimination** - it is preferable to remove the impact or risk altogether;
- **Substitution** - substitute the impact or risk for a lower one;

- **Engineering control measures** – use engineering solutions to prevent or detect the hazard or control the severity of consequences/impacts;
- **Administrative control measures** – use of procedures, JHA etc to assess and minimise the environmental impacts or risks of an activity; and
- **Protective** – use of protective equipment (e.g. the use of appropriate containers).

5.2.2 Risk ranking process

Risks are ranked using the Jadestone Qualitative Risk Matrix (Table 4-1 Environmental ranking of a measure between **Low** to **Extreme** is determined by evaluating the likelihood of the accidental event occurring, and evaluation of the expected severity of the consequence with standard control measures in place.

Table 4-1: Jadestone Qualitative Risk Matrix

Rating		Consequence				
		Negligible	Minor	Moderate	Major	Critical
Likelihood	Expected	Medium	Medium	High	Extreme	Extreme
	Probable	Medium	Medium	Medium	High	Extreme
	Likely	Low	Medium	Medium	Medium	High
	Unlikely	Low	Low	Medium	Medium	Medium
	Rare	Low	Low	Low	Medium	Medium

Consequence levels for accidental events are assigned on the basis of the expected extent of area that may be affected, the duration of effect and the severity of the effect. A consequence level of **Negligible** to **Critical** may be assigned (Table 4-2).

Table 4-2: Definition of Consequence Levels

Consequence	Consequence description	Socio-economic
5. Critical	Massive effect; recovery in decades; ecosystem collapse	Extensive damage International impact
4. Major	Major effect; recovery in 1 to 2 years; impact to population	Major damage National reputation impact
3. Moderate	Local effect; recovery in months to a year; impact to localised community	Local damage Considerable reputation impact
2. Minor	Minor effect; recovery in weeks to months; death of individuals	Minor damage Limited reputation impact
1. Negligible	Slight effect; recovery in days to weeks; injury to organism	Slight damage Slight reputation impact

Likelihood levels for accidental or unplanned events are assigned on the basis of preceding performance in relation to the specific activity at the Facility, in the region or in the industry. A

likelihood level of **Rare** to **Expected** maybe be assigned to accidental or unplanned events (**Table 4-3**). A likelihood level is not assigned to planned events.

Table 4-3: Definition of Likelihood Levels

Likelihood	
5. Expected	Happens several times a month in similar exploration and production operations
4. Probable	Happens several times a year in similar exploration and production operations
3. Likely	Event has occurred in similar exploration and production operations
2. Unlikely	Heard of in the exploration and production industry
1. Rare	Never heard of in the exploration and production industry

Once assessed and treated, an assessment as to whether the impacts and risks recorded can be demonstrated as being acceptable and ALARP is made. The processes for determining if risks and impacts have been reduced to ALARP and acceptable levels are described below.

5.3 Impact Assessment

Environmental impacts that will occur as a result of planned activities may cover a wider range of issues, multiple species, persistence, reversibility, resilience, cumulative effects and variation in severity. The degree of impact and the corresponding level of acceptability is assessed against several guiding principles:

- Principles of ecologically sustainable development (ESD);
- Conservation and management advice;
- Stakeholder feedback;
- Reputational ramifications;
- Environmental context; and
- Jadestone’s HSE Policy and Management System.

The application of the guiding principles within the acceptability matrix are outlined in Table 4-1.

The following process has been applied to demonstrate acceptability in the reduction of planned impacts:

- **GREEN** residual impacts are Tolerable, if they meet management requirements, stakeholder requirements, environmental context, and the Jadestone Energy HSE Policy and management system requirements; and
- **ORANGE** residual impacts are Intolerable and therefore unacceptable. Planned impacts with this rating will require further investigation and mitigation to reduce them to a lower and acceptable level. If after further investigation the impact remains in the unacceptable category, the impact requires appropriate business sign-off to accept the impact.

A reduction of impacts to ALARP follows the process described in Section 5.5.

5.4 Demonstration of Acceptability

An acceptable level of risk of an unplanned event occurring must be scored with a low or medium rating. Risks receiving a score of high (orange) or extreme (red) risk ratings in Table 4-1 are unacceptable. For those risks found to have an unacceptable rating, a return to the planning process

for the activity is required to determine if an alternative approach to undertaking the activity can be identified.

Table 5-1: Jadestone Energy’s acceptability matrix

Guiding principles		Impact level				
		1	2	3	4	5
A	Principles of ESD	Discharges/emissions have slight effect – recovery in days to weeks	Discharges/emissions have minor effect – recovery in weeks to months	Discharges/emissions have local effect – recovery in months to a year	Discharges emissions have major effect – recovery in multiple years	Discharges emissions have catastrophic effect – recovery in decades
B	Conservation and management advice	Activity does not contact/interact with sensitivities protected by conservation and management advice	Activity Triggered and adopts conservation and management advice of affected sensitivities	Activity must be modified to uphold conservation and management requirements of affected sensitivities	Activity as planned cannot uphold conservation and management requirements of affected sensitivities	Activity as planned will contravene conservation and management requirements of affected sensitivities
C	Stakeholders	No issues raised by stakeholders	Concern/ query received by stakeholders due to activity	Delay in commencement of activity due to stakeholder consultation	Modification of planned activity to achieve negotiated outcome	Executive involvement in resolving stakeholder concerns
D	Reputation	Slight impact – no media coverage	Limited impact – State media coverage	Considerable impact – national coverage	National impact – persistent national coverage	International impact – international coverage
E	Environmental context	Slight effect – recovery in days to weeks	Minor effect – recovery in weeks to months	Local effect – recovery in months to a year	Major effect – recovery in multiple years	Catastrophic effect – recovery in decades
F	Policy and Management System compliance	Proposed activity complies with JSE HSE Policy and Management System	Parts of the activity will not align with JSE HSE Policy and Management System	Proposed activity must be modified to align with JSE HSE Policy and Management System	Proposed activity cannot uphold intent of JSE HSE Policy and	Proposed activity does not comply with JSE HSE Policy and Management System

					Management System	
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5.5 Demonstration of ALARP

Regulation 10A(b) of the Environment Regulations requires a demonstration that risks are reduced to ALARP.

The ALARP principle states that it must be possible to demonstrate that the cost involved in reducing the risk further would be grossly disproportionate to the benefit gained. The ALARP principle arises from the fact that infinite time, effort and money could be spent attempting to reduce a risk to zero. An iterative evaluation process is employed until such time as any further reduction in the residual ranking is not reasonably practicable to implement. Following identification of the residual ranking, the ALARP principle is applied:

- Where the residual rank is **LOW** as:
 - Good industry practice or comparable standards have been applied to control the risk, because any further effort towards reduction is not reasonably practicable without sacrifices grossly disproportionate to the benefit gained.
- Where the residual rank is **MEDIUM**:
 - Good industry practice is applied for the situation or risk; and
 - Alternatives have been identified and the control measures selected to reduce the risks to ALARP. This may require assessment of Company and industry benchmarking, review of local and international codes and standards, consultation with stakeholders, etc. to demonstrate that alternatives have been considered, and reasons for rejection provided.
- Where the residual rank is **HIGH** or **EXTREME** the risk is not considered to be acceptable and the activity cannot continue as described. Further control measures must be applied such that an acceptable risk is demonstrated and the residual risk is reduced to 'Medium' or lower as described above. The activity should not be carried out if the residual risk remains 'High' or 'Extreme'.

The process of evaluating the reduction of impacts and risks to ALARP is illustrated in **Figure 4-2**.

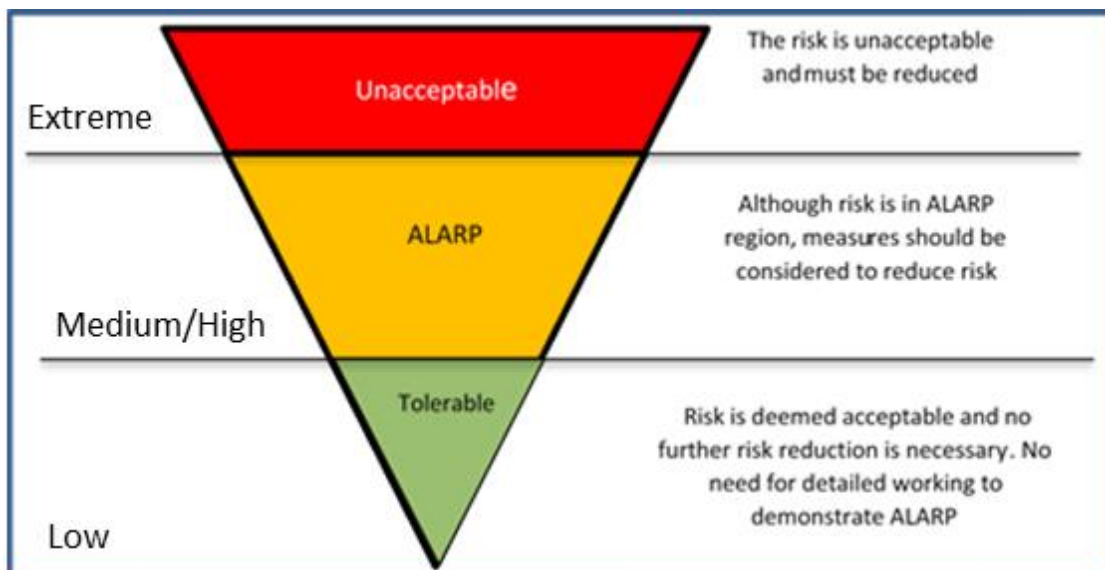


Figure 4-2: ALARP Triangle

5.6 Evaluation Summary

An impact and risk assessment workshop was conducted by Jadestone in July and October 2022 to revise the existing hazard register and develop an updated register to reflect the Jadestone Energy Impact and Risk Management Framework (JS-70-PR-F-00009). The assessment was undertaken by a multidisciplinary team with sufficient breadth of knowledge, training and experience to reasonably assure that risks and impacts were identified and assessed. The assessment team included management, engineering, operations, maintenance, emergency response and environmental personnel.

The assessment process undertaken by Jadestone for operational activities at the Stag Facility identified nine planned hazards and six unplanned hazards and their associated environmental impacts and risks that will or may occur during operation of the Stag Facility.

The output of the assessment process is documented in the Stag Facility ENVID Register and this EP and is summarised in **Table 4-6**. Further detail underpinning the assessment record is provided in **Sections 6 and 7**.

Table 4-6: Summary of the environmental impact and risk assessment rankings for hazards associated with planned and unplanned events during operation of the Stag Facility

Hazard	Consequence Ranking
<i>Planned activities</i>	
1. Light emissions	Negligible
2. Noise emissions	Negligible
3. Atmospheric emissions	Minor
4. Discharge of produced water	Negligible
5. Liquid discharges	Negligible
6. Interaction with other users	Negligible
7. Interaction with fauna	Negligible
8. Physical footprint	Negligible
9. Spill response activities	Negligible

<i>Unplanned activities</i>	<i>Consequence</i>	<i>Likelihood</i>	<i>Residual Ranking</i>
1. Invasive marine species introduction	Moderate	Rare	Low
2. Unplanned release of solids	Minor	Likely	Medium

3. Unplanned release of non-hydrocarbon liquids	Minor	Unlikely	Low
4. Unplanned release of Stag crude oil	Major	Unlikely	Medium
5. Unplanned release of Diesel	Minor	Unlikely	Low

5.7 Risk Assessment Approach for Worst-case Hydrocarbon Spill Response

The risk assessment approach for the worst-case hydrocarbon spill response follows the risk assessment process as described above, with additional steps and considerations to determine an environmentally acceptable oil spill response strategy and an ALARP level of response preparedness:

- Determine threshold concentrations to be used in oil spill modelling to define the RISK EMBA as per NOPSEMA Bulletin #1;

- Determine the environment that may be exposed (RISK EMBA);

- Determine the environmental receptors (Appendix C) that may be affected within the RISK EMBA;

- Identify sensitive receptors;

- Determine priority receptors, and

- ALARP and Acceptability evaluation for spill response activities.

5.7.1 Determine Oil Spill Modelling Thresholds

Threshold concentrations for each of the hydrocarbon component types (floating oil, entrained oil and dissolved aromatic hydrocarbons (DAH)) are specified as inputs for the model to determine what potential exposure is recorded for each hydrocarbon type and the receptor/ location, to ensure that potential exposure is assessed as per NOPSEMA Bulletin #1. **7.4.2.17.6**

5.7.2 Determine the RISK EMBA

The RISK EMBA for hydrocarbon concentration thresholds for the worst-case spill scenario for this EP is shown in Figure 3-1 and described in Appendix H. These contact concentrations are used to describe potential exposure to receptors at risk from the worst-case credible spill scenario. A description of the worst-case credible spill scenario resulting in the RISK EMBA is provided in Section 7.4

5.7.3 Determine the impact threshold

Threshold concentrations for each of the hydrocarbon component types (shoreline accumulated oil, floating oil, entrained oil and DAH) are specified as inputs for the model to determine what contact is recorded for each hydrocarbon type and the receptor/location, to ensure that recorded contacts are assessed at environmentally meaningful concentrations. Meaningful concentrations are those concentrations at which environmental (or biological) impacts may occur, and at which societal values (e.g. visual aesthetics, economics) may be impacted.

The determination of environmentally meaningful impact thresholds is complex since the degree of impact will depend on the sensitivity of the value, the duration of the contact (exposure) and the toxicity of the hydrocarbon mixture making the contact. The chemical and physical properties of a hydrocarbon change over time due to weathering processes altering the composition. To ensure conservatism in defining the subsequent impact/risk assessment, the threshold concentrations

applied to the model are based on the most sensitive environmental resources that may be exposed, the longest likely exposure times and on toxicity information for the hydrocarbon. Impact pathways and impact threshold concentrations are detailed in Table 7-13.

5.7.4 Sensitive Receptor Identification

Jadestone has generated spatial layers of known environmental and socio-economic values within the marine and coastal environment in WA State, Northern Territory, Commonwealth and adjacent international jurisdictions, to identify sensitive receptors (locations with highest environmental and/or socio-economic values relative to other locations). The RISK EMBA is overlaid as a boundary to identify the sensitive receptors that exist within.

Sensitive receptor assessment considers:

- Protected Area Status: used as an indicator of the biodiversity values contained within that area (e.g. World Heritage Areas, Ramsar sites and Marine Protected Areas);
- Biologically Important Areas (BIA) of Listed Threatened and Migratory Species: these are spatially defined areas where aggregations of individuals of a species are known to display biologically important behaviour such as breeding, feeding, resting or migratory;
- Social values: socio-economic and heritage features (e.g. commercial fishing, recreational fishing, amenities and aquaculture);
- Economic values: recreations and commercial fishing areas;
- Listed species status and predominant habitat (surface versus subsurface): critically endangered/ endangered species, listed species, surface species (e.g. reptiles and birds) and subsurface species (e.g. mammals, sharks and fish); and
- Recovery Plans, Conservation Advice for threatened species.
- Once the sensitive receptors within the RISK EMBA have been identified, the potential oil pollution risks are described and evaluated (refer Sections 8.5 and 8.6). In addition, the environmental risks from implementing spill response control measures are described and evaluated.
- Sensitive receptors are further evaluated by considering what values are contained within them when determining appropriate spill response strategies (refer Section 6.9 Table 6-19). This informs the OPEP and guides spill response preparedness and planning.
- The next step is to determine those sensitive receptors within the RISK EMBA that are considered the highest risk from the worst-case credible oil spill scenario and are common across ALL modelled scenarios and seasons, that is the priority receptors.

5.7.5 Priority Receptors

It is important to note that in the event of a single worst-case hydrocarbon spill, not all sensitive receptors and areas within the RISK EMBA will be exposed or contacted at the same time or at all. Instead, the RISK EMBA is a collation of numerous possible scenarios (generally 100 or more) to develop the areas for focus in response preparedness and strategic planning. As such, only a portion would be contacted during a spill event.

It is best practice to develop spill response strategies for those areas most likely to be contacted in a single maximum credible worst-case spill. To be able to develop these strategies, the sensitive receptors in the RISK EMBA and their vulnerability to a hydrocarbon event (considering nature and scale of spill) need to be understood. A critical first step is to identify these areas – a concept termed

here as 'priority receptors'. The selection of priority receptors is based on stochastic modelling of multiple hydrocarbon spills.

Defining priority receptors determines the scale and needs of the oil spill response strategy. Thus, priority receptors (as a subset of all the sensitive receptors present within the full extent of the RISK EMBA) specific to a particular spill are selected using the following criteria:

- Sensitive receptor within RISK EMBA; AND
- >5% probability of shoreline contact based on modelling results; OR
- Has the largest volume of floating oil shoreline contact; OR
- Has the shortest timeframe to floating oil shoreline contact; OR
- Vulnerability to impact from hydrocarbons – e.g. mangroves are more vulnerable than intertidal rock pavement; known turtle nesting beaches are vulnerable during nesting periods⁴; AND
- Any other area of interest within the RISK EMBA including areas that have a high social value or are a concern raised through stakeholder consultation (refer Section 4).
- It is logical and best practice to focus spill response planning and strategies on those locations most likely to be contacted in the credible worst-case oil spill scenario; that is, the scenario that represents the highest risk across all modelled scenarios covering any season, rather than attempt to cover the full spatial extent of the RISK EMBA. This allows for flexibility in response planning as plans are developed for environmental resources at greatest risk of being contacted by an oil spill and can be adapted for any scenario that occurs.
- The evaluation of priority receptors is based upon stochastic modelling of multiple hydrocarbon spills. The focus for spill response planning and preparedness is based upon the level of risk (probability of contact, vulnerability to hydrocarbons, time to contact and volume/concentration of loading). Response Plans are based on the nature and scale of the worst-case modelled hydrocarbon event for each Priority Receptor 7.4.2.17.6 which includes estimation of shoreline loading volume and time to contact, which are provided in the OPEP.
- For purposes of spill response preparedness strategies, it is not necessary for all priority receptors to have specific operational response plans in place. For example, wholly submerged priority receptors may only be contacted by entrained oil, and the response will largely be the implementation of scientific monitoring to assess impact and recovery. Priority receptors with emergent features can have response actions prepared.
- Jadestone's Framework for Scientific Monitoring (JS-70-PR-I-00038) was previously submitted as part of the Sea Eagle-1 and Tahbilk-1 Vessel Based Activity Environment Plan (TM-50-PLN-I-00004) approval which is publicly available on the NOPSEMA website. In accordance with

⁴ IPIECA, the global oil and gas industry association for environmental and social issues, the International Maritime Organisation (IMO) and International Association of Oil and Gas Producers (OGP) developed a guidance document for 'Sensitivity mapping for oil spill response' IPIECA/IMO/OPG (2012). This document was used as a reference and basis for the sensitivity of habitats vulnerability assessment

Regulation 31 of the OPGGS(E)R, Jadestone refers to this information previously given rather than reattaching to this submission.

5.7.6 ALARP and Acceptability Evaluation for Spill Response

Jadestone applies a robust and systematic process to ensure that credible spill scenarios are adequately evaluated, to promote a clear link between the nature and scale and the priority receptors, and, to ensure that effective control measures exist to mitigate environmental risks and impacts to a level that is ALARP and acceptable. This process is depicted in **Figure 5-1**.

The process promotes a clear link between the nature and scale of the maximum credible worst-case spill scenario and the identified priority receptors to ensure that selected response strategies are appropriate and demonstrated to be effective and adequate.

As part of the risk assessment process, the spill response strategies selected are evaluated for their environmental impact (**Figure 5-2**).

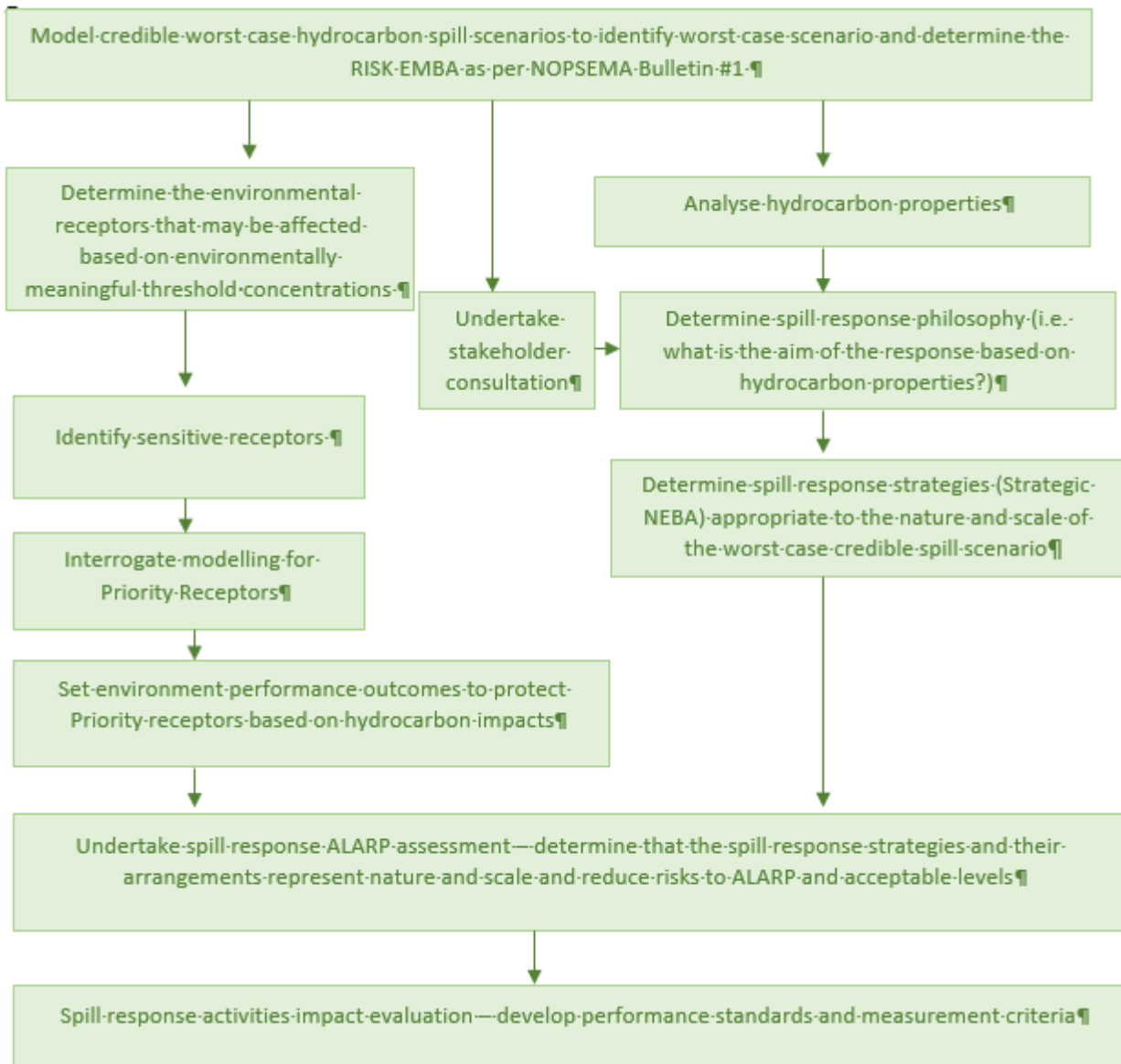


Figure 5-1: Spill Scenario Evaluation and ALARP Determination Process

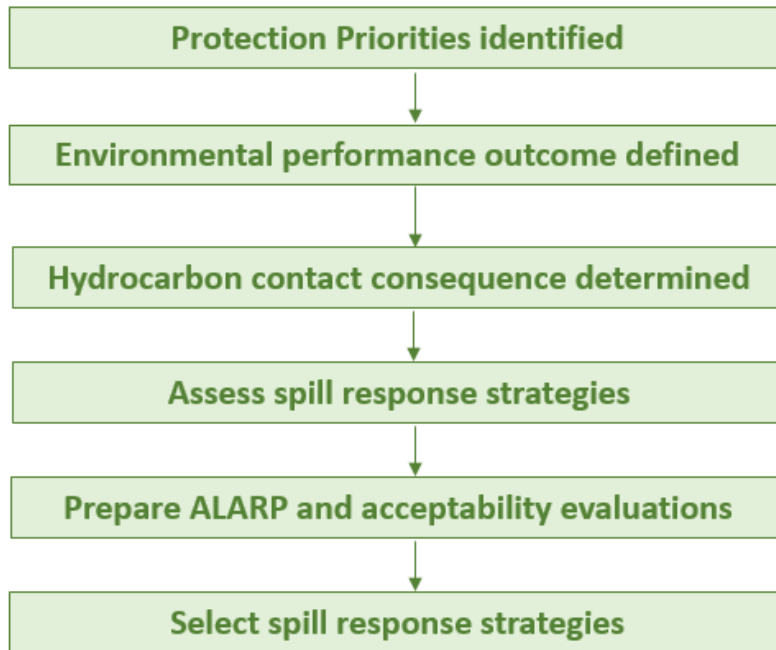


Figure 5-2: Spill Control Analysis and ALARP Determination Process

6. HAZARD ASSESSMENT – PLANNED ACTIVITIES

This section of the EP describes the environmental impacts that may or will arise from planned activities associated with operation of the Stag facilities. In addition, mitigation and management measures that will be implemented to reduce impacts to an acceptable level are defined.

The impact assessment process identified nine environmental hazards associated with planned operating activities. The residual consequence rankings for the hazards listed are summarised in **Table 6-1** and presented in detail in this section.

Table 6-1: Summary of the Environmental Consequence Assessment Rankings for Hazards Associated with Planned Activities

Hazard	Consequence Ranking
1. Light	1 - Negligible
2. Noise	1 - Negligible
3. Atmospheric emissions	1 - Negligible
4. Discharge of produced water	1 - Negligible
5. Discharge of liquid wastes	1 - Negligible
6. Interaction with other users	1 - Negligible
7. Interaction with fauna	1 - Negligible
8. Physical footprint	1 - Negligible
9. Spill response activities	3 - Moderate

The evaluation of impacts identified during the assessment process for hazards associated with planned activities is provided as follows:

- Description of the hazard;
- Impacts – a discussion and assessment of the environmental impacts associated with the proposed activity;
- Environmental performance – a description of a measurable level of performance required for the management of environmental aspects to ensure that the environmental impacts and risks will be of an acceptable level; and a statement of performance required of a control measure. This includes a description of the control measures in place to reduce the impacts; and
- Demonstration of ALARP and Acceptability – a demonstration that the environmental impacts will be reduced to ALARP and will be of an acceptable level, and the rationale for these statements.

For noting, a cumulative impact assessment of the brines and cooling water has been provided in **Section 6.5**, as this is a mixed effluent stream with a common discharge point at the CPF. The produced water discharge stream at the CPF is separate and distinct from the cooling water and brine discharges and so was therefore not considered in the cumulative impact assessment of the brines and cooling water discharges; the impacts of the produced water discharge from the CPF have been considered in **Section 6.4**.

Jadestone believes that with the information provided for liquid discharges as presented in the EP, adequate information is available to be able to undertake a comprehensive evaluation of the impacts and risks to the environment due to these discharges, and their subsequent management.

6.1 Light

6.1.1 Description of Hazard

Aspect	Light emitted from the CPF and support vessels, as well as flaring associated with production at the CPF.
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6.1.2 Impacts

Direct light spill on surface waters from the facility will be limited to the area directly adjacent to the CPF and support vessels present from time to time within the Operational Area.

Depending on weather conditions, the Stag Facility lighting, is visible at distances of tens of kilometres, with intensity attenuating with distance. Light from support vessels is visible over shorter distances since lights on vessels are closer to the sea surface. In all cases (Stag Facility, support vessels and flaring), lighting is not expected to illuminate any beaches with the closest being >30 km away (Dampier Archipelago).

Modelling

Light modelling undertaken for Santos' Dorado Development for an FPSO operational lighting with no flaring, and with flaring on the FPSO, was undertaken in 2020 (Santos, 2021). In the non-flaring scenario, the model results show that radiance has reduced to ambient (less than 0.01 full moon equivalent) at 17.7 km from the source. In the flaring scenario, the flare is no longer directly visible at 42.4 km, when the flare drops below the horizon. As the flare drops below the horizon, radiance declines rapidly and is no longer visible. This was based on a flare boom of 110m above the deck. The flare tip is approximately 30 m high on the Stag facility and therefore the distance at which light from flaring may be visible is likely to be less than that modelled for the Dorado scenario.

Lighting impacts are not only related to the amount of artificial light, but also the types of light and the wavelengths that the different light types emit. Measurements of light emitted from an FPSO recorded peak wavelengths between 530 to 620 nm, which is within the range that is visible to marine turtles and seabirds (300 to more than 700 nm) (Woodside, 2019). This lighting was likely metal halide, halogen or fluorescent lighting rather than LED. Light emitted from a natural gas flare recorded peak wavelengths between 750 to 900 nm (Pendoley, 2000, in Woodside, 2019). While this peak is outside the visible spectrum which is most disruptive to wildlife, including marine turtles and seabirds (CoA, 2020), light emissions from gas flares tend to be high intensity which is also an important factor. Therefore, light emissions from gas flares still pose a potential risk to wildlife.

There is no evidence to suggest that artificial light sources adversely affect the migratory, feeding or breeding behaviours of cetaceans. Cetaceans predominantly utilise acoustic senses to monitor their environment rather than visual sources (Simmonds et al., 2004). Therefore, light from the Stag Facility is not considered to be a significant factor in influencing cetacean behaviour or survival.

Potential impacts to marine fauna from artificial lighting associated with the Stag Facility are:

- Disorientation, attraction or repulsion; and
- Disruption to natural behavioural patterns and cycles.

These potential impacts are dependent on:

- Density and wavelength of the light emitted and the extent to which light spills into areas that are significant for breeding and foraging;
- Timing of overspill relative to breeding and foraging activity; and
- Resilience of the fauna populations that are affected.
-

A PMST Search was conducted on a 20km buffer around the defined operational area to identify any MNES species within the recommended 20km threshold that light impacts may occur. Only the Roseate tern was identified as potentially occurring within the 20km buffer and potentially affected by light emissions in addition to those species identified to occur within the defined operational area. Within 42km of the flare, it is feasible that light may be visible, however species that may be affected beyond the 20km boundary are considered to be marine turtles attracted by sky glow and ambient light from the the flare given the distance to land. It is recognised that light emissions from the flare may be visible at turtle nesting beaches, but given they are >35km away, the effects are considered to be negligible; impacts are assessed further below.

Marine Turtles

Turtles are known to use a variety of cues for navigation when in the water. However, light is not thought to be an important cue for adults, although adults are considered to have a preference for non-illuminated beaches (EPA 2010). The significant concern is to nesting beaches as identified in the Recovery Plan for Marine Turtles in Australia (DoEE 2017).

The National Light Pollution Guidelines states that a 20 km buffer (based on sky glow) to important habitat for turtles should be applied when considering possible impacts (DoEE, 2020). However, the demonstrated impacts on which this buffer is based were in response to light emissions associated with a liquified natural gas (LNG) plant. Although details around the individual light sources of the case study and the light sources on the vessels are unknown, it is expected that light emissions associated with vessels and flaring at the facility will be notably lower compared to an LNG plant.

The Recovery Plan for Marine Turtles in Australia 2017–2027 (CoA, 2017) highlights artificial light as a threat to marine turtles. Specifically, the plan indicates that artificial light may reduce the overall reproductive output of a stock, and therefore recovery of the species, by:

- inhibiting nesting by females
- disrupting hatchling orientation and sea-finding behaviour
- creating pools of light that attract swimming hatchlings and increase their risk of predation.

The most significant risk posed to marine turtles from artificial lighting is the potential disorientation of hatchlings following their emergence from nests by light spill on beaches, although breeding adult turtles can also be disoriented (Longcore & Rich, 2016, in EPA, 2010). The Recovery Plan for Marine Turtles in Australia: 2017-2027 specifies the following priority actions for turtles in relation to artificial light:

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

Internesting and Foraging turtles

Experienced nesting females are unlikely to be disturbed by light, but first-time nesters may be disturbed by light when they are selecting their first nesting beach (Pendoley, 2014).

The Flatback turtle BIA (inter-nesting buffer) overlaps the operational area, and the 42km light EMBA overlaps BIA for flatback, green and hawksbill turtles as well as habitat critical for the survival of these

species. Although there may be transient individuals, most females inter-nest close to their nesting beaches, typically in shallow (0–10 m) nearshore waters within 5–60 km of the nesting beach (Chevron 2008). The activities are in a water depth of approximately 49 m depth, and the nearest significant nesting beaches are 35 km away on Dampier Archipelago and the Montebello/ Barrow/ Lowendal Islands (75 km SW). The lighting visible on nesting beaches from flaring is considered unlikely to be biologically relevant due to the attenuation of light over distance and the intensity reducing from a single point source.

Adult turtles transiting or foraging (e.g. flatback turtles during internesting) through permit WA-15-L, may temporarily alter their behaviour while attracted to the light spill from infrastructure and flaring.

If individual turtles are present, light emissions from vessels are unlikely to be of concern. There is no evidence, published or anecdotal, to suggest internesting, mating, foraging or migrating turtles are impacted by light from offshore vessels, and nothing in their biology would indicate this as a plausible threat as marine turtles do not use light as a cue during these behaviours (Pendoley, 2019; Witherington and Martin, 2003). As such, light emissions from vessels and the CPF are unlikely to result in displacement of or behavioural changes to individuals in these life stages. Potential impacts to foraging turtles are limited to local attraction to prey species attracted to light (Kebodeaux, 1994). Marine turtles do not feed during the breeding season (Limpus et al., 2013), and light is not a cue to internesting behaviours. Therefore, potential impacts of artificial light from vessels or flaring to internesting turtles are not considered likely.

Adult turtles have been observed feeding on prey presumed to be attracted by lights of oil production platforms in the Gulf of Mexico (Kebodeaux, 1994). However, illuminating fishing nets has been shown to reduce the bycatch of green turtles as they are thought to alert them to the presence of a net (Ortiz et al., 2016). This suggests that, although aggregation of foraging turtles may occur around light sources as a secondary response to effects of light on prey distribution, light does not appear to act as a cue to foraging behaviour.

Hatchlings

Hatchlings disoriented or misoriented by artificial lighting may take longer, or fail, to reach the sea. This may result in increased mortality through dehydration, predation or exhaustion (Salmon and Witherington, 1995).

Once hatchlings enter the ocean, they are thought to employ a survival strategy that involves rapid dispersal away from predator rich nearshore habitats to reach deeper waters where they develop into juveniles. An internal compass set while crawling down the beach, together with wave cues, are used to reliably guide them offshore (Lohmann & Lohmann, 1992; Stapput & Wiltshcko, 2005; Wilson et al., submitted). In the absence of wave cues however, swimming hatchlings have been shown to orient towards light cues (Lorne & Salmon, 2007; Harewood & Horrocks, 2008) and in some cases, wave cues were overridden by light cues (Thums et al., 2013, 2016). The speed and direction of at-sea dispersal is substantially influenced by currents; the offshore trajectory of flatback hatchlings at Thevenard Island was displaced by tidal currents which ran parallel to the beach, an effect that increased as the hatchlings moved further offshore (Wilson et al., 2018, 2019).

However, when light was present this effect was diminished, showing that hatchlings actively swam against currents and towards the light source, which slowed their offshore dispersal from 0.5 m/s when no light was present, to 0.35 to 0.44 m/s, depending on the type of light (Wilson et al., 2018). The mean swimming of flatback hatchlings under natural light conditions (0.5 m/s) were similar to speeds of green turtle hatchlings (0.49 m/s) (Thums et al., 2016).

The locations of the proposed activities are greater than 35 km from the turtle nesting beaches of the Dampier Archipelago and Montebello Islands and therefore negligible impact to marine turtle

hatchlings is expected as the flaring lighting that may reach these locations will likely be reduced to near ambient at this distance.

Seabirds

The light from the CPF and vessels may provide enhanced capability for seabirds to forage at night (BHPB, 2005). Studies in the North Sea indicate that migratory birds are attracted to lights on offshore platforms when travelling within a radius of 3–5 km from the light source. Outside this area their migratory path will be unaffected (Marquenie et al., 2008).

According to the National Light Pollution Guidelines for Wildlife, a 20 km threshold provides a precautionary limit based on observed effects of sky glow on marine turtle hatchlings demonstrated to occur at 15 to 18 km from the light source and fledgling seabirds grounded in response to artificial light 15 km away. The intensity and extent of light glow, and the potential to result in biological impact, will be dependent upon the light source itself, including the number, intensity, spectral output and position of individual lights at the source. The effect of light glow may occur at distances greater than 20 km for some species and under certain environmental conditions (Commonwealth of Australia, 2020). The Wildlife Conservation Plan for Seabirds (CoA, 2020) identifies light as a threat and includes navigation aids, but also recognises that adult seabirds are less impacted than fledglings. The matrix identifies potential impacts to seabirds from light pollution as minor and recommends mitigation of light pollution around breeding colonies and from boats.

Given that only a small number of seabirds are likely to be affected by light spill from the activities whilst in transit, any behavioural disturbances that may occur such as disorientation and attraction are expected to be minor and temporary. The breeding BIA of the EPBC migratory species – wedge tailed shearwater overlaps the Operational area and 20km buffer. However, light emissions are not identified as a threat to the species (SPRAT Wedge-tailed shearwaters, DEE 2017as).

Plankton, Fish and sharks

The response of fish to light emissions varies according to species and habitat. Experiments using light traps have found that some fish and zooplankton species are attracted to light sources (Meekan et al. 2001). Lindquist et al. (2005) concluded from a study that artificial lighting resulted in an increased abundance of clupeids (herring and sardines) and engraulids (anchovies); these species are known to be highly photopositive. Shaw et al. (2002), in a similar light trap study, noted that juvenile tuna (Scombridae) and jack (Carangidae), which are highly predatory, may have been preying upon higher than usual concentrations of zooplankton that were attracted to a vessels light field.

There is a potential for individuals to be impacted by light emissions from lighting. However, as the Operational Area does not contain any significant feeding, breeding or aggregation BIAs for fish it is more likely there will be individuals traversing the area than large groups of species.

Light associated with the activity will affect a small portion of the vast biologically important foraging area for whale sharks. However, impacts at a population level are not expected due to the limited duration of the activities.

Overall Consequence assessment: Negligible

6.1.3 Environmental Performance

Hazard		Light (EPH-2)		
Performance outcome		Activity lighting managed in accordance with navigational and safety requirements		
ID	Management controls	Performance standards	Measurement criteria	Responsibility
001	Stag Safety Critical Elements Performance Standards Report (PS-04 Navigational Aids (GA-70-REP-F-00007) ensures navigation aids and equipment meet regulatory and safety requirements	Facility navigation lights are visible at a range of 6 NM for masthead lights and 3 NM for side and stern lights as per COLREGs requirements.	CMMS confirms navigational equipment is maintained	Integrity Supervisor
002	Stag Safety Critical Elements Performance Standards Report: PS-04 Navigational Aids (GA-70-REP-F-00007) ensure navigational lights are present and working	Aircraft warning lights mark tall objects that may be an obstruction to a helicopter approach to the helideck. Marine Navigational lights are positioned on the platform and CALM buoy such that at least one light is visible to a vessel approaching from any direction.	Formal inspection every 90 days confirms lights present and functioning, recorded in BASSnet	Stag OIM
0030 0400 5	Vessel navigation aids and equipment meet regulatory and safety requirements by aligning with Navigation Act 2012	<ul style="list-style-type: none"> Vessels will comply with maritime safety and navigation requirements including: -International Regulations for Preventing Collisions at Sea 1972 (COLREGS); Chapter V of Safety of Life at Sea (SOLAS); 	PMS confirms navigational equipment is maintained to regulatory and safety standards Records confirm that required navigation equipment is fitted to all vessels to ensure compliance with maritime	Vessel Master

Hazard		Light (EPH-2)		
Performance outcome		Activity lighting managed in accordance with navigational and safety requirements		
ID	Management controls	Performance standards	Measurement criteria	Responsibility
		<ul style="list-style-type: none"> • Marine Order 21 (Safety of navigational and emergency procedures) (as appropriate to vessel class); • Marine Order 30 (Prevention of collisions) (as appropriate to vessel class) • Vessels to maintain radio channels and other communication systems. 	safety and navigation requirements. Records confirm vessels maintain communication systems.	

6.1.4 ALARP Assessment

On the basis of the impact and risk assessment process completed, Jadestone considers the control measures described above are appropriate to manage the risk of light emissions to ALARP, the residual risk ranking for this potential impact is considered Low, and therefore ALARP has been demonstrated, no further controls are required. Additional controls considered but rejected are detailed below.

Rejected Control	Hierarchy	Practicable	Cost Effective	Justification
All activities completed in daylight hours only	Eliminate	No	No	Daylight operations only considered to introduce unnecessary cost (i.e. 12 vs 24 hr. ops.), whilst delivering little / no environmental benefit. The operations cannot be shut down on a daily basis, and there would be a >50% reduction in production over the course of a year resulting in significant costs. Light from the Stag facility does not illuminate beaches where receptors (including turtle hatchlings) sensitive to light emissions are present.
Replace external lights or reduce the lighting	Substitute	No	No	Lights are required to create illumination levels needed for safe working, emergencies and navigational requirements. No additional cost; but introduces unacceptable safety risks to personnel and vessels. Little benefit given relatively low numbers of turtles and seabirds in operational area and surrounding waters.
Add filters to lights or re-design placement/ positioning	Engineering	No	No	Lighting has been positioned such that maximum illumination of work surfaces within facility structures is achieved. Costly and considered grossly disproportional to any gain when considering the distances that the facility is from turtle or seabird nesting areas.
Reduce usage of lighting in peak sensitive receptor windows	Isolation	No	N/a	To ensure lighting meets health and safety requirements, lighting is required throughout the day/ night and across the year. To isolate usage such that lights were not used during sensitive receptor windows would create a non-conformance with health and safety requirements.
None identified	Administrative	N/a	Na/a	N/a

6.1.5 Acceptability Assessment

The potential impacts due to light emissions are considered 'Broadly Acceptable' in accordance with the Environment Regulations, based on the acceptability criteria outlined below. No control measures are proposed as a reduction below maintenance of light levels in accordance with health and safety regulations as is currently the case.

Policy compliance	Jadestone's HSE Policy objectives are met.
Management system compliance	Section 9 demonstrates that Jadestone's HSE Management System is capable of meeting environmental management requirements for this activity.

<p>Social acceptability</p>	<p>Stakeholder consultation has been undertaken (see Section 6), and no stakeholder concerns have been raised with regards to impacts from lighting on sensitive receptors.</p>
<p>Laws and standards</p>	<p>Lighting on the Stag facility has been designed to meet health and safety requirements. All vessels in Australian waters adhere to the navigation safety requirements contained within the Navigation Act 2012 and subordinate Marine Orders with respect to navigation and workplace safety equipment (including lighting).</p> <p>There are no standards for acceptable levels of lighting to seabirds or turtles.</p>
<p>Industry best practice</p>	<p>Lighting on the Stag facility is designed to be at minimum safe operational levels.</p>
<p>Environmental context</p>	<p>While there is direct light spill to sea surface immediately around the Stag facility, the impact and risk assessment process indicates that the light spill will not cause significant behavioral effect to adult turtles and marine mammals that may transit the Operational Area or light EMBA.</p> <p>Light is identified in the National recovery plan for Turtles (2017) as a threat to turtles on nesting beaches only. Although the operational area overlaps an internesting BIA for flatback turtles, impacts to adults from lighting is not expected to significantly affect the adult turtle behaviour. There will be no direct light spill on nesting beaches, though some increase from ambient may be expected from the flaring emissions on turtle nesting beaches within 42 km of the flare (though very unlikely) and therefore the activity is considered to be conducted in a manner that is consistent with the Recovery Plan and the National Light Pollution Guidelines for Wildlife (CoA, 2020).</p> <p>Light is also identified as a threat to seabirds in the Wildlife Conservation Plan for Seabirds (CoA, 2020), however the operational area is not within 20 km of a breeding colony and lighting is essential for the activity (navigational lighting).</p> <p>Light is not identified as a threat to the wedge tailed shearwater which a breeding BIA overlaps the Stag Facility.</p> <p>The potential impact is considered acceptable after consideration of:</p> <ul style="list-style-type: none"> - Potential impact pathways - Preservation of critical habitats - Assessment of key threats as described in species and Area Management /Recovery plans - Consideration of North-West Bioregional Plan; and - Principles of ecologically sustainable development ESD
<p>Conservation and management advice</p>	<p>Light is identified in the National recovery plan for Turtles (2017) as a threat to turtles on nesting beaches only. There will be no very limited indirect light spill from flaring on nesting beaches and therefore the activity is considered to be conducted in a manner that is consistent with the Recovery Plan and the National Light Pollution Guidelines for Wildlife (Commonwealth of Australia 2019).</p> <p>Light pollution is identified as a threat in the Wildlife Conservation Plan for Seabirds (CoA, 2020) and includes navigation aids. Though the plan does identify lighting from vessels as having potential impacts, the operational area is not in close proximity to any breeding areas and therefore only individuals overflying the location are considered likely and the impacts are considered negligible. No explicit controls are listed in the plan to manage lighting impacts.</p>

	Jadestone has had regard to the representative values of the protected areas within the RISK EMBA, and the respective management plans and other published information. Impacts from light emissions will have a negligible impact on any of the social and ecological objectives and values, of any AMPs, or state marine parks. This is consistent with the objectives of the protected area management plans and considered acceptable.
ALARP	The residual risk has been demonstrated to be ALARP.

6.2 Noise

6.2.1 Description of hazard

Aspect	<p>Noise is generated by activity vessels (including support vessels) and helicopters. Highest noise levels are likely to occur where vessels use bow thrusters.</p> <p>Noise is also generated by equipment such as generators and pumps on the CPF. The median sound level for five FPSOs on the NWS has been recorded at 181 dB re 1 μPa (Erbe et al., 2013). Side-scan sonar (SSS) is an activity that may be used during inspection, maintenance and repair work, likely to be applied for several days at a time every few years.</p>
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Vessels

Under normal operating conditions when vessels are idling or moving between sites, support vessel noise would be detectable only over a short distance (tens of metres). When a support vessel is using main engines and bow thrusters to hold position, the noise may be detectable above background noise levels for hundreds of metres or more during calm weather conditions, although this range of audibility will be reduced under noisier (windier) background conditions (BHPB, 2005). Studies of the radiating underwater noise generated from the propellers of support vessels when holding position ('DP') indicate highest measured levels of up to 182 dB re 1Pa with levels of 120 dB re 1Pa measured at 3–4 km (McCauley, 1998). McCauley (1998) also measured underwater sound levels from the Pacific Ariki, a 64 m long support vessel with 8000 HP (6,000 kW) main engines during calm conditions in the Timor Sea in 110 m of water while transiting at 11 knots, and found the distance to 120 dB re 1 μ Pa to be approximately 1 km.

Helicopters

The extent of helicopter noise impacts are limited to take off and landing at the MODU as they do not fly close to the ocean surface (with a typical cruising height of between approximately 1,000 to 1,400 m) except to undertake these tasks.

The main acoustic source associated with helicopters is the impulsive noise from the main rotor and high-speed impulsive noise related to trans-sonic effects on the advancing blade. Dominant tones in noise spectra from helicopters and fixed wing aircraft are generally below 500 Hz (McCauley, 1994). Other tones associated with the main and tail rotors and other engine noise can result in a larger number of tones at various frequencies (BHPB, 2005).

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, with sound penetrating water at angles less than 13°. The noise from the flyover of a Bell 214 helicopter (stated to be a noisy model) has been recorded underwater (Richardson et al., 1995). The sound source was 162 dB re 1 μ Pa @ 1 m at its peak and had frequency of 155 Hz.

CPF Activities

Noise from platform operations is expected to be low as operating equipment including generators, engines and machinery is above sea level. The frequency and noise level received underwater will depend on a number of variables including the type of infrastructure; the types and sizes of engines; as well as the local hydro-acoustic and geo-acoustic environment.

IMR Activities

For the IMR activities covered in the EP, side-scan sonar (SSS) is a rare activity that would only occur for several days at a time within the operational area every few years. SSS transmits at high frequencies (approximately 70 – 400 Hz) and produces a highly focussed beam of sound down towards the seabed, due to this there is very limited horizontal sound propagation. SSS is generally considered a high acoustic density source and medium frequency generator. The level of sound pressure ranges from about 200–235 dB re 1 μ Pa SPL. The frequency ranges from about 75 to 900 kHz (Jimenez-Arranz et al., 2017). The maximum potential duration of exposure is limited to the time taken for a migrating whale to pass a vessel performing side-scan sonar in the operational area, potentially only minutes per individual.

6.2.2 Impacts

The nature and scale of impacts from noise emissions generated during this activity must be considered in the context of the ambient noise environment. Ambient underwater noise levels are dependent on location, and are often dominated by local wind noise, waves, biological noise and ship traffic. Wind speed and seabed conditions have a clear influence on the ambient noise level. Existing anthropogenic underwater noise sources in the region of the activity include shipping, small vessel traffic servicing the Stag CPF and other nearby operators, as well as the overarching operations that are ongoing at the Stag CPF.

The response of marine fauna when exposed to underwater noise from anthropogenic sources is dependent on a number of factors, including distance from the sound source, water depth and bathymetry, the animal's hearing sensitivity, type and duration of sound exposure and the animal's activity at time of exposure. Potential impacts to marine fauna due to noise and vibration in the underwater environment may occur, and can result in a range of responses including (Richardson *et al.*, 1995; Southall *et al.*, 2007):

- Injury to hearing or other organs: hearing loss may be temporary (temporary threshold shift (TTS)) or permanent (permanent threshold shift (PTS));
- Masking or interfering with other biologically important sounds (including vocal communication, echolocation, signals and sounds produced by predators or prey); and
- Disturbance leading to behavioural changes or displacement of fauna. The occurrence and intensity of disturbance is highly variable and depends on a range of factors relating to the animal and situation. This includes attraction to the noise sources as well as avoidance.

EPBC Act listed and threatened migratory species that may be present near the activities include whales migrating through the operational area, whale sharks and turtles. Noise is identified as a threat within the conservation advice or recovery plans (refer Table 3-5) for a number of the EPBC species that may occur in the operational area including humpback whales, whale sharks and turtles. The

operational area also overlaps BIAs for pygmy blue whale (distribution), humpback whale (migration) and flatback turtle (interesting).

A PMST Search was conducted on a 20km buffer around the defined operational area to identify any MNES species within the vicinity upon which noise impacts may occur. The following species (potentially impacted by noise) were identified as potentially occurring within a 20km buffer in addition to those identified to occur within the defined operational area:

- Sei Whale
- Fin whale
- Dugong
- Shortfin mako
- Longfin Mako

Marine Mammals

Cetaceans may travel through the area, particularly given the migration BIA for the humpback whale and the distribution BIA for the pygmy blue whale overlap the operational area. Additionally, conservation advice and management plans for humpback whales and blue whales list noise interference as a potential threat. Both these species are low-frequency cetaceans. Low (baleen whales) and mid-frequency (toothed whales except porpoises) cetaceans may frequent the operational areas. There are no known aggregation, resting, breeding or feeding areas for cetaceans in close proximity to the operational area.

Dugongs may also frequent the area, although the BIA is not within the operational area or 20 km buffer. While dugongs may occur in the area, dugongs spend most of their time in shallow tidal and subtidal seagrass meadows. There are no assessments for impacts of vessel noise on dugongs (sirenians) using the Southall et al. (2019) criterion. As their frequency-weighting is most similar to HF cetaceans, and their thresholds are higher (as they are less sensitive), results for vessel noise impacts on HF cetaceans have been used as a proxy for those on dugong, noting that this is likely to be conservative.

Whales are low-frequency hearing cetaceans with an estimated functional hearing frequency range of 7–22 kHz (Southall et. al.2007).

The threshold criteria that is currently recognised for the potential behavioural impacts to marine mammals is 120 dB re 1 μ Pa SPL (unweighted) for non-impulsive noise sources (NOAA, 2019).

PTS and TTS onset thresholds have been identified for low frequency cetaceans and dugongs, and high-frequency cetaceans which are weighted SEL24h received levels.

Table 6-2 details cetacean behavioural, TTS and PTS thresholds for continuous noise (vessels and CPF), and Table 6-3 details cetacean behavioural, TTS and PTS thresholds for impulsive noise (survey equipment).

Table 6-2: Continuous noise: summary of cetacean impact thresholds as derived from Southall *et al.* (2019) and National Oceanic and Atmospheric Administration (2019)

Hearing group	NOAA (2019)	Southall <i>et al.</i> (2019)	
	Behaviour	PTS onset thresholds (received level)	TTS onset thresholds (received level)
	SPL (dB re 1 μ Pa)	Weighted SEL _{24h} (dB re 1 μ Pa ² ·s)	Weighted SEL _{24h} (dB re 1 μ Pa ² ·s)
LF cetaceans	120	199	179
HF cetaceans		198	178

Table 6-3: Impulsive noise: summary of marine mammal impact thresholds as derived from Southall *et al.* (2019) and United States National Marine Fisheries Service (2014)

Hearing group	PTS onset thresholds ⁵		TTS onset thresholds ³		Behaviour (SPL, dB re 1 μ Pa)
	Weighted SEL _{24h} (dB re 1 μ Pa ² ·s)	PK (dB re 1 μ Pa)	Weighted SEL _{24h} (dB re 1 μ Pa ² ·s)	PK (dB re 1 μ Pa)	
HF cetaceans	185	230	170	224	160
LF cetaceans	183	219	168	213	

Potential impacts from CPF and vessels

Using predicted source levels described above, estimated distances from activity vessels to behavioural and physiological thresholds (as listed in Table 6-2) for cetaceans are provided below.

The predicted extent of thresholds for a vessel in transit have been estimated using measurements of the *Pacific Arika* (McCauley, 1998) and the ranges predicted for the CPF operating in isolation, are as follows:

- + The range to the 120 dB re 1 μ Pa NOAA (2019) criterion for behavioural responses in marine mammals is estimated to be 1 km.
- + PTS and TTS in LF cetaceans could occur within approximately 20 or 200 m respectively, if the animal remains within that range for 24 hours.
- + PTS is not predicted in HF cetaceans, although they could experience TTS within 50 m if the animal remains within that range for 24 hours.

Considering modelling assessments of other similar operations (such as the Artisan-1 Exploration Well), and applying a conservative approach, a range to TTS of 50 m for HF cetaceans will be used to represent potential effects on odontocetes within this assessment.

Auditory masking impacts may occur when there is a reduction in audibility for one sound (signal) caused by the presence of another sound (noise). For this to occur the noise must be loud enough and have a similar frequency to the signal and both signal and noise must occur at the same time. Therefore, the closer the marine mammal is to the vessel, and the more overlap there is with their

⁵ Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS onset.

vocalisation frequencies, the higher the probability of masking. The potential for masking and communication impacts is therefore classified as high near the vessel (within tens of metres), moderate within hundreds to low thousands of metres (Clark *et al.*, 2009).

Generally, the spatial and temporal scale of behavioural response effects on marine mammals would be limited to the localised area surrounding the CPF (thousands of metres) and the periods of intensified activities. These ranges will be greater during resupply operations. Because the operations will be focused at a static site, and therefore only influence a small region within the region not known to be a critical habitat for any cetacean species, significant effects at the population level are not expected.

Potential impacts from survey equipment

Modelling of survey geophysical equipment has been undertaken at a number of locations including the coast of Russia, Greenland, California and the Otway basin (Zykov *et al.*, 2013; Austin *et al.*, 2012; McPherson and Wood, 2017; Zykov *et al.*, 2012). These studies, along with the example of accumulation provided in McPherson (2020) indicate that both peak and frequency-weighted SEL noise emissions from survey equipment such as SSS operating at 75-900 kHz are typically below sound levels that could result in low and high-frequency marine mammal TTS or PTS from either PK or SEL criteria (**Table 6-3**) in a horizontal direction. The threshold for behavioural disturbance (**Table 6-3**) could be exceeded within 120 m (McPherson, 2020). SSS impulses are outside the auditory range of LF species and baleen whales (such as humpback and pygmy blue whales) but within the mid-frequency (MF) and HF cetacean marine fauna auditory range (such as sperm whales and dolphins). However, PTS and TTS thresholds for these species (**Table 6-3**) are only expected to be exceeded close to the source. Due to the lack of aggregating areas for these species, individuals are expected to be transitory only, displaying behavioural responses, and moving away from the source, before TTS and PTS thresholds are exceeded.

Survey equipment could cause masking of vocalisations of cetaceans due to the overlap in frequency range between signals and vocalisations. Masking will primarily apply to HF cetaceans, with all signals above 2 kHz. Higher frequency sounds have limited propagation, and attenuate rapidly, resulting in a relatively small area of influence. Therefore, the range at which masking impacts could occur would be limited to within hundreds of metres from the sound source.

The risk of impact is further reduced as the survey vessels will be moving around subsea equipment when conducting these types of surveys and for very short durations. The likelihood of an individual remaining within the distances above for any length of time is highly unlikely.

The Blue Whale Conservation Management Plan 2015–2025 (DoE, 2015) lists noise disturbance as a threat, specifically relating to impulsive sound sources and acute industrial noise such as pile driving. Shipping noise in busy shipping channels is also identified as a potential source of noise emissions, although the risk assessment determines that consequences would be restricted to individuals, and no population level effects expected. The plan also recognises that avoidance of these activities is typically shown. The plan requires that anthropogenic noise in distribution areas will be managed such that any blue whale continues to utilise the area without injury. As defined by the guidance on key terms in the CMP (DAWE, 2021), injury is considered to be either PTS or TTS from underwater noise. The received levels from the CPF and vessels will decline rapidly from the source and be below thresholds for PTS at source and below TTS within approximately 1 km of the source. As injury is not expected as a result of continuous sound sources resulting from the activity, impacts will be managed in adherence with the Management Plan.

Generally, the spatial and temporal scale of behavioural response effects on marine mammals would be limited to the localised area surrounding the CPF and vessels (thousands of metres) and the periods of intensified activities such as vessel re-supply.

Impacts to cetaceans from underwater noise generated by the activity is considered negligible

Marine Reptiles

The interesting buffer BIA and habitat critical to the survival for flatback turtles intersect the operational area. Studies have demonstrated however, that the suitable interesting habitat for marine turtles is more likely to remain in water depths of <20m and within 10km of the coastline (Whittock et al., 2016), Fossette et al, 2021). Therefore, while marine turtles may be present in offshore waters during the interesting period, they are typically freely moving through these areas before they return to shallow waters to rest in the days leading up to nesting activity, and foraging can occur outside of designated BIAs but typically in shallower water depths than those of the operational area.

The Recovery Plan for Marine Turtles in Australia (2017) identifies noise interference as a threat to marine turtles and suggest the impact of noise on turtle stocks may vary depending on whether exposure is acute or chronic. 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. This activity will result in chronic noise rather than acute, from the vessel movements.

While numerical thresholds have been developed for impacts of impulsive noise sources to marine turtles (for example, Finneran *et al.*, 2017), the approach defined by Popper *et al.* (2014) has been applied to impulsive and continuous noise (Table 6-4 and Table 6-5).

Table 6-4: Acoustic effects of continuous noise on marine turtles

Potential marine fauna receptor	Popper <i>et al.</i> , 2014	
	Masking	Behaviour
Marine turtle	(N) High (I) High (F) Moderate	(N) High (I) Moderate (F) Low

Note: Relative risk (high, moderate, low) is given for animals at three distances from the source defined in relative terms as near (N) – tens of metres, intermediate (I) – hundreds of metres, and far (F) – thousands of metres.

Table 6-5: Criteria for impulsive noise exposure for marine turtles, adapted from Popper *et al.* 2014

Potential marine fauna receptor	Masking	Behaviour	TTS	Recoverable injury	Mortality and potential mortal injury
Marine turtle	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low	(N) High (I) Low (F) Low	(N) High (I) Low (F) Low	>210 dB SEL _{24h} or >207 dB PK

Note: Relative risk (high, moderate, low) is given for animals at three distances from the source defined in relative terms as near (N) – tens of metres, intermediate (I) – hundreds of metres, and far (F) – thousands of metres.

Potential impacts from the CPF and vessels

Based on the criteria detailed within Table 6-5, there is a low risk of any injury to marine turtles from activity vessel noise. Behavioural changes, such as avoidance and diving, are only predicted for

individuals near the activity vessels (high risk of behavioural impacts within tens of metres of a vessel and moderate risk of behavioural impacts within hundreds of metres of a vessel). There is a high risk of masking within hundreds of metres of the vessel, and a moderate risk of masking within thousands of metres from the vessel. Little is known regarding masking in marine turtles, and behavioural reactions have been found to be highly context specific, with behavioural sensitisation and habituation affecting the onset threshold for reactions and impacts (Ellison et al., 2012). However, given the relatively low-level increase in sound, it is unlikely that vessel noise will cause significant masking impacts in turtles.

Sea snakes may also be affected by noise, although as they generally associated with reef systems including at coral reefs (the closest are approximately 32 km away from the Operational Area at the Dampier archipelago), it is considered unlikely they will frequent the Operational Area. It is considered that there is a moderate risk in the near and intermediate distances (which extends hundreds of metres) of behavioural impacts to seasnakes, with the impacts being limited to temporary avoidance of the area. Such impacts are unlikely to result in substantial impacts to seasnake populations or distribution.

Potential impacts from SSS

The sound levels of the survey equipment are below those associated with the PK criterion for injury (Table 6-5) beyond a few metres (McPherson, 2020), and due to the low per-pulse SEL (McPherson, 2020), the SEL criterion will also not be exceeded. Recoverable injury and TTS could occur within tens of metres applying the relative risk criteria from Popper et al. (2014) (Table 6-5). Behavioural changes, such as avoidance and diving, are only predicted for individuals in close proximity to the activity vessels (high risk of behavioural impacts within tens of metres of source and moderate risk of behavioural impacts within hundreds of metres of the source).

Turtles are unlikely to experience masking even at close range to the source. This is in part because the sounds from survey equipment are all outside of the hearing frequency range for turtles (approximately 50 to 2000 Hz, with highest sensitivity to sounds between 200 and 400 Hz) (Ridgway et al., 1969; Bartol et al., 1999; Ketten and Bartol, 2005; Bartol and Ketten, 2006; Yudhana et al., 2010; Piniak et al., 2011; Lavender et al., 2012, 2014).

Impacts to marine turtles from underwater noise generated by survey equipment are unlikely to result in substantial impacts given that impacts are likely to be limited to physiological impacts in individuals located within tens of metres of the sound source, and behavioural impacts in individuals located within hundreds of metres of the sound source. The risk of impact is further reduced as the vessels will be moving when undertaking surveys and it is highly unlikely that any individual would remain within the distances above for any length of time

Fish, sharks and rays

A number of shark species may also occur in the region, including the EPBC Act listed whale shark, though the operational area does not overlap any fish, shark or ray BIAs. Approved Conservation Advice for *Rhincodon typus* (whale shark) (2015) does not identify noise interference as a threat to the species. Elasmobranchs (rays, skates, sharks) rely on low frequency sound to locate prey (Myrberg, 1978). The large hearing structure of the whale shark will be most responsive to long-wave, low-frequency sound (Myrberg 2001) in the range of 20 and 800 Hz. Elasmobranchs do not have swim bladders and are not typical hearing specialists (Baldrige, 1970).

Fish sensitivity and resilience to underwater noise varies greatly depending on the species, hearing capability, habits, proximity to the noise source, and the timing of the noise (i.e. the noise may occur during a critical part of the fish's lifecycle; McCauley and Salgado-Kent, 2008). Most marine fish are hearing generalists (Amoser and Ladich, 2005) with relatively poor hearing. Hearing generalists are

not as sensitive to noise and vibration as hearing specialists, which have developed hearing specialisations and can be particularly vulnerable to intense sound vibrations because many possess an air-filled swim bladder (Nedwell et al. 2004).

Popper et al. (2014), a working group of leading experts, suggested that behavioural responses in fish, which are less sensitive to noise than cetaceans, are more likely to occur within tens or hundreds of metres from vessels and other continuous/ non-impulsive noise sources. While fish may show an initial behavioural response, fish are known to quickly habituate to continuous noise sources (Smith et al. 2004; Wysocki et al. 2006; Spiga et al. 2012; Nichols et al. 2015; Johansson et al. 2016; Holmes et al. 2017). In particular, many fish species are known to aggregate around the foundations of oil and gas platforms and subsea structures, despite operational noise. Therefore, behavioural impacts fish are expected to be limited and highly localised.

The criteria defined in Popper *et al.* (2014) for continuous noise sources has been applied to the assessment of impacts to sharks, rays and fish (Table 6-6).

Table 6-6: Continuous noise: criteria for noise exposure for fish (adapted from Popper *et al.*, 2014)

Potential marine fauna receptor	Mortality and potentially mortal injury	Impairment			Behaviour
		Recoverable injury	TTS	Masking	
Type 1 Fish: No swim bladder (particle motion detection) includes sharks and rays.	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Type 2 Fish: Swim bladder not involved in hearing (particle motion detection)	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Type 3 Fish: Swim bladder involved in hearing (primarily pressure detection)	(N) Low (I) Low (F) Low	170 dB SPL for 48 h	158 dB SPL for 12 h	(N) High (I) High (F) High	(N) High (I) Moderate (F) Low
Fish eggs and fish larvae	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low	(N) Moderate (I) Moderate (F) Low

Note: Relative risk (high, moderate, low) is given for animals at three distances from the source defined in relative terms as near (N) – tens of metres, intermediate (I) – hundreds of metres, and far (F) – thousands of metres.

Based on this study, vessel/CPF noise has a low risk of resulting in mortality for all fish types. The risk of recoverable injury to Type 1 and 2 fish is low, however is moderate for TTS and behavioural impacts when fish are within tens of metres of an activity vessel (Popper *et al.*, 2014). For Type 3 fish, recoverable injury and TTS may occur within 60 m of the source (McPherson *et al.*, 2019), with a high risk of behavioural impacts occurring within tens of metres of an activity vessel (Popper *et al.*, 2014).

The most likely impacts to fish from noise will be behavioural responses. Popper et al. (2014) identified a moderate risk of behavioural impacts to fish in near (tens of metres) and intermediate distances (hundreds of metres) from the noise source. Masking in fish could also occur within thousands of metres under a worst-case scenario.

Impacts to fish from underwater noise generated by vessel and CPF operations are unlikely to result in substantial impacts to populations or distribution given that impacts are likely to be limited to physiological impacts in individuals located within tens of metres of the vessel, behavioural impacts in individuals located within hundreds of metres of the vessel, and masking of fish within thousands of metres. Fish are considered unlikely to remain in proximity to vessels and are therefore unlikely to be exposed to sound at the above thresholds. Noise effects to fish of potential commercial value would be restricted to within hundreds of metres of the noise source.

Potential impacts from SSS

The criteria defined in Popper et al. (2014) for impulsive noise sources has been adopted (Table 6 7). Impulsive noises from survey equipment could result in physiological impacts to fish located within metres of the sound source considering the results presented in McPherson (2020). The likelihood of fish being close enough to the sound source for physiological impacts to occur is considered remote.

Table 6-7: Criteria for impulsive noise exposure for fish, adapted from Popper et al., 2014

Marine fauna group	Mortality and potential mortal injury	Impairment			Behaviour
		Recoverable injury	TTS	Masking	
I Fish: No swim bladder (particle motion detection)	>219 dB SEL _{24h} or >213 dB PK	>216 dB SEL _{24h} or >213 dB PK	>>186 dB SEL _{24h}	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low
II Fish: Swim bladder not involved in hearing (particle motion detection)	210 dB SEL _{24h} or >207 dB PK	203 dB SEL _{24h} or >207 dB PK	>>186 dB SEL _{24h}	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low
III Fish: Swim bladder involved in hearing (primarily pressure detection)	207 dB SEL _{24h} or >207 dB PK	203 dB SEL _{24h} or >207 dB PK	186 dB SEL _{24h}	(N) Low (I) Low (F) Moderate	(N) High (I) High (F) Moderate
Fish eggs and fish larvae	>210 dB SEL _{24h} or >207 dB PK	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low

Note: Relative risk (high, moderate, low) is given for animals at three distances from the source defined in relative terms as near (N) – tens of metres, intermediate (I) – hundreds of metres, and far (F) – thousands of metres.

Behavioural impacts to fish from survey equipment noise may occur in individuals located within hundreds of metres of the source. The proposed survey equipment does not have energy below 1 kHz, and therefore it is unable to be heard by most fish, which further reduces the risk of impact (Ladich and Fay, 2013). The impact of masking is low at all ranges, apart from fish who specialise in pressure detection, which can be impacted in a moderate way at thousands of metres. However, as these signals are outside the hearing range of most fish in the region, the risk of impact is reduced.

Impacts to fish from underwater noise generated by survey equipment are unlikely to result in substantial impacts to populations or distribution given that impacts are likely to be limited to behavioural impacts within hundreds of metres and masking within thousands of metres. Fish are considered unlikely to remain in proximity of the sound source for long periods of time and are therefore unlikely to be exposed to sound at the above thresholds.

6.2.3 Environmental Performance

Hazard		Noise (EPH-3)		
Performance outcome		Procedures implemented to ensure no death or injury to EPBC listed marine fauna from noise emissions		
ID	Management controls	Performance standards	Measurement criteria	Responsibility
006	Noise Survey undertaken to record noise levels and compare with previous levels	'Noise Survey Review' conducted every five years to determine whether noise conditions have increased above required levels, whether additional monitoring / survey is required and if corrective actions are required.	Record of Noise Survey Review and any corrective actions in BASSnet	OIM
007	Vessel contract reviewed to ensure that support vessels comply with EPBC Regulations 8.05 and 8.06	Support Vessel Masters will comply with relevant parts of EPBC Regulation (2000): Reg. 8.05 & 8.06 respectively, where safe to do so: <ul style="list-style-type: none"> - Within the caution zone for a cetacean (including a calf) (within 300 m of a cetacean), the Vessel Master must operate the vessel at a constant speed of less than 6 knots and minimise noise; and - If a calf appears within an area that means the vessel is then within the caution zone of the calf, the Vessel Master must immediately stop the vessel and turn off the vessel's engines, or disengage the gears or withdraw the vessel from the caution zone at a constant speed of less than 6 knots. - The above requirements will also apply to whale sharks if they are sighted within 300m of the vessel. 	Vessel Contract includes compliance with EPBC Regulations prior to mobilisation BASSnet SAFIR incident reports records any incidences of non-compliance with EPBC Regulations 2000 - Part 8 Division 8.1 (interacting with cetaceans)	Operations Manager
008	Helicopter contract reviewed to ensure that helicopters comply with EPBC Regulations 8.07	Helicopters will comply with the following elements of EPBC Regulations 2000 Regulation 8.07, except during take-off/ landing, during an emergency or when action is required to maintain safe operations:	Helicopter Contractor's procedures include compliance with EPBC Regulations	Logistics Lead

Hazard		Noise (EPH-3)		
Performance outcome		Procedures implemented to ensure no death or injury to EPBC listed marine fauna from noise emissions		
ID	Management controls	Performance standards	Measurement criteria	Responsibility
		<p>- A helicopter will not operate at a height lower than 1,650 feet or within a horizontal radius of 500 m of a cetacean; and</p> <p>- A helicopter will not deliberately approach a cetacean from head-on.</p> <p>Helicopter operators are required to report any instances where these standards are breached, and any event involving injury to or death of marine fauna due to helicopter operations.</p>	BASSnet SAFIR incident reports records any incidences of non-compliance with EPBC Regulations 2000 - Part 8 Division 8.1 (interacting with cetaceans)	
009	Valid Flag State Certificate indicates vessel engines and equipment is certified and maintained	<p>Vessel machinery is maintained in accordance with Flag State certification requirements.</p> <p>Maintenance is conducted in accordance with the vessel maintenance management system.</p>	Flag State Certificate / ISM.	Operations Manager
010	Planned maintenance of engines and equipment	All engines, compressors and machinery on the CPF are maintained via a maintenance management system	CMMS shows maintenance has been satisfactorily completed as scheduled	Stag OIM
			BASSnet confirms maintenance completed on engines	Engineering & Maintenance Manager
011	Vessels operate at speeds in accordance with Stag Marine Facility Operating Manual (GF-90-MN-G-00038) to reduce potential for collision with marine fauna	Vessels operating within the restricted zone must not exceed a speed of five (5) knots.	Vessel Masters provided and required to operate in accordance with the Stag Marine Facility Operating Manual (GF-90-MN-G-00038) – Sign-off sheet for completed by Vessel Master.	Supply Chain Lead

Hazard		Noise (EPH-3)		
Performance outcome		Procedures implemented to ensure no death or injury to EPBC listed marine fauna from noise emissions		
ID	Management controls	Performance standards	Measurement criteria	Responsibility
012	Competency and Training Management System (JS-60-PR-Q-00015) provides a process for ensuring that Contractors and Services Providers have the appropriate level of HSE capability	Online induction includes information on speed limits in the PSZ and requirements on interacting with marine fauna	Induction Records (Vessel Masters)	Vessel Master

6.2.4 ALARP Assessment

<p>On the basis of the impact and risk assessment completed, Jadestone considers the control measures described above are appropriate to manage the impact and risk of noise due to operation of machinery, vessels and helicopters. The residual risk ranking for this potential impact is considered Low, and therefore ALARP has been demonstrated, no further controls are required. Additional controls considered but rejected are detailed below.</p>				
Rejected Control	Hierarchy	Practicable	Cost-effective	Justification
Remove machinery that emits noise	Eliminate	No	N/a	Noise from vessels, helicopters and machinery cannot be eliminated. Without vessels, helicopters and machinery the operation cannot be undertaken. SSS is necessary for integrity
Replace machinery that emits noise with quieter machinery	Substitute	No	No	All equipment as listed is required; no opportunities for substitution were identified.
Provide additional muffling on machinery, or design to reduce noise emissions	Engineering	No	No	Machinery is generally designed with human health hearing requirements taken into consideration, reducing operating noise to as low as efficiently and cost effectively as possible.
Do not operate noisy machinery in areas of sensitivity	Isolation	No	N/a	The Activity is located at distance from sensitive receptors and the coastline. Other fauna in the vicinity may experience short term behavioral effects only and cannot be prevented from being in the vicinity of the activity
Additional facility specific noise emissions procedures for vessels, helicopters and machinery	Administrative	No	No	Through the application of EPBC Regulation 8 for helicopter and vessel marine fauna interaction procedures, vessel speed restrictions, inductions for personnel on interacting with marine fauna and application of machinery maintenance, potential impacts are reduced. No further procedures are considered necessary.
Dedicated Marine Mammal Observer (MMO) (as per EPBC Policy Statement 2.1 – Part B.1)	Administrative	No	No	This would require an additional cost of contracting several specialist marine fauna observers, and even if marine fauna are identified, noise sources cannot be shut down in the event marine fauna are detected, since they are integral to safe operation of vessels and CPF. Therefore the cost is disproportionate to the increase in environmental benefit given the potential impacts are expected to be limited to behavioural impacts to marine fauna.

6.2.5 Acceptability assessment

<p>The potential impacts of machinery, helicopter and vessel noise emissions are considered 'Broadly Acceptable' in accordance with the Environment Regulations, based on the acceptability criteria outlined below. The control measures proposed are consistent with relevant legislation, standards and codes.</p>	
Policy compliance	Jadestone’s HSE Policy objectives are met.

Management system compliance	Section 9 demonstrates that Jadestone’s HSE Management System is capable of meeting environmental management requirements for this activity.
Social acceptability	Stakeholder consultation has been undertaken (see Section 6), and no stakeholder concerns have been raised with regards to impacts from noise on sensitive receptors.
Laws and standards	Noise emissions from topsides equipment on the CPF, supply and support vessels machinery are managed through maintenance of equipment as per safety legislative and regulatory requirements administered by NOPSEMA and Flag State. EPBC Regulation 8 and the Australian National Guidelines for Whale and Dolphin Watching 2017 (Commonwealth of Australia 2017b) control vessel speeds
Industry best practice	Noise from CPF, helicopters and vessel equipment is designed to be at minimum safe operational levels. The APPEA Code of Environmental Practice (CoEP) (2008) objectives are met with regards to offshore production operations.
Environmental context	While there are noise emissions to sea surface immediately around the Stag facility and high frequency noise associated with SSS, the impact and risk assessment process indicates that noise will not result in death, injury or significant long-term behavioral effects to marine fauna. This is in alignment with relevant conservation advice and recovery plans for EPBC species that may occur in the Operational Area including humpback, blue whale and whale sharks. Jadestone intends that any impacts from noise generating activities are not inconsistent with protected area management plans or relevant IUCN principles. The potential impact is considered acceptable after consideration of: <ul style="list-style-type: none"> - Potential impact pathways - Preservation of critical habitats - Assessment of key threats as described in species and Area Management /Recovery plans - Consideration of North-West Bioregional Plan; and - Principles of ecologically sustainable development ESD
Conservation and management advice	Noise interference is identified as a threat to fauna that may be present in the operational area and 20 km buffer in: <ul style="list-style-type: none"> - The Recovery Plan for Marine Turtles in Australia (2003) - The Blue Whale Conservation Management Plan 2015 - 2025 (DoE, 2015b) - Approved Conservation Advice for Balaenoptera borealis (sei whale) (TSSC, 2015b) - Approved Conservation Advice for Balaenoptera physalus (fin whale) (TSSC, 2015c) <p>Which suggest noise may lead to the avoidance of important habitat in marine turtles and mask cetacean vocalisations.</p> <p>The Operational Area overlaps with the flatback turtle internesting BIA, the humpback whale migration BIA and the pygmy blue whale distribution BIA. Given the noise sources used during the activity, distance from the Operational Area to the closest turtle nesting site at Dampier Archipelago (32 km) and the large navigable area available in the open ocean to these species, it is expected that the impact of noise interference on individual transient turtles or cetaceans travelling through the Operational Area is expected to result in temporary avoidance reactions.</p> <p>The risk matrix presented within the Recovery Plan for Marine Turtles in Australia provides a risk rating of low to moderate associated with industrial and shipping noise</p>

	<p>on turtles. No further controls are considered appropriate given the distance from turtle BIAs and the low levels of noise from the proposed activity.</p> <p>The risk matrix presented within the Conservation Management Plan for Blue Whales (DoE (2015)) provides a risk rating of low to moderate associated with industrial and shipping noise on blue whales. The proposed controls including reduction of vessel speed in the vicinity of a whale align with the priority for action recommended in this management plan. Jadestone has had regard to the representative values of the protected areas within the RISK EMBA, and the respective management plans and other published information. Impacts from noise will have a negligible impact on any of the social and ecological objectives and values, of any AMPs, or state MPs. This is consistent with the objectives of the protected area management plans and considered acceptable.</p> <p>The Approved Conservation Advices for <i>Balaenoptera borealis</i> (sei whale) and <i>Balaenoptera physalus</i> (fin whale) (TSSC, 2015b,c) identify anthropogenic noise and acoustic disturbance as a threat with a consequence rating of minor. No specific controls to manage noise are identified.</p> <p>EPBC Regulation 8 and the Australian National Guidelines for Whale and Dolphin Watching 2005 (DEH 2006) set the requirements for vessels interacting with cetaceans.</p>
ALARP	The residual risk has been demonstrated to be ALARP.

6.3 Atmospheric Emissions

6.3.1 Description of Hazard

Aspect	<p>Sources of atmospheric emissions include:</p> <ul style="list-style-type: none"> • Power generation and process heating; • Production gas and flaring; • Engine exhausts; and • Fugitive emissions.
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As per the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard (2015, GHG emissions are categorised as:

- Scope 1: GHG emissions are direct emissions from sources owned or controlled by the company.
- Scope 2: GHG emissions are indirect emissions from the consumption of purchased electricity.
- Scope 3: GHG emissions are indirect emissions that are a consequence of the activities of the company, but occur from sources not owned or controlled by the company

In relation to the Stag CPF, scope 1 and scope 3 emissions are relevant, but Scope 2 emissions are not as electricity purchased from the grid is not used on the facility.

Scope 1 Emissions

A summary of the carbon dioxide equivalent emissions at the Stag facility in 2021 is provided in **Figure 6-1**. Forecasted emissions for over the producing life estimate a GHG total (tonnes of CO₂^e) of between 41,000 and 53,000 tonnes (including CO₂, N₂O and CH₄). GHG forecast estimates have focused on material GHG sources only and are based on current business plans which may be subject to change. . The profile has been modelled using business-as-usual flaring, gas as fuel and crude oil consumption forecasts, that will inevitably carry a margin of error.

Combustion emissions of Stag crude oil are released to atmosphere and comprise predominantly of CO₂ gas that is excess to the fuel requirements for heating in the production process and excess blanket gas from the gas flotation unit, is burned as a continuous release through a flare system present on the CPF. As these sources are predominantly methane, the combustion in the flare converts the methane to CO₂. Approximately 20% of the gas produced is used as fuel for equipment on board the CPF, the balance (80%) is flared.

The auxiliary boiler, which provides steam for heating in the production process to aid in the separation of the crude oil and produced water uses fuel gas (natural gas) recovered from the process to fire it. Products of combustion of the gas (predominantly CO₂) are exhausted to the atmosphere.

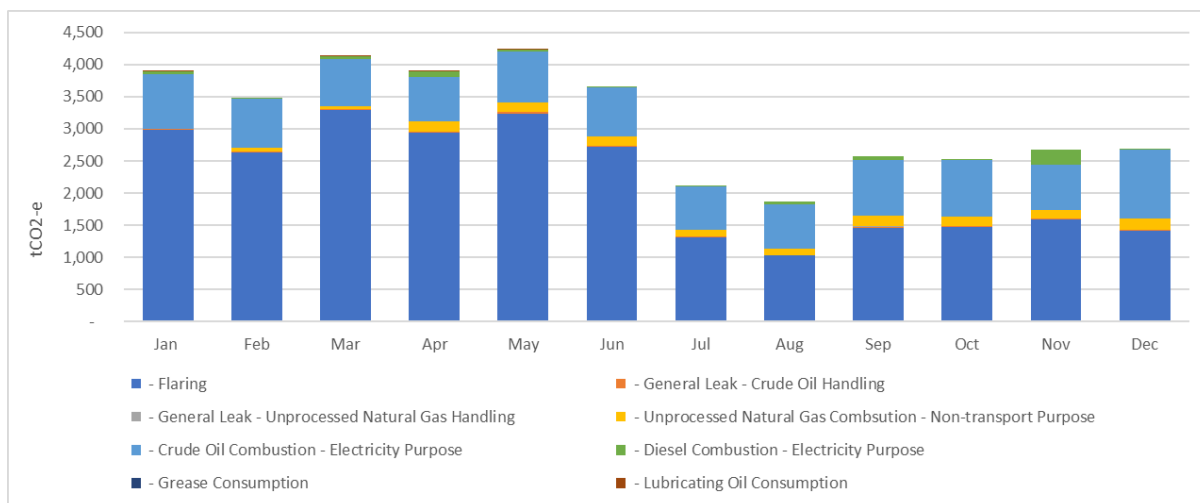


Figure 6-1: GHG emissions due to combustion sources at Stag Facility in 2021

Fuel (crude oil, diesel and avgas) burning equipment on the CPF will contribute to emissions of gases including CO₂, CO and NO₂. The crane on the platform is driven by a diesel engine which exhausts directly to atmosphere. Other diesel-powered portable equipment will also generate localised point source emissions from their operation on an intermittent basis.

The flare system is designed to handle a continuous flaring rate which ranges between 0.3 and 10 mmscfd, and typically operates at approximately 0.3 mmscfd. In addition, the flare system can accommodate an instantaneous flaring rate of 15 mmscfd.

Minor amounts of fugitive emissions occur on the facility. Hydrocarbon vapours are released from storage tanks and equipment on filling of the CPF day tanks and continuous minor venting. Emissions of Volatile Organic Compounds (VOCs) are extremely low during crude offloading, as Stag crude has low VOCs due to its weathered nature (Batelle, 1998). Blanket gas (inert gas from the boiler flue gas) is pumped into cargo tanks of the third-party tanker minimising any fugitive VOC emissions.

Scope 1 emissions are reported to the Clean Energy Regulator as part of the statutory annual National Greenhouse and Energy Reporting Act 2007 (NGER Act). NGER reporting includes direct emissions from fuel use, venting and fugitive emissions associated with the facilities where Jadestone has operational control.

Scope 3 GHG Emissions

Scope 3 emissions are defined as all indirect GHG emissions (not included in scope 1 or 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions. Scope 3 GHG emissions can be considered indirect consequences of the activity and therefore have impacts (EPBC Act 1999).

in Section 527E). Scope 3 GHG emissions are not reported under the NGER Scheme and have been estimated using the most appropriate emission factors available.

Jadestone has engaged a specialist third-party to undertake a review of its scope 3 emissions relating to Stag operations. When defining its approach, the Greenhouse Gas Protocol and relevant sector guidance have been consulted, which included:

- GHG Protocol: Corporate Accounting and Reporting Standard
- GHG Protocol: Corporate Value Chain Accounting and Reporting Standard
- IPIECA: Estimating petroleum industry value chain (scope 3) greenhouse gas emissions

As a first step, Group reporting boundaries were defined and a consolidation approach for direct GHG emissions selected. As Jadestone reports its GHG direct emissions based on the operational control principle, scope 1 boundary clearly delineated relevant value chain activities falling within scope 3 categories.

Subsequently, in order to establish a view of the likely material scope 3 emission categories, benchmarking of relevant E&P operators was undertaken. Materiality of value chain categories is dependent on the type of business operations and there is no uniform approach to scope 3 across the industry, however key scope 3 trends have been established through the benchmarking exercise.

As a next step, Jadestone has undertaken a detailed review of the value chain activities pertaining to Stag operations, considering all 15 categories defined by the GHG Protocol. Factors such as relevance to Jadestone business operations, materiality threshold as well as availability of data were taken into account, with the following categories shortlisted:

- Category 3: Fuel and energy related activities
- Category 4: Upstream transportation and distribution
- Category 10: Processing of sold products
- Category 11: Use of sold products

Table 6-8 provides an overview of the assumptions and methods applied for quantifying the value chain emissions for Stag.

Table 6-8: Overview of the assumptions and methods applied for quantifying the value chain emissions for Stag

Category	Assumptions	Method of quantification
3: Fuel and energy related activities	Includes all upstream (i.e. cradle-to-gate) emissions from the extraction, production and transportation of diesel, being the only fuel type consumed in the generation of power at the Stag facilities, that was acquired by Jadestone in the reporting year and was not included in scope 1 or scope 2.	Jadestone determined the quantity of diesel purchased and utilised at Stag operations and then applied cradle-to-gate emission factors
4: Upstream transportation and distribution	Includes marine transportation of sold products paid for by Jadestone	The monetary amount spent for an offtake tanker by Jadestone in the reporting year was multiplied by the relevant emission factor
10: Processing of sold products	Includes emissions associated with processing of Jadestone crude oil by refineries; assumed all crude produced was processed into bunker fuel at refineries (no chemical feedstocks)	Crude oil refining emission factors had been applied to the amount of bunker fuel sold in the reporting year

Category	Assumptions	Method of quantification
11: Use of sold products	Includes emissions from crude in their use-phase, assuming all sold product used as fuel	Sales volumes the reporting year were converted into emission by applying IPCC emission factors

Table 6-9: Summary of Scope 3 GHG Emissions in 2022

Scope 3 Category	Total Emissions (tCO2e)	% Coverage
3 Fuel and Energy Related Activities	156	0.04
4 Upstream transportation and distribution	1,914	0.54
10 Processing of Sold Products-Oil	17,363	4.93
11 Use of Sold Products-Oil	333,051	94.49
Scope 3 Total	352,484	100

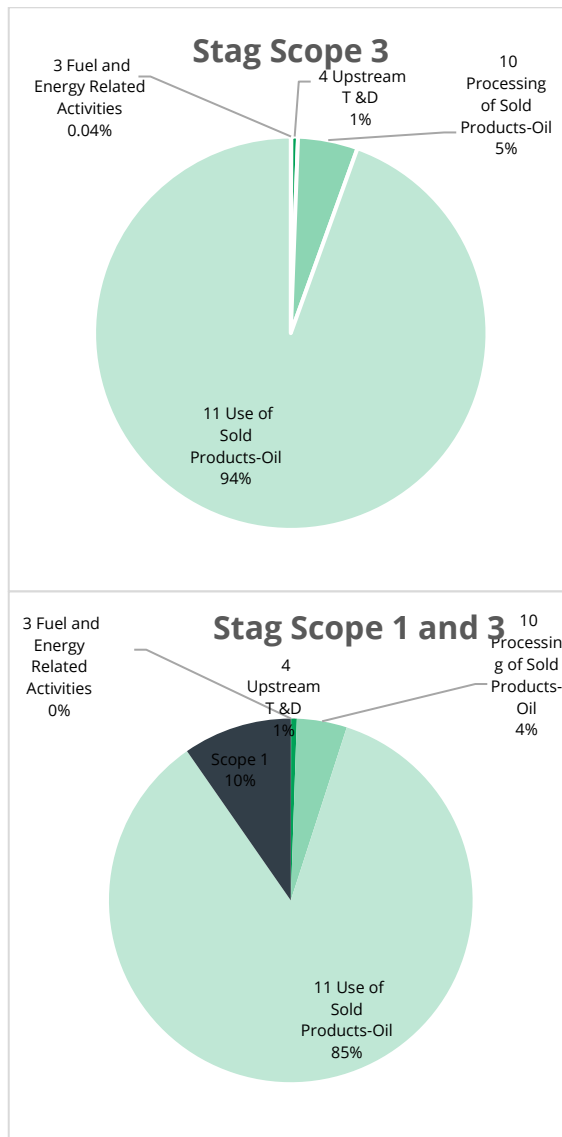


Figure 6-2: Scope 3 emissions in 2022 (top) and including scope 1 (bottom)

In 2022, the majority of scope 3 emissions came from Use of Products (category 11) (94% of quantified scope 3 emissions) (Figure 6-2). This category covers the use of refined products by the consumer, assumed to be 100% combustion of bunker oil by marine vessels. Processing emissions (category 10) comprise 5%, upstream transport and distribution (category 4) comprise 1% and upstream emissions of diesel use (category 3) comprise 0.04% of quantified scope 3 emissions (Figure 6-2). Scope 1 emissions are approximately 10% of the total direct and indirect emissions (scope 1 and 3) associated with the Stag facility.

Over the remaining 12 years of field life, when considering a business-as-usual scenario, scope 1 emissions are expected to increase whilst scope 3 emissions are expected to decrease (Figure 6-3). This is because as the reservoir is depleted, more energy is required to extract the reduced output and as a result, the scope 1 emissions will increase. With reduced production output, emissions from processing and combustion/use of the processed product will be reduced due to fewer barrels to process and combust. Cumulative scope 3 emissions (extrapolated from those quantified here) are expected to be approximately 5,237,199 tCO₂e over the remaining life of the field.

Forecasts are calculated using NGER methodology and include flaring, gas as fuel and crude oil consumption, representing over 95% of emission sources. Forecasts are aligned with workplan and budget and include allowances for planned and unplanned downtime. These calculations are revisited annually by the Subsurface team.

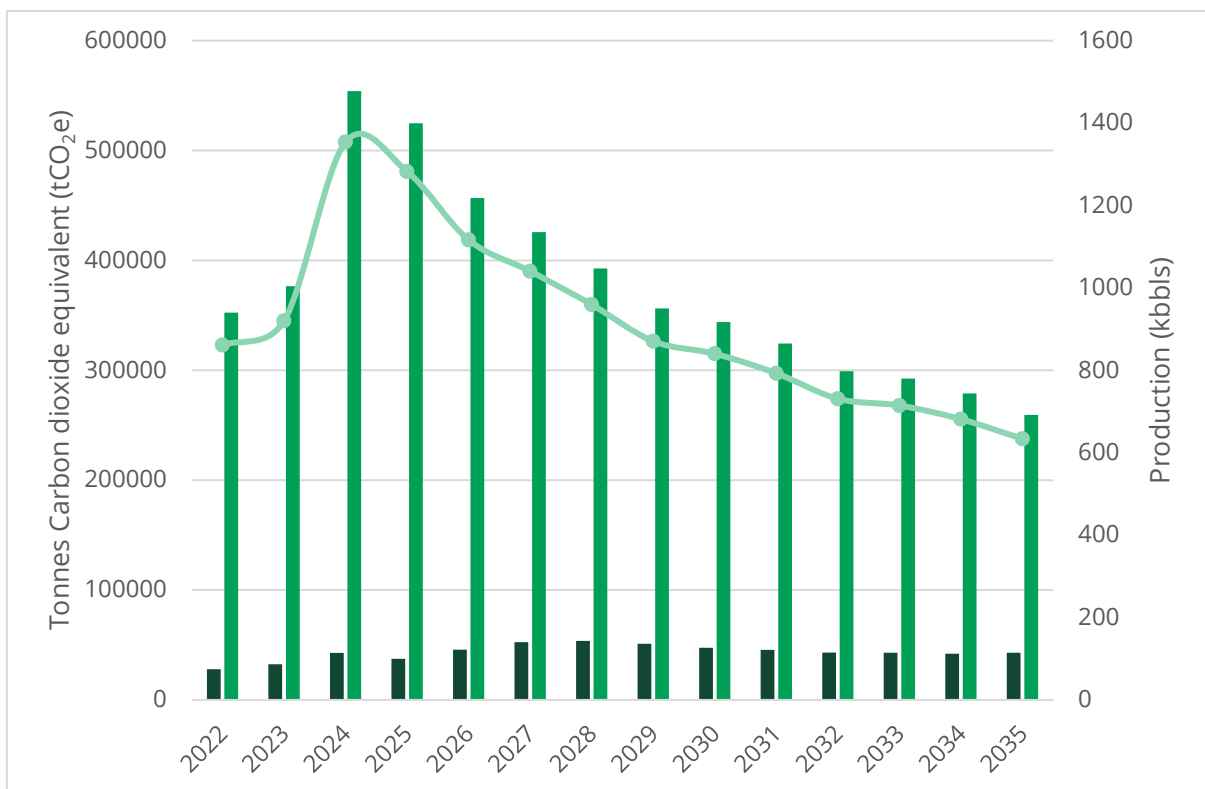


Figure 6-3: Business-as-usual forecast scope 1 and scope 3 emissions over the remaining lifespan of the Stag facility. The secondary axis shows anticipated production.

6.3.2 Impacts

Emissions can reduce air quality in the immediate vicinity of the Facility. Under normal circumstances, the gaseous emissions will quickly dissipate into the surrounding atmosphere in the immediate vicinity of the facility. As Stag Facility operations occur in offshore waters, the combustion of fuels in such remote locations will not impact on air quality in coastal towns or other sensitive locations, and impacts to nearby petroleum

activities such as Wandoo facility operated by Vermillion Energy (approximately 20 km north east) are not expected.

Greenhouse gases are persistent by nature and the key impact of these emissions is that they accumulate in the atmosphere. Upon release from a facility, CO₂ persists for thousands of years in the atmosphere, nitrous oxides persists for hundreds of years and methane persists for a least a decade (EPA, 2022). Whilst CO₂ is cycled out of the atmosphere by various carbon sinks (vegetation and the ocean surface in particular) the natural source/sink cycle has been out of balance since the beginning of the industrial revolution, when fossil fuels such as coal first started being combusted, and area of sinks reduced through development resulting in an ever-increasing concentration of greenhouse gases in the atmosphere. This increasing concentration has led to a greenhouse or warming effect resulting in the physical, chemical and biological effects of climate change.

Global climate change is the result of atmospheric accumulation of GHG emissions and GHG sinks since the start of the industrial revolution. Predicting GHG emissions' impacts at the ecosphere level is an inherently complex exercise because of the influence of variables such as surface pressure, wind, temperature, humidity and rainfall within multiple ecosystems. These are all interdependent variables that would have to be considered in determining a contribution to global temperature increase.

Annually, direct emissions from Stag represent 0. 1% of emissions from energy industries in Western Australia and 0.02% of energy industries nationally (DCCEE, 2022). Whilst this facility is a relatively low contributor to state and national emissions, due to the persistent nature of greenhouse gases, it is important to acknowledge that all emissions contribute to climate change. Stag has been operational since 1998, however Jadestone only acquired the asset in late 2017. The facility is expected to stay operational until approximately 2035. Over the entire period of Jadestone ownership, total, direct cumulative emissions associated with Stag are forecast in a business-as-usual scenario to be approximately 778,882 tCO₂e.

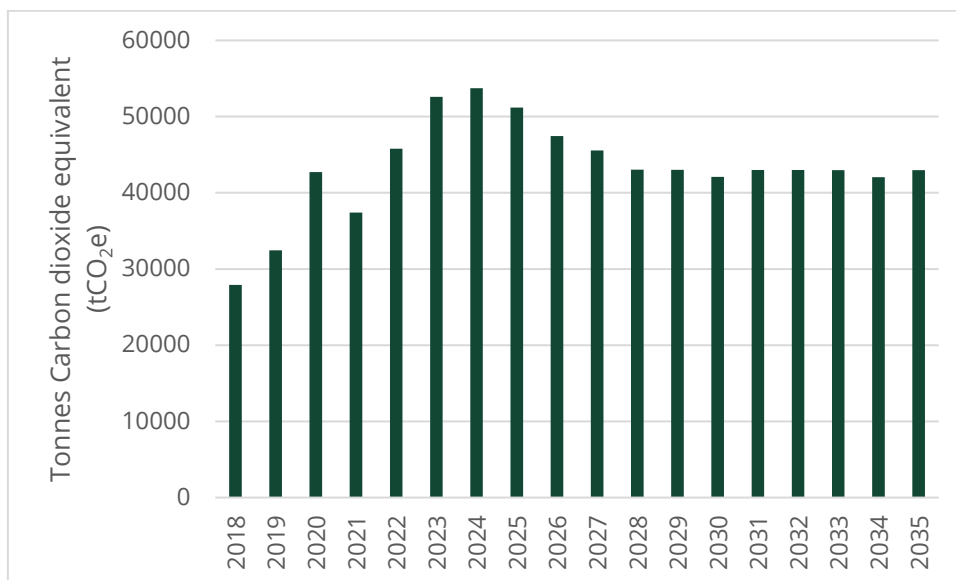


Figure 6-4: Actual (2018–2021) and business-as-usual forecast (2022–2035) scope 1 emissions at Stag

Table 6-10: Comparison of Stag’s annual emissions with State and National emissions profiles (Energy Industries category)

Emissions Profile	Annual (2020)
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Stag scope 1 emissions	43,030
Western Australia energy industry* emissions*	36,536,000
Australian energy industry emissions*	207,566,000

*Source: Australia’s Greenhouse Gas Inventory , 2022

It is important to acknowledge that climate change impacts cannot be directly attributed to any one activity, as they are the result of global GHG emissions, minus global GHG sinks, that have accumulated in the atmosphere since the industrial revolution began. Therefore, there is no direct link between GHG emissions from the Stag facility operations and climate change impacts to specific ecological receptors.

The consequence of GHG accumulation in the atmosphere will result in an increase in temperature and will have an adverse effect on ecosystems and threaten biodiversity (IPCC 2021). Ecosystems that are particularly susceptible to adverse effects of climate change include alpine habitats, coral reefs, wetlands and coastal ecosystems, polar communities, tropical forests, temperate forests and arid and semi-arid environments (DoEE, 2019). Human-induced global warming has already caused multiple observed changes in the climate system including increases in both land and ocean temperatures and an increase in the frequency and duration of heatwaves both on land and in the marine environment (Hoegh-Guldberg et al. 2018).

Extreme weather events such as droughts, floods, storms and fire can affect population dynamics, species boundaries, morphology, reproduction, behaviour, community structure and composition and ecosystem processes. Changes in the frequency and intensity of extreme weather events may have larger impacts on many species and communities than increases in temperature and changes in rainfall patterns (Steffen et al. 2009).

Hoegh-Guldberg et al. (2018) concludes that constraining global warming to 1.5°C rather than 2°C has strong benefits for terrestrial wetland ecosystems. Species range losses, increased extinction risks, changes in phenology together with projected increases in extreme weather events all contribute to the disruption of ecosystem functioning and loss of services provided by these ecosystems to humans such as avoidance of desertification, flood control, water and air purification, pollination, nutrient cycling, some sources of food, and recreation.

Impacts on ecosystems from this are spatially variable and species dependent due to the varying degrees of sensitivity to changes in the local and global ecosystem. At the point where global temperature rise, due to climate change, reaches 2°C, increasing numbers of receptor groups suffer impacts which are high to very high, and likely to be irreversible (terrestrial ecosystems, warm-water corals, unique and threatened systems, and arctic regions) (Hoegh-Guldberg et al. 2018).

In Australia, the particular values and sensitivities that have been identified as having a potential to be impacted by climate change include:

- Terrestrial ecosystems: Alpine regions, rainforests, wetlands, grasslands, forests
- Marine ecosystems: coral reefs, mangroves, estuaries and inland waterways

The Australian Natural Resource Management Ministerial Council (NRMCC) recognizes climate change as a key additional threat to the conservation of Australia’s biodiversity (Steffen et al., 2009). Impacts to the physical, biological and socioeconomic receptors within these areas could be impacted with predicted impacts highly variable between ecosystems and within on both the ecosystem structure and its flora and fauna. In many cases, the impacts of climate change on biodiversity are exacerbated by other pressures such as land clearing and invasive species, but in some cases impacts can be unequivocally attributed to climate

change (Hughes et al. 2019). A summary of the potential impacts on each of these is provided in Table 6-11 below.

Table 6-11: Potential impacts of climate change on identified receptors from greenhouse gas emissions

Receptor	Potential Impacts
Terrestrial Ecosystems	
<p>All terrestrial ecosystems are likely to be impacted by a changing climate (Steffen et al 2009, Hughes 2011, Dunlop et al. 2012, Hoegh-Guldberg et al. 2018). The predicted impact of climate change on these ecosystems is highly variable, both between ecosystems and within individual ecosystems (Dunlop et al. 2012).</p>	
<p>Tropical Rainforests</p>	<p>Changes in the timing of seasons resulting in longer hot or wet seasons which could result in changes in seasonal responses and alterations to species range and abundance (Hoegh-Guldberg et al., 2018) through the change in patterns of flowering, fruiting or leaf flush.</p> <p>Increased temperatures leading to hotter and potentially more intense fires and cyclones.</p> <p>An increased probability of fires may change the dynamics of the rainforest with a change from fire-sensitive vegetation to fire-tolerant species (McInnes, 2015).</p> <p>Change in rainforest disturbance as cyclones become more intense (Hughes, 2011).</p> <p>Change in vegetation structure or vegetation species dominance due to tolerance/intolerance of increased CO₂ levels (Steffen et al, 2009).</p>
<p>Temperate forests</p>	<p>An increased probability and intensity of fires may change the dynamics of the forest with a change from fire-sensitive vegetation to fire-tolerant species (Steffen et al., 2009) due to a change in structure and species.</p> <p>Increases in temperature and decrease in rainfall may result in reduction in productivity as the soil dries out and reduction in forest cover.</p> <p>Increased rainfall may increase productivity of temperate forest and result in large areas of coverage (Steffen et al., 2009).</p> <p>The ranges of the majority of Australia’s eucalypt species are predicted to shrink in size over the next 60 years (González-Orozco et al. 2016). Eucalypts dominate forest canopies and ecosystems across Australia, and were once more widespread but are now restricted to small ranges and are predicted to disappear or shift their location, and this is likely to have significant flow-on effects for ecosystem structure and function.</p>
<p>Alpine Regions</p>	<p>Alpine and montane areas are considered to be very vulnerable to climate change (Hughes, 2003) due to the increase in temperature reducing the areas covered by snow.</p> <p>Alpine ecosystems and biodiversity in Australia are particularly vulnerable to climate change that affects snow depth and the spatial and temporal extent of snow, which have all declined since the late 1950s (BOM & CSIRO 2020). Long-term monitoring of alpine vegetation in Australia has shown shifts in plant species composition and diversity, changes in the timing of flowering, and declines in endangered fauna such as the mountain pygmy possum (Hoffmann et al. 2019). Species that are dependent on snow coverage for stable temperature maintenance (during hibernation), or for protection from predation may be more vulnerable (Hughes, 2003).</p>

Receptor	Potential Impacts
Grasslands	Increased CO ₂ levels may result in a shift in species dominance between woody and grass species due to their tolerance. This will affect herbivores dependent on these species as well as changes in the spatial availability of habitat for fauna associated with the different foliage (Steffen et al., 2009). Increased temperatures leading to hotter and potentially more intense fires that may also increase in frequency and area due to a shift in the vegetation fuelling the fires.
Arid and semi-arid regions	<p>Reduction in patches of fire-sensitive mulga in spinifex grasslands potentially leading to landscape-wide dominance of spinifex.</p> <p>Increased drying due to increase in CO₂, with a large shift in vegetation distribution due to changes in annual precipitation.</p> <p>Shifts in the seasonality or intensity of rainfall which can result in enhanced runoff distribution which will intensify vegetation patterning. Reduction in rainfall can result in increased fire frequency and intensity. Dryland salinity could be affected by changes in the timing and intensity of rainfall.</p>
Marine and freshwater ecosystems	
<p>Sea surface temperatures have increased across the globe over recent decades which poses a significant threat to marine ecosystems, including changes to species abundance, community structure and increased frequency and intensity of thermally induced coral bleaching events (CSIRO, 2017). Sea surface temperatures in the Australian region have been increasing. Since 1900, they have risen by approximately 1.1 °C (BOM & CSIRO 2020). As on land, most of the increase has been since the 1950s. Sea surface temperatures have risen more slowly than temperatures on land. Sea-surface temperatures are projected to continue to increase. The western Tasman Sea has warmed especially quickly in recent decades, with some areas having warmed by more than 1 °C since 1980 (BOM & CSIRO, 2020).</p> <p>Since near-global satellite altimetry records began in 1993, global mean sea level has been rising at a rate of 3.3 millimetres per year (mm/yr), amounting to a total increase of about 9 centimetres (cm) from 1993 to 2020 (DCCEEW, 2021). Ocean currents have also been shown to be affected by a change in temperature and stratospheric ozone depletion with currents increasing in strength (Cai and Cowan, 2006), subsequently resulting in suppression of upwellings (leading to a shift in productivity) and a change in the distribution and productivity of marine ecosystems both spatially and temporally (Steffen et al , 2009).</p>	
Coral reefs	<p>An increase in sea surface temperatures across the globe has resulted in changes to species abundance, community structure and increased frequency of coral bleaching events (CSIRO, 2017a). Climate change has emerged as a threat to coral reefs, with temperatures of just 1°C above the long term summer maximum for an area over 4–6 weeks being enough to cause mass coral bleaching and mortality (Hoegh-Guldberg 1999, Hughes et al. 2017, Spalding and Brown 2015).</p> <p>An increase in the frequency of bleaching events can result in less time for reefs to recover and therefore remaining in early successional state (unable to support extensive habitat for organisms) or be replaced by ecosystems dominated by macroalgae.</p> <p>Coral mortality or die off following coral bleaching events can stretch across thousands of square kilometres of ocean (Hoegh-Guldberg 1999, Hughes et al. 2017). The impacts associated with a warming ocean, coupled with increasing acidification, are expected to undermine the ability of tropical coral reefs to provide habitat for fish and invertebrates, which together provide a range of ecosystem services (e.g., food, livelihoods, coastal protection) (Hoegh-Guldberg et al. 2018).</p>

Receptor	Potential Impacts
	<p>As CO₂ is gradually absorbed by oceans and fresh water, the water becomes more acidic, which increases the solubility of calcium carbonate, the principal component of the skeletal material in aquatic organisms (Steffen et al. 2009) reducing the capacity for corals to build and maintain skeletons.</p> <p>Coral reefs are likely to degrade over the next 20 years, presenting fundamental challenges for those who derive food, income or coastal protection from coral reefs (Hoegh-Guldberg et al. 2017).</p>
Saltmarsh and coastal freshwater wetlands	<p>Sea levels are predicted to increase by 18 to 59 cm by 2100 in response to both thermal expansion and melting of ice-sheets (Solomon et al. 2007). This will lead to some coastal inundation affecting mangroves, salt marshes and coastal freshwater wetlands. Changes to the upstream freshwater habitats will result in changes to the spatial distribution of saltwater intolerant species further upstream with freshwater swamps and groundwater affected and areas of riparian vegetation being replaced by mangroves over time (Steffen et al., 2009).</p> <p>Further inland, reduction in rainfall may result in reduced river flows and changes in seasonality of flows and drought frequency and intensity increasing. Altered water quality, as well as quantity, will be a major trigger for climate change effects on freshwater biodiversity. For example, the combination of hot conditions, low flows and significant algal blooms during the recent major drought (2018–20) resulted in mass fish kills in the Murray–Darling Basin (Koehn et al. 2020).</p> <p>Changes in water quality including nutrient flows, sediment loading, O₂ and CO₂ concentration can result in increased intensity, duration and frequency of eutrophication (Steffen et al., 2009).</p> <p>Rocky shore and saltmarsh species in areas of low topographic relief will be vulnerable to complete loss of habitat, especially when bounded by cliff lines or coastal development (Steffen et al, 2009).</p>
Mangroves	<p>Mangrove ecosystems in Australia will face higher temperatures, increased evaporation rates and warmer oceans (McInnes 2015) as well as an associated sea-level rise (Hoegh-Guldberg et al. 2018).</p> <p>Mangrove range may increase their southern range as temperatures increase in the region, but the higher temperatures, ocean acidification and sea level rise may also result in a decrease in mangrove abundance (Duke et al., 2017). There is some evidence to suggest that sea level rise may not affect mangroves in such a negative way as they can accumulate more peat or mud to constantly adjust to the gradual sea level rise (Field, 1995). However, as mangroves are found along the coastline, they can be exposed to multiple pressures such as drought and sea level drop, el Niño events or other extreme weather systems combined with increased sea surface temperatures; this occurred in the Gulf of Carpentaria in 2015-2016 along a 1,000 km stretch of coastline (Duke et al 2017).</p>
Flora and Fauna	
<p>Changes occur in species interactions as responses to environmental change, and usually have knock-on effects to whole communities and ecosystems. These higher order changes range from direct species–species interactions – such as mutualism, competition and predation – to changes in the ways in which species influence the structure and functioning of ecosystems, including cascading impacts through ecosystems, and the formation of novel communities and ecosystems (Steffen et al, 2009) including invasion of species.</p>	

Receptor	Potential Impacts
Mammals	<p>Terrestrial mammals may be affected by a change in fire regime and extreme weather events resulting in drought, vegetation loss and starvation. Removal or addition of key species in the food web can also result in ecological cascades. Terrestrial mammals across Australia have experienced high rates of extinction and are subject to population decline. This is evidenced by further increase in the number of species listed as threatened or vulnerable (DCCEEW, 2021).</p> <p>Narrow-ranged endemics (particularly in montane regions) are susceptible to rapid climate change in situ (Williams et al. 2003).</p> <p>Changes in ocean temperatures, upwellings, ocean acidification and melting of Antarctic sea ice may impact krill availability, the major food source for blue whales (DoE 2015). It is predicted that cetaceans limited to warmer areas such as pygmy blue whales will experience a southward shift in distribution as ocean temperature increases. There is evidence of these changes already occurring in other marine mammal species, but such changes are difficult to detect for whales due to the complexity of ecological systems and the lack of long-term records (DoE 2015).</p>
Birds	<p>Impacts to birds can include (Steffen et al. 2009):</p> <ul style="list-style-type: none"> - Changes in phenology of migration and egg laying (Chambers et al. 2005); - Increased competition of resident species with migratory species as the latter species stay at breeding grounds for longer periods; - Reduced breeding of waterbirds susceptible to reduction of freshwater flows into wetlands; - Changes in food supply as a result of ocean warming (Smithers et al. 2003); - Rising sea levels will affect birds that nest on or burrow in sandy and muddy shores, salt marshes, inter-tidal zones, coastal wetlands and low-lying islands; - Saltwater intrusion into freshwater wetlands, especially in northern Australia, will affect breeding habitat (Williams et al. 1995) <p>Bird species in Australia are suffering population declines and increased risks of extinction (DCCEEW, 2021).</p>
Reptiles	<p>Warming temperatures may alter sex ratios of species with environmental sex determination (ESD) such as crocodiles and turtles (some species likely to modify use of microhabitats to cope with warming in situ) (Steffen et al., 2009)</p> <p>Climate change is likely to have impacts on marine turtles across their entire range and at all life stages. Climate change is expected to cause changes in dispersal patterns, food webs (e.g. seagrass dieoff), species range, primary sex ratios, habitat availability (e.g. loss of nesting beaches due to se level rise), reproductive success and survivorship. Impacts will differ based on the ability of a stock to adapt to changes in suitable nesting beaches and food availability (DEE 2017a).</p> <p>Sea level rise presents a risk of nests flooding which may complicate hatchling success. The magnitude of sea level rise is expected to be greater at more southerly latitudes, particularly for WA.</p> <p>Reptilian experts believe by 2040 more than 11 reptile species such as lizards and snakes will become extinct due to habitat loss and unsuitable conditions and half of Australian freshwater turtle species are in drastic population decline (DCCEEW, 2021).</p>

Receptor	Potential Impacts
Amphibians	<p>Increased drying in bog and swamp areas will limit the range of habitat available to frogs and toads. Recent studies showed more than 18% of Australian frog species are either extinct or critically endangered (DCCEEW, 2021).</p> <p>Threatened alpine species (such as the southern corroboree frog <i>Pseudophryne corroboree</i>) at risk from changes to their breeding sites as snow coverage is reduced and areas dry out (Steffen et al, 2009).</p> <p>Increased outbreaks of pathogenic chytrid fungus in frogs as high temperatures provide optimum growth conditions (Laurance, 2008).</p> <p>Cane toad distribution may increase resulting in increased predation and competition as their range expands with warming.</p>
Invertebrates	<p>Invertebrates are expected to be more responsive than vertebrates due to short generation times, high reproduction rates and sensitivity to climatic variables. Flying insects such as butterflies may be able to adapt by shifting ranges, as long as they are not limited by host plant distributions; non-flying species with narrow ranges are susceptible to rapid change in situ (e.g. Wilson et al. 2005 estimated that 25% of insect diversity in the wet tropics may be threatened this century).</p> <p>Invertebrate herbivores may also be affected by reduced foliar quality under elevated CO₂ and changes in rainfall and localised ecosystem changes.</p> <p>Most threatened invertebrates are suffering from large-scale habitat degradation and loss of biodiversity.</p>
Fish and plankton	<p>Many marine fauna are sensitive to average temperature changes, even by less than 3 degrees, resulting in effects on dispersal, growth rates, reproduction, susceptibility to disease and survival; this includes impacts throughout the food web starting with phytoplankton production and secondary production in benthic communities. Freshwater fish throughout Australia have more than a 50% risk of extinction in the next 20 years (DCCEEW, 2021).</p> <p>Changes in seasonal cycles of plankton abundance, with potential for mismatch between phytoplankton blooms and zooplankton growth, leading to cascading effects to the rest of the marine food chain (Hays et al. 2005).</p> <p>Freshwater species are vulnerable to changes in water flow and quality with limited capacity for species to move to new waterways.</p> <p>Many marine organisms are highly sensitive to changes in temperature, leading to effects on growth rates, survival, dispersal, reproduction and susceptibility to disease. Increasing temperatures may reduce larval development time, potentially reducing dispersal distances and warm-water assemblages may replace cool-water communities.</p>
Plants	<p>Longer-lived plants such as trees may be highly vulnerable if climate change 'moves' suitable establishment sites for seedlings beyond seed dispersal distance at a rate exceeding generation time. Narrow-ranged endemic plants requiring a very specific set of environmental characteristics (such as specific soil types) will have limited capacity to disperse to similar, rare sites. Elevated CO₂ will increase photosynthetic rates as long as other factors, such as water and nutrients, are not limiting (Steffen et al, 2009). There is potential for productivity to be boosted in some regions by a combination of increased CO₂ and longer growing seasons (e.g. Dunlop and Brown 2008).</p>

Receptor	Potential Impacts
	<p>This effect, however, may not occur in regions where drying occurs. Increasing CO₂ will increase water use efficiency at an individual plant level. But at an ecosystem level, total water use may not necessarily decrease, due to decreased total leaf area and increased evaporation from soil as a consequence of warmer temperatures (Steffen et al, 2009).</p> <p>Any changes in productivity and foliar nutrients will have flow-on effects to herbivores. Changes to fire regimes will have significant impacts on vegetation; increases in frequency and intensity of fires may disadvantage obligate seeders relative to vegetative resprouters. Changes in the timing of plant phenology and insect life cycles will affect pollination and some forms of dispersal.</p>
Socioeconomic factors	<p>Socioeconomic impacts resulting from climate change include impacts on the functions, interests or activities of other users which rely on these ecological values, including commercial and recreational fisheries and aquaculture. There may also be impacts to cultural heritage sites and places of spiritual importance in coastal locations due to sea level and sea surface temperature rises.</p>

6.3.3 Environmental Performance

Hazard		Atmospheric emissions (EPH-4)		
Performance outcome		No unplanned emissions to the atmosphere Emissions to air meet legislative requirements and Marine Order 97		
ID	Management controls	Performance standards	Measurement criteria	Responsibility
013	Ultrasonic flare flow meter (FQI 3110) measures gas volumes	Flare flow meter measures the volume of gas passing through the flare continuously and is monitored by production monitoring system	Production monitoring system (P2) records	Production Maintenance Supervisor
014	Flag State Certificate (IAPP) certifies measures are in place to manage air emissions	A current International Air Pollution Prevention (IAPP) Certificate that confirms: <ul style="list-style-type: none"> - Incinerators are certified to meet prescribed emissions standards - Diesel engines >130 kW are certified to meet prescribed emission standards - Current waste management plan - measures to prevent ozone-depleting substance (ODS) emissions are in place 	Valid and current statutory Certificate (IAPP) Waste Management Plan	OIM
011	Planned maintenance of engines and equipment	All engines, compressors and machinery on the CPF are maintained via a maintenance management system	CMMS shows maintenance has been satisfactorily completed as scheduled	Stag OIM
			BASSnet confirms maintenance completed on emission generating equipment	Engineering & Maintenance Manager

6.3.4 ALARP Assessment

On the basis of the impact and risk assessment completed, Jadestone considers the control measures described above are appropriate to manage atmospheric emissions from production and operations equipment. The residual risk ranking for this potential impact is considered Low, and therefore ALARP has been demonstrated, no further controls are required. Additional controls considered but ultimately rejected are detailed below. Jadestone continues to review control options periodically and is currently investigating an alternative, mitigated GHG forecast for the site, subject to techno-economic analysis.

Rejected control	Hierarchy	Practicable	Cost effective	Justification
All emissions producing equipment is removed	Eliminate	No	N/a	Atmospheric emissions from production and operating equipment including vessels and helicopters is required to undertake the Activity. Equipment cannot be removed completely.
Transportation of waste to shore instead of incineration	Substitute	No	N/a	The option of waste being transported to shore for disposal rather than incineration was considered: emissions associated with disposal transport on water and on land was considered to have similar or possibly more detrimental airshed impacts given the closer proximity to communities to onshore disposal options.
Equipment is re-designed/ replaced with equipment designed to reduce emissions. The facility is modified to reduce air emissions e.g. new well for reinjection, scrubbers	Engineering	Yes	No	Risk and impact reduction are achieved through planned maintenance ensuring clean and efficient running of engines. While scrubbers could be installed on generators and the boiler, to purchase the scrubbers would be high (more than \$500,000 per piece of equipment), a cost higher than the generator itself, for example. Reinjection of produced natural gas would require a new well, a high-pressure gas compressor (which in turn produces emissions) and gas turbines to drive the compressor. The estimated cost of this infrastructure is \$20M (including rig costs). Given the volumes of emissions generated, and the low impact considerations due to the location, the costs associated with alternative processing arrangements are considered disproportionate to the benefits that would be gained.
None identified	Isolation	N/a	N/a	The Activity is located at distance from sensitive receptors and the coastline.
None identified	Administrative	N/a	N/a	Compliance with relevant and appropriate MARPOL requirements

6.3.4.1 Mitigations

Jadestone is committed to achieve Net Zero scope 1 and 2) GHG emissions for its operated assets by no later than 2040. Jadestone defines Net Zero as the state reached when its GHG emissions are reduced in line with the goals of the Paris agreement, and any remaining emissions that cannot be reduced further, are fully neutralised by like-for-like permanent removals. For those emissions that are economically or technically difficult to eliminate, Jadestone will employ nature-based solutions and offsets to mitigate. Jadestone is

currently developing a Net Zero Plan which will be finalized and published end of 2023). The use of offsets to mitigate hard to abate emissions is the least preferred option in the mitigation hierarchy and Jadestone will continue to assess reduction options over the life span of the facility. Where offsets are used, Jadestone will ensure they are properly measured, verified, and represent permanent removal of carbon from the atmosphere

6.3.5 Acceptability Assessment

<p>The potential impacts of atmospheric emissions are considered 'Broadly Acceptable' in accordance with the Environment Regulations, based on the acceptability criteria outlined below. The control measures proposed are consistent with relevant legislation, standards and codes.</p>	
Policy compliance	Jadestone’s HSE Policy objectives are met.
Management system compliance	Section 9 demonstrates that Jadestone’s HSE Management System is capable of meeting environmental management requirements for this activity.
Social acceptability	Stakeholder consultation has been undertaken (see Section 6), and no stakeholder concerns have been raised with regards to impacts from atmospheric emissions from ongoing operations.
Laws and standards	Atmospheric emissions from production, operation and asset equipment are compliant with MARPOL and AMSA Marine Orders.
Industry best practice	Atmospheric emissions from production, operation and asset equipment is designed to be at a minimum safe operational level. The APPEA Code of Environmental Practice (CoEP) (2008) objectives are met with regards to offshore production operations.
Environmental context	<p>Whilst direct impacts to localised receptors is considered negligible, the cumulative impact of Stag's annual emissions does contribute to climate change. .</p> <p>The potential impact is considered acceptable after consideration of:</p> <ul style="list-style-type: none"> - Remaining project life span - Decreasing emissions - Limited options to reduce actual emissions - Offset hard to abate emissions in line with objectives of Paris Agreement
Conservation and management Plans	<p>No Management Plans identified air emissions such as those described above as being a threat to marine fauna or habitats.</p> <p>Jadestone has had regard to the representative values of the protected areas within the RISK EMBA, and the respective management plans and other published information. Impacts from atmospheric emissions will have a negligible impact on any of the social and ecological objectives and values, of any AMPs, or state MPs. This is consistent with the objectives of the protected area management plans and considered acceptable. It is important to acknowledge that climate change impacts cannot be directly attributed to any one activity, as they are the result of global GHG emissions, minus global GHG sinks, that have accumulated in the atmosphere since the industrial revolution began. Therefore, there is no direct link between GHG emissions from the Stag facility operations and climate change impacts to specific ecological receptors.</p>
ALARP	The residual risk has been demonstrated to be ALARP.

6.4 Discharge of Produced Water

6.4.1 Description of Hazard

Aspect	<p>Water produced during the recovery of hydrocarbon from the reservoir and during the oil/ water separation production process, is termed produced water.</p> <p>Produced water from the Stag field contains a mixture of dissolved hydrocarbons and suspended oil droplets, naturally occurring radioactive materials (NORM), dissolved inorganic salts, dissolved metals, dissolved gases as well as low residual concentrations of a small number of chemical additives that are introduced during the production process such as corrosion and scale inhibitors and biocides. There may also be some residual drilling fluids that have been lost to the reservoir formations or is produced through direct communication via fractures in the formations.</p> <p>A continuous produced water stream is discharged overboard at hull level of the CPF (approximately 5 m above sea level) currently at an average monthly rate of 92,278 kL (approximately 3,033 kL per day) with an average oil-in-water (OIW) concentration of approximately 6 mg/L during normal operations. The maximum discharge rate for the facility is 47,300 bpd (7,520 m³/d), driven by an increasing water cut.</p> <p>Historically, produced water pushed forward to the FSO discharged this to ocean on occasion; however, this no longer occurs.</p>
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In describing the produced water discharges made from the Stag CPF, the following information is provided:

- Source and production: an outline of where produced water originates during the Activity and how the discharge is modified/ added to during topside production (Section 6.4.1.1);
- Characterisation: a list of produced water constituents and concentrations, and ecotoxicological information gathered from Whole Effluent Toxicity (WET) testing (Section 6.4.1.2);
- Volume and loads: a history of produced water discharge volumes and loads (Section 6.4.1.3); and
- Area of Impact: the area of dispersion within the marine environment from produced water discharges as determined by modelling and verification of the modelling with field data (Section 7.4.1.4).

6.4.1.1 Source and production

Formation water is trapped for hundreds of millions of years with oil and natural gas in a reservoir comprising a porous sedimentary rock formation between layers of impermeable rock within the earth's crust (Collins, 1975). Therefore, when a hydrocarbon reservoir is penetrated by a well the produced fluids may contain formation water in addition to the oil, natural gas and/ or gas liquids. In addition, production chemicals and seawater are commonly injected into a reservoir to enhance hydrocarbon recovery rates, and to improve the safety of operations.

Produced water contains a mixture of dissolved and particulate organic and inorganic chemicals, resulting from the combination of formation and injected water containing production chemicals.

Onboard the Stag CPF, produced water recovered in the process separators and water recovered from the slops tanks (which receive deck drainage and over-specification produced water) is directed to two Corrugated Plate Interceptor (CPI) vessels operated in parallel. Periodically an emulsion breaker is injected into the feed water upstream of the CPIs to assist in the oil/ water separation process.

A number of chemicals are used during processing of the crude oil, all production chemicals are selected in accordance with the Chemical Selection Evaluation and Approval Procedure (JS-70-PR-I-00033), which promotes the use of environmentally low risk chemicals based on ecotoxicity data and information gathered from ChemAlert). Residual drilling fluids that may be also be produced will have undergone the Chemical Selection Evaluation and Approval Procedure and approved under the sperate drilling environmental plans.

Recovered oil from the CPIs is pumped back to the second stage separator to join the export oil stream. Water from the CPIs enters a Gas Flotation Unit (GFU) which aerates and coalesces the water to capture remaining oil. A continuous small bleed of produced water from the gas flotation unit is directed through an oil-in-water (OIW) fluorescence monitor to provide an indication of OIW concentrations and performance of the water treatment circuit. This small bleed volume of produced water is then discharged, unless OIW concentration exceeds 30 mg/L or the maximum OIW daily load is greater than 112 kg.

If OIW concentrations exceed 15 mg/L an alarm is activated and recorded in the central control room and logged in the alarm logbook. A check of the alarm and manual samples to confirm oil in water concentrations are then taken. If oil in water concentrations reach 30 mg/L or the daily OIW load is greater than 112 kg the discharge is diverted inboard to slops tanks T411 and/or T412 or is sent to the third-party tanker by closing Produced water SDVs and pushing production forwards.

The slops tanks have capacity for up to one hour of produced water at normal production levels (storage capacities of 245 and 250 m³, respectively), during which time production upsets (e.g. hydrocarbon characteristics, chemical injection, boiler function, etc.) affecting the OIW concentration of produced water may be rectified without affecting production. If capacity of the slops tanks is reached, production may be shut in or pushed forward to tanker so that produced water discharges with high OIW concentrations do not occur. Following return to normal operations, produced water in the slops tanks is pumped to the second stage separators for processing. For maintenance and integrity purposes, the slops tanks are dosed with a biocide periodically.

6.4.1.2 Characterisation

The main contaminants of concern in discharged produced water are (Neff et al., 2011):

- Oil in water (OIW);
- Aromatic hydrocarbons as a component of OIW;
- Trace metals and nutrients; and
- Naturally occurring radioactive materials (NORM).

Particularly, it is the aromatic hydrocarbons, PAHs and alkylphenols that are the main toxicants present in produced water (Neff et al., 2011).

To understand the potential impacts of the mixed effluent discharge in the receiving environment, produced water characterisation and toxicity testing (whole effluent testing) are used to assess the discharge stream. Provided below is a rationale for these monitoring approaches.

Chemical Characterisation

Chemical characterisation of the produced water stream is undertaken annually.

Provided below is an outline of the main constituents within the produced water discharge for the CPF, wherever the data is available. For noting, while variability is evident in the analytes measured, generally the measured concentration ranges (minimum to maximum/ average) are reasonable; ranges are not extreme (e.g. orders of magnitude variation observed over time). In addition, the concentrations of the aromatics and metal/metalloids are below the laboratory limits of reporting or close to guideline values for contaminants of concern. These results suggest that while the discharge stream varies in quality, the variability is tolerable. Given a tolerable level of variability in the monitoring data, this underpins a position to continue the frequency of characterisation (i.e. annually).

Oil in water

Routine measurement of the OIW concentration of produced water discharged from the CPF measures the total hydrocarbon content. Analysis of manually collected produced water samples taken at the CPF between 2017 and 2022 recorded an average OIW content of 5.5 mg/L (Figure 6-5).

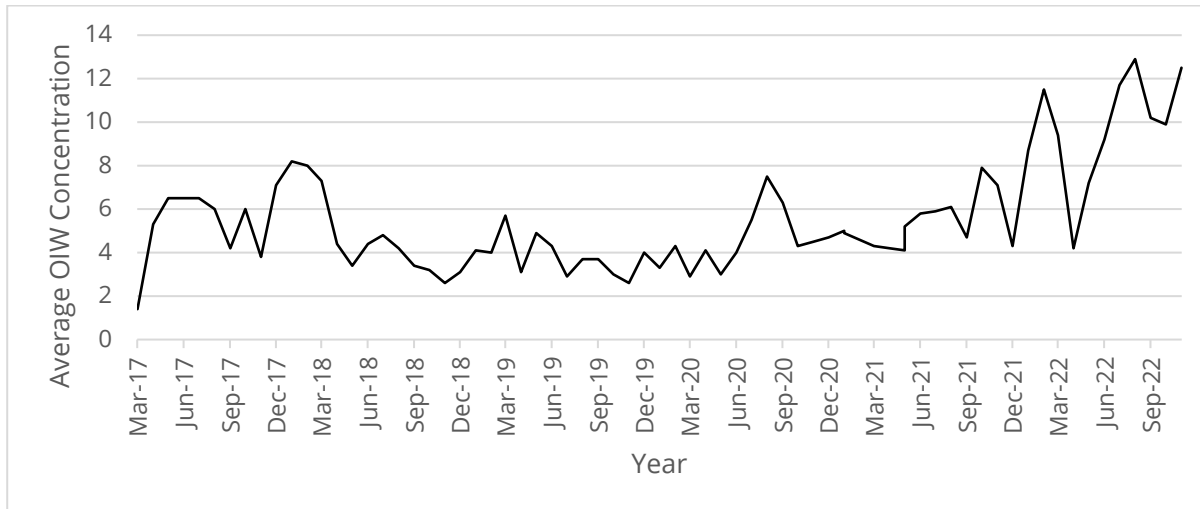


Figure 6-5: Oil in water concentration (mg/L) of produced water discharged from the CPF 2017-2022

Aromatic hydrocarbons

Dissolved hydrocarbons in produced water comprise monocyclic aromatic hydrocarbons (MAH), such as BTEX (benzene, toluene, ethylbenzene and xylenes), and lower molecular weight polycyclic aromatic hydrocarbons (PAHs) such as naphthalene, phenanthrene and their alkyl homologues (Neff *et al.*, 2011a).

Biannual analysis of CPF produced water samples taken between 2017 and 2021 revealed total BTEX concentrations have been <0.018 mg/L (<18 µg/L) over this period, with individual BTEX chemicals all <0.003 mg/L (<3 µg/L) (Table 6-12). In addition, over that time all PAHs except naphthalene were below the laboratory limits of reporting (LORs) typically 0.0001 mg/L (0.1 µg/L). Naphthalene was only just detectable on occasion (Table 6-12) but well below of the ANZG (2018) 99% species protection guideline of 50 µg/L in marine water.

Table 6-12: Concentrations of BTEX and hydrocarbon chain ranges measured in CPF produced water biannual sampling 2017–2021

Parameter	Average (mg/L)	Min (mg/L)	Max (mg/L)
Hydrocarbons C6–9	0.03	<0.01	0.05
Hydrocarbons C10–14	0.42	<0.03	1.0
Hydrocarbons C15–28	1.93	<0.10	7.2
Hydrocarbons C29–36	0.34	<0.10	1.2
Total Hydrocarbons C6–36	2.71	0.24	9.45
Benzene	0.002	<0.001	<0.003
Toluene	0.002	<0.001	<0.003
Ethyl-Benzene	0.002	<0.001	<0.003

Parameter	Average (mg/L)	Min (mg/L)	Max (mg/L)
Sum of Xylenes (m+p+o)	0.006	<0.003	<0.009
Sum BTEX	0.012	<0.006	<0.018
Naphthalene	0.0002	<0.0001	0.0005

These results are likely attributable to Stag crude oil being highly weathered and thus having a smaller component of volatile hydrocarbons such as BTEX (Battelle, 1998), as well as this component being quickly lost during processing due to its volatility (Terrens and Tait, 1996). PAHs account for a small proportion of Stag crude oil (~5% by mass of the semi-volatile cut; Intertek, 2008).

Trace metals and nutrients

The type and concentration of trace metals within produced water depends on the geology of the reservoir formation from which it is produced (Neff *et al.*, 2011a). The metals most frequently found at elevated concentrations in produced water include barium, iron, manganese, mercury and zinc (Neff *et al.*, 2011a).

According to biannual sampling of produced water from the CPF (**Table 6-13**), concentrations of trace metals consistently measured above analytical limits of reporting include arsenic, barium, copper, iron, manganese, strontium and zinc. From the original WET testing in 2008, an ecological trigger value of 0.31% (produced water sample) was derived that would protect 99% of marine species; 0.31% produced water equates to a produced water dilution factor of 332:1. During the last five years, the highest manganese concentration was only 1.3 times the draft guideline of 130 µg/L (Stauber *et al.*, 2008), the highest zinc concentration was 2.1 times the ANZG (2018) 99% species protection guideline of 3.3 µg/L and strontium is only 4 times background seawater. In addition, the highest copper concentration was 13 times the ANZG (2018) guideline value of 0.3 µg/L, the highest arsenic concentration was 16 times the ANZECC/ARMCANZ (2000) low reliability trigger value of 2.3 µg/L for As (III) and the highest iron concentration was 37 times higher than the ANZECC/ARMCANZ (2000) low reliability trigger value of 300 µg/L. Barium which has no guideline value and therefore was compared to background concentrations, was the only metal that required more than the 332 dilutions to dilute to background.

The average total organic carbon (TOC) concentration measured in CPF produced water over the sampling period was 15.5 mg/L and the average chemical oxygen demand was 607 mg/L (**Table 6-13**). Ammonia, nitrate, total nitrogen and total phosphorous concentrations were also measured in CPF produced water discharges (**Table 6-13**).

Table 6-13: Concentrations of trace metals, nutrients and pH measured in CPF produced water biannual sampling 2017-2021

Parameter	Average (mg/L)	Min (mg/L)	Max (mg/L)
Total Organic Carbon	15.5	5	64
Ammonia	37.8	27	41
Nitrate + nitrite	0.007	<0.004	0.019
Total Nitrogen	41.5	39	43
Total Phosphorous	7.4	1.6	40

Parameter	Average (mg/L)	Min (mg/L)	Max (mg/L)
Total Dissolved Solids	38,880	37,000	40,000
Total Suspended Solids	34.7	7.3	78
Arsenic	0.023	0.006	0.037
Barium	1.54	0.53	3.9
Cadmium	<0.0001	<0.0001	<0.0001
Chromium	0.0004	<0.0002	0.001
Copper	0.0011	0.0003	0.0039
Iron	6.64	0.021	11
Lead	0.0002	<0.0001	<0.001
Manganese	0.125	0.02	0.17
Mercury	0.0002	<0.0001	<0.0005
Nickel	0.003	<0.0003	0.014
Silver	0.0002	<0.0001	<0.001
Strontium	30.13	28	32
Zinc	0.0044	0.002	0.007
Oil and Grease	6	<5	10
Chemical Oxygen Demand	607	81	1100

Whole of Effluent Toxicity Testing

A WET test of CPF produced water was undertaken by Ecotox Services Australia and Hydrobiology Pty Ltd using a sample of Stag produced water collected on the 9th of April 2008 (Hydrobiology 2009).

The average OIW content of produced water sampled over that day was 24.2 mg/L and the monthly average for April 2008 was 14.7 mg/L. These values are higher than the CPF produced water OIW content averaged over 2002–2016 (8.5 mg/L; **Figure 6-5**). The sample taken for WET testing was collected downstream of the point where production chemicals were added.

WET testing used the method described in the Australian and New Zealand water quality guidelines (ANZECC/ ARMCANZ, 2018). The selection of the test species used (**Table 6-14**) satisfies the requirements of ANZECC/ARMCANZ (2018) guidelines for the assessment of toxicants in receiving waters, by having at least five species from four trophic levels as part of the testing suite. As there were both acute (i.e. fish and tiger prawn tests) and chronic (i.e. the remaining four species) toxicity tests conducted, an acute to chronic ratio (ACR) was used to convert acute data to estimates of chronic toxicity. A default ACR of ten is recommended by ANZECC/ ARMCANZ (2018). The chronic tests exposed a sensitive life stage of the test organism, and for the purposes of the derivation of dilution factors, can therefore be treated as chronic toxicity data.

The no observed effect concentration (NOEC) results (i.e. raw data) for each test were used to derive the protective concentration (PC) (**Table 6-14**). The BurrliOZ software package was used to calculate the species sensitivity distribution (SSD) (**Figure 6-6**). The most conservative protective concentration of PC99 was used

to generate safe dilution and dispersion boundaries for the discharge activity. The PC99 is expected to protect 99% of species in the ecosystem being considered.

The fit of the Burr Type III distribution to the above set of data was acceptable for the number of data points available for curve derivation (Figure 6-6). From the SSD, an ecological trigger value of 0.31% (produced water sample) was derived that would protect 99% of marine species; 0.31% produced water equates to a produced water dilution factor of 332:1.

Table 6-14: WET test results of Stag CPF produced water

Test	% of produced water		
	EC ₅₀	NOEC	LOEC
Chronic: 72 h sea urchin larval development test using <i>Heliocidaris tuberculata</i>	14.8	6.25	12.5
Chronic: 72 h macroalgal germination test using <i>Hormosira banksii</i>	8.5	6.25	6.25
Chronic: 48 h larval development test using the rock oyster <i>Saccostrea commercialis</i>	14.7	6.25	12.5
Acute: 96 h acute (survival) test using the tiger prawn <i>Penaeus monodon</i>	34.1	25 [2.5 ACR]	50
Acute: 96 h fish imbalance test using the striped trumpeter <i>Latris lineata</i>	14.9	12.5 [1.25 ACR]	25
Chronic: 72 h marine algal growth test using <i>Isochrysis aff. galbana</i>	62.9	12.5	25

EC₅₀ = Median effective concentration (required to induce a 50% effect); NOEC = No observable effect concentration (these values were used to derive trigger values); LOEC = Lowest observable effect concentration; Data summarised from Hydrobiology Pty Ltd (2009)

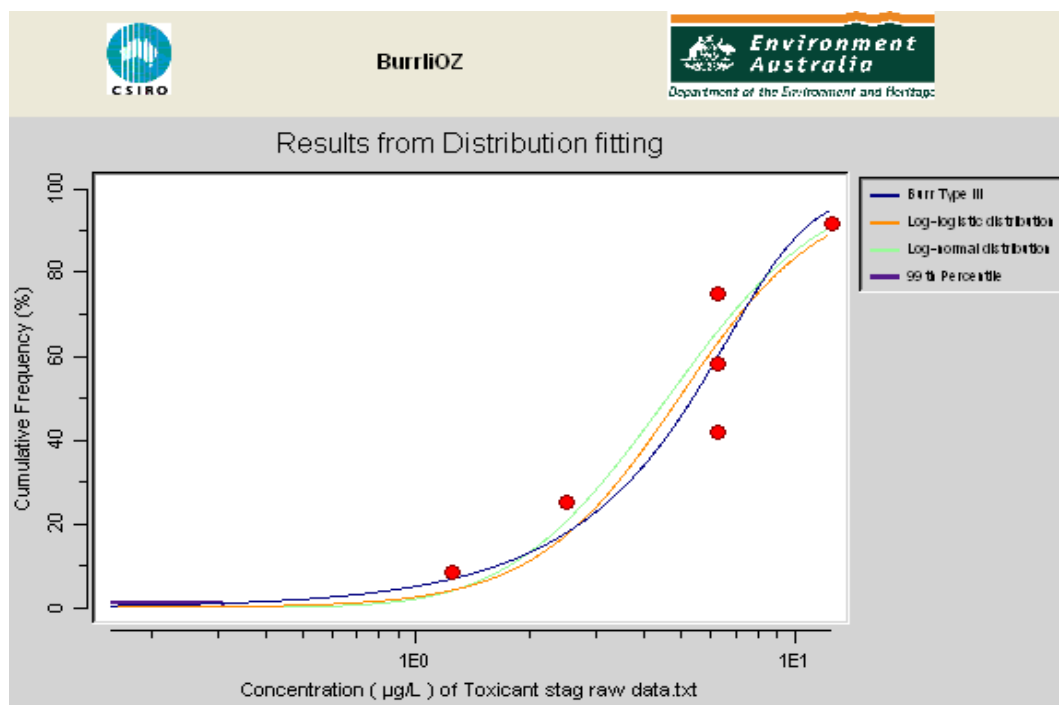


Figure 6-6: Species sensitivity distribution output from BurrliOz for Stag produced water

Since that time, WET testing was undertaken in 2018 and 2020 using the guidance of Warne *et al.* (2018). The estimated safe dilutions were lower than 2008 (Table 6-15).

Table 6-15: Guideline values (estimated safe dilutions) for Stag CPF PW in 2018 and 2020

PCx	2018	2020
PC99 (50) – 8 chronic tests	2.9% (1 in 35)	1.3% (1 in 77)
PC95 (50) – 8 chronic tests	4.7% (1 in 22)	2.8% (1 in 36)

6.4.1.3 Volumes

The volumes of produced water discharged from the CPF to the marine environment vary from month to month depending on production profiles and rates. The average monthly produced water discharge volume between 2018 and 2022 was 92,278 kL (Figure 6-7).



Figure 6-7: Produced water discharge volumes (kL per month) 2018 – 2022 from the CPF

6.4.1.4 Area of impact

Modelling

The area of impact from the discharge of produced water from the CPF was estimated based on the following information:

- Discharge points: describes the produced water discharge point;
- Discharge composition: water quality characteristics as determined from contaminant concentrations measured biannually for several years in produced water samples collected at the CPF were used to estimate the area of impact to water quality; see Section 7.4.1.2 for detail. For the purpose of estimating sedimentation rates, the average concentration of suspended solids (6.7 mg/L) was applied. Sinking and sedimentation rates are dependent on the size, shape and density of negatively-buoyant particles. Particles in discharge waters at the CPF are relatively fine, having passed through separation processes which include two hydrocyclones (centrifuges). Hence, a distribution was modelled using data for the particle size distribution of fine silt and clay particles, with a maximum size of 0.5 mm. The assumed distribution is biased towards coarser sizes however, which yields conservative (high) estimates of deposition rates;
- Modelling approach: describes the methodology behind dispersion modelling of the discharge;

- Near field mixing results: describes the initial dilution of the produced water discharge. The end of the near field mixing zone was judged as being either when the buoyance or momentum of the plume had ceased, or the plume had resurfaced;
- Far field mixing results: describes the produced water discharge behaviour as the plume disperses in the marine environment. The far field mixing zone considers dispersion at sea surface, through the water column and to benthic habitats; and
- Verification: Field data collected to verify the area of impact predicted by the model.

Discharge points

Produced water discharge from the CPF is from a pipe of 10” internal diameter.

Modelling approach

RPS group provided liquid dispersion modelling to predict the area of impact affected by the discharge of produced water.

The discharge scenario modelled was:

Discharge from the CPF – continuous release of 7,520m³/d⁶ and 8,744 m³/d from a 10” diameter pipe.

The produced water characteristics considered in the model were based on biannual characterisation data (refer **Section 7.4.1.2**). The model considered the dilution of water-soluble components and sedimentation rates of negatively buoyant particulates.

Near field modelling

The near field mixing zone refers to the initial region around the discharge where the hydrodynamics of the discharge dominate over background processes. Typically, the momentum or buoyancy (or both) of the discharge are the strongest influence on the dilution process within the near field mixing zone.

The modelling of the near field mixing zone considered the dilution of soluble constituents of the produced water discharge, which are expected to disperse in the upper water column. Consequently, ambient current data for the upper surface layer (<10 m) were extracted for waters at the Stag Facility from a 10-year composite data set (2009-2018) that accounted for drift and tidal currents. The data was statistically analysed to determine the 5th, 50th and 95th percentile current at the discharge locations (**Table 6-16**). These statistical current speeds can be considered representative of the range of seasonal and episodic conditions at the CPF location:

- 5th percentile current speed: weak currents, low dilution and slow advection.
- 50th percentile (median) current speed: average currents, moderate dilution and advection.
- 95th percentile current speed: strong currents, high dilution and rapid advection to nearby areas.

Table 6-16: Adopted ambient current conditions adjacent to the Stag CPF location

Season	Depth (m)	5 th Percentile (Weak) Current Speed (m/s)	50 th Percentile (Medium) Current Speed (m/s)	95 th Percentile (Strong) Current Speed (m/s)

⁶ Approximately 228,733 kL per month

Summer	0	0.055	0.209	0.463
	10	0.042	0.190	0.432
	20	0.039	0.182	0.415
Transitional	0	0.052	0.211	0.476
	10	0.040	0.191	0.448
	20	0.038	0.185	0.439
Winter	0	0.051	0.219	0.481
	10	0.046	0.196	0.431
	20	0.044	0.187	0.419
Annualised	0	0.052	0.214	0.474
	10	0.043	0.193	0.437
	20	0.040	0.185	0.425

The near field mixing parameters reported included surface current speed, plume diameter (or width), plume trapping depth (height of the plume in the vertical after initial dilution), plume temperature, plume ambient temperature difference and the maximum horizontal distance from the release site. The dilutions and concentrations presented are the minimum and average dilutions/ concentrations across the entire plume width at the end of the near field mixing zone. The end of the near field mixing zone was judged as being either when:

- The buoyancy and momentum of the plume had ceased; or
- The plume resurfaced.

Minimum and average dilutions across the near field mixing zone have been presented.

Far field modelling

Once the momentum of the discharge is lost at the boundary of the near field mixing zone, the local hydrodynamics of the ocean become the dominant influence on the dilution and dispersion process. At this point, the plume is considered to be in the far field. Further dilution in the far field is a function of diffusion and transport by ambient currents occurring over longer time scales and larger spatial areas.

Far field modelling was carried out to quantify the dispersion of the produced water discharge. The far field modelling expands on the near field assessment by simulating for longer discharge periods and allowing the effect of time-varying currents to be included, together with the potential for recirculation of the discharge plume back to the discharge location.

For each near field mixing zone scenario, a sample of independent simulations was performed with start times randomly selected within the period of the 10-year current dataset. The replicate simulations starting at random dates allowed for a wide range of possible environmental conditions to be modelled. One hundred simulations of the CPF discharge scenario were run, with each representing continuous discharge for seven days.

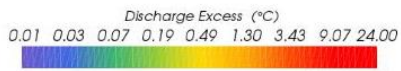
Near field mixing results

Modelling of the discharge configuration from the CPF prepared by APASA, involving discharge of heated water with greater buoyancy than ambient water, was predicted to result in rise of the produced water plume once the momentum of the downward plunge was lost. The plume was predicted to reach sea surface within a horizontal distance of 8 m from the discharge location, with this distance greatest when the current was strongest. Dilutions at the outer edge of the near field mixing zone were predicted to range from 8.6 to 30.8 depending on the prevailing current. The plunge depth of the plume ranges between 1.1 m and 4.0 m below the surface.

A summary of the near field mixing zone characteristics for the produced water discharge from the CPF under different ambient current speeds is provided in **Table 6-17**. Conceptual plots of the near field discharge plume for the three current scenarios modelled are provided in **Figure 6-8**.

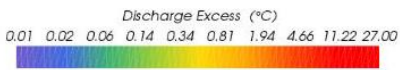
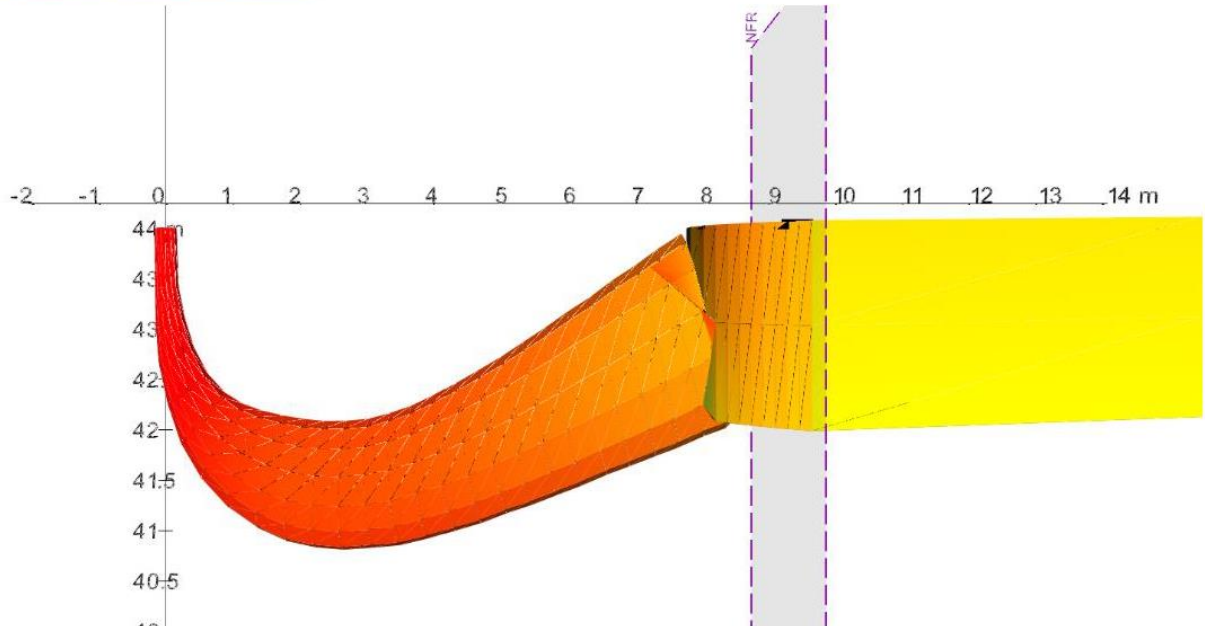
Table 6-17: CPF produced water plume parameters at end of near field for each current speed (RPS, 2022)

Discharge volume	Current speed (m/s)	Dilution (1:x)	Max. horizontal distance of centre line from release point (m)	Plunge depth (m)
47,300 bpd (7,520 m ³ /d)	Weak (0.06)	8.6 – 9.2	10.1 – 12.3	3.9 – 4.0
	Medium (0.21)	29.2 – 30.8	8.0 – 8.5	2.2 – 2.3
	Strong (0.46)	21.2 – 22.3	10.1 – 10.3	1.1-1.2



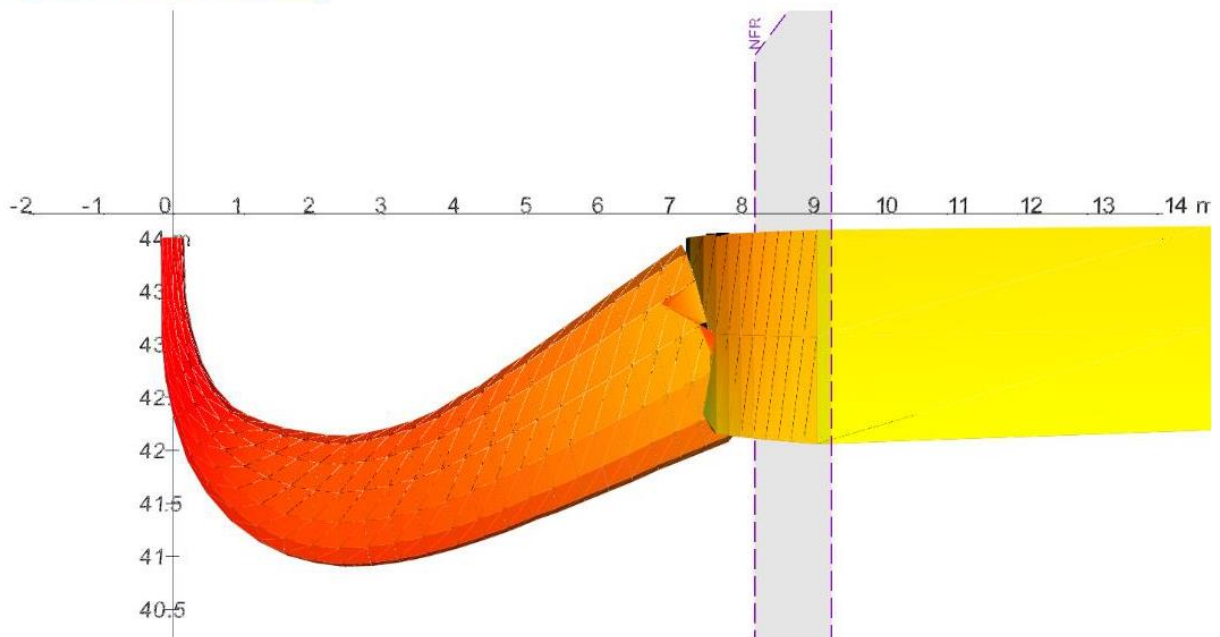
MAW0885J_Stag_PFW_SUM_5th
 Flow Class: IPV2 Origin: Ambient Bottom
 CORMIX1 Simulation
 Distortion Scale: Y:X = 1 Z:X = 3
 Visualization up to X = 2200 m (out of ROI X = 2200 m)

- Plume Centerline
- End of Near Field Region (NFR)
- Comox Module Boundary (MOD)



MAW0885J_Stag_PFW_TRA_5th
 Flow Class: IPV2 Origin: Ambient Bottom
 CORMIX1 Simulation
 Distortion Scale: Y:X = 1 Z:X = 3
 Visualization up to X = 2200 m (out of ROI X = 2200 m)

- Plume Centerline
- End of Near Field Region (NFR)
- Comox Module Boundary (MOD)



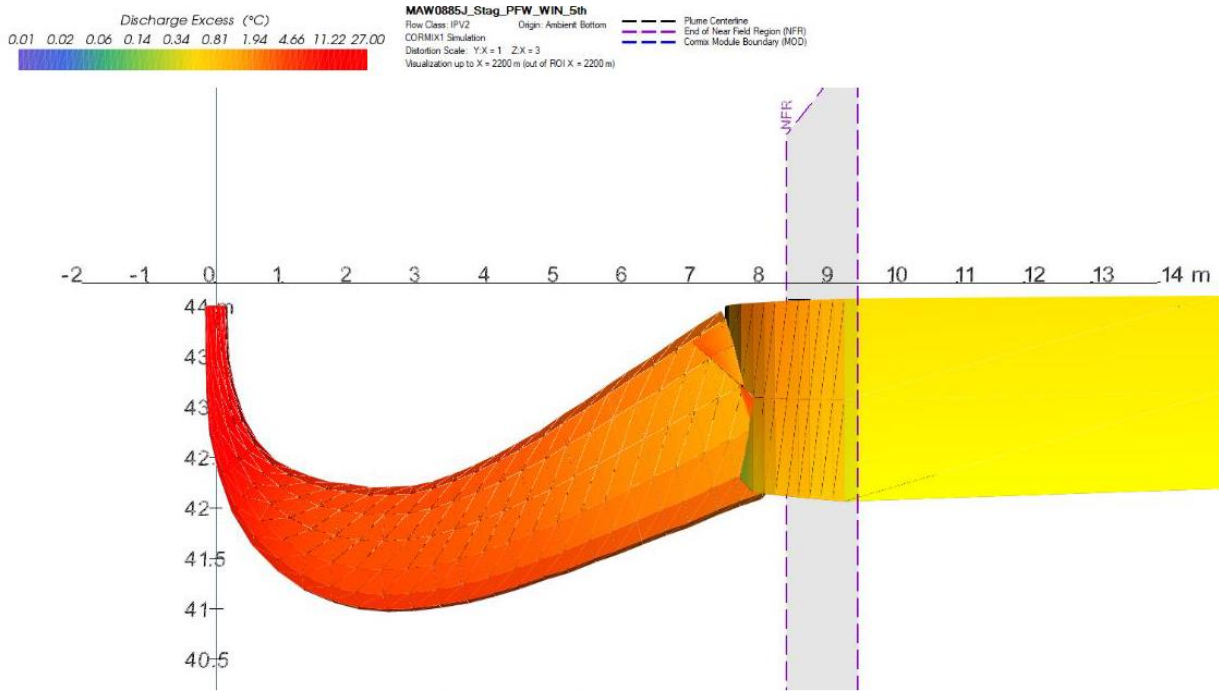


Figure 6-8: Near-field average dilution results for constant moderate summer (top), Transitional (middle) and winter (bottom) with a discharge flow rate of 7,520 m³/d at discharge height of 5 m above the sea surface

Far field mixing results

The results for each simulation of a given current scenario were combined and statistically analysed to produce percentile contours of dilution. Average dilution fields are presented to represent the central tendency for the modelling predictions generated.

To indicate the outer extents of the dilution fields, the 95th percentile dilution contours have been calculated. The 95th percentile contour would not be exceeded for 5% of the time. Note that these figures do not represent the plume’s location at any point in time but are a statistical summary of the percentage of time that dilution values occur across all replicate modelling runs and time steps.

Dilution contours are calculated from the ratios of dispersing contaminant concentrations in the receiving waters to the initial concentration of the contaminant in the discharge. Note that this assumes the background concentration of the constituent in the receiving waters is zero and there is no significant biodegradation of the discharged constituent over the short duration of the dispersion process. Dilutions can be used to calculate change in concentration given specification of an initial concentration at discharge (assuming no other process affects concentrations) (**Table 6-18**).

Table 6-18: Example calculations for concentration change given change in dilution

Discharge component	Constituent Concentration (mg/L)
Initial concentration in discharge	100
Concentration in receiving waters	0
Concentration at 50x dilution	1
Concentration at 100x dilution	0.5
Concentration at 200x dilution	0.3
Concentration at 400x dilution	0.25

Figure 6-9 shows the average and 95th percentile dilution contours for produced water discharged from the CPF during the transitional season. The discharge moves mainly with the tidal axis along ESE and WNW directions. The 95th percentile dilution reaches the 99% species protection dilution requirement (1:332) at a distance of 125 m from the CPF discharge point during transitional season (for other seasons the maximum distance is lower).

Simulation of the sedimentation of fine particles released with the produced water indicated that there would be broad dispersal at low concentrations (<0.001 g/m²/d as a maximum) surrounding a localised area of higher deposition aligned with the tidal axis in the receiving environment (**Figure 6-10**).

Average daily deposition rates are the most appropriate estimators for evaluating annual deposition rates because they are calculated for the widest range of conditions and therefore incorporate variability in rates due to changes in environmental conditions. Average daily deposition rates only account for input estimates however and do not include removal due to resuspension, or for mixing and dilution with ambient sediments, and therefore they are overly conservative as an estimate to net deposition to the marine environment.

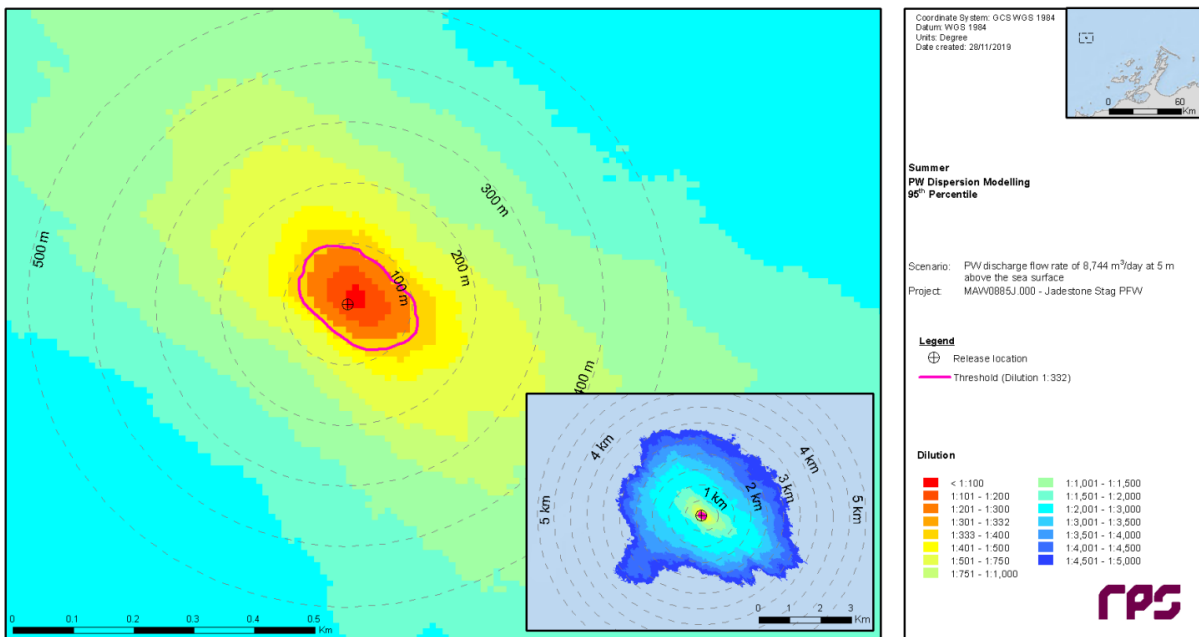
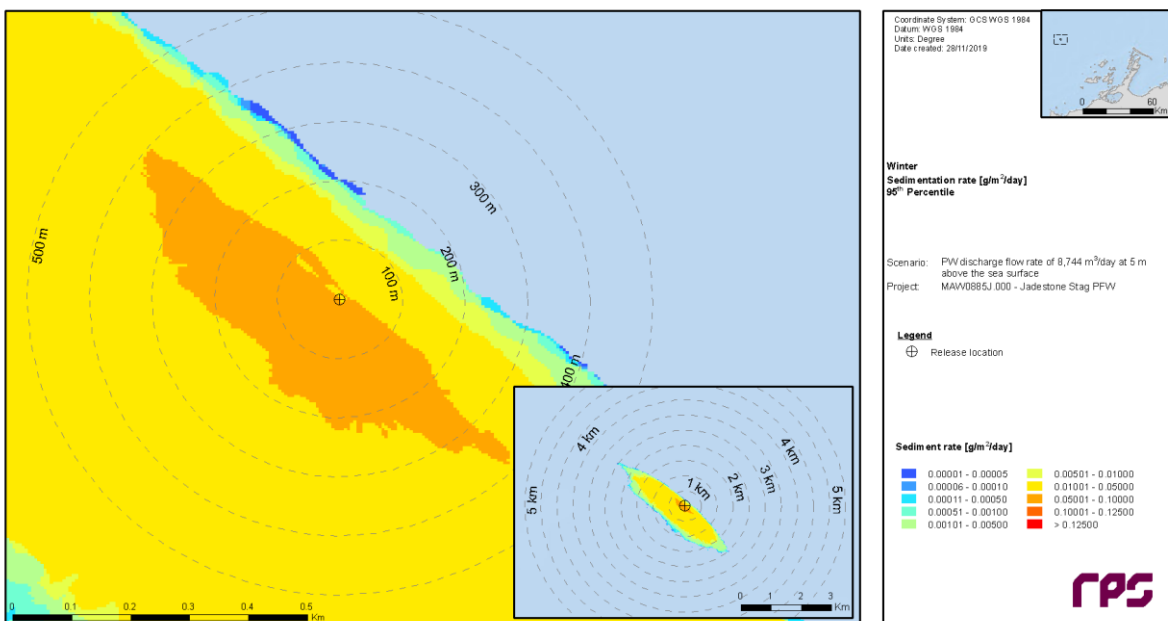


Figure 6-9: Calculation for the 95th percentile distance that may be affected by dilutions of the PW under summer conditions (Discharge at 8,744 m³ / d considered conservative).



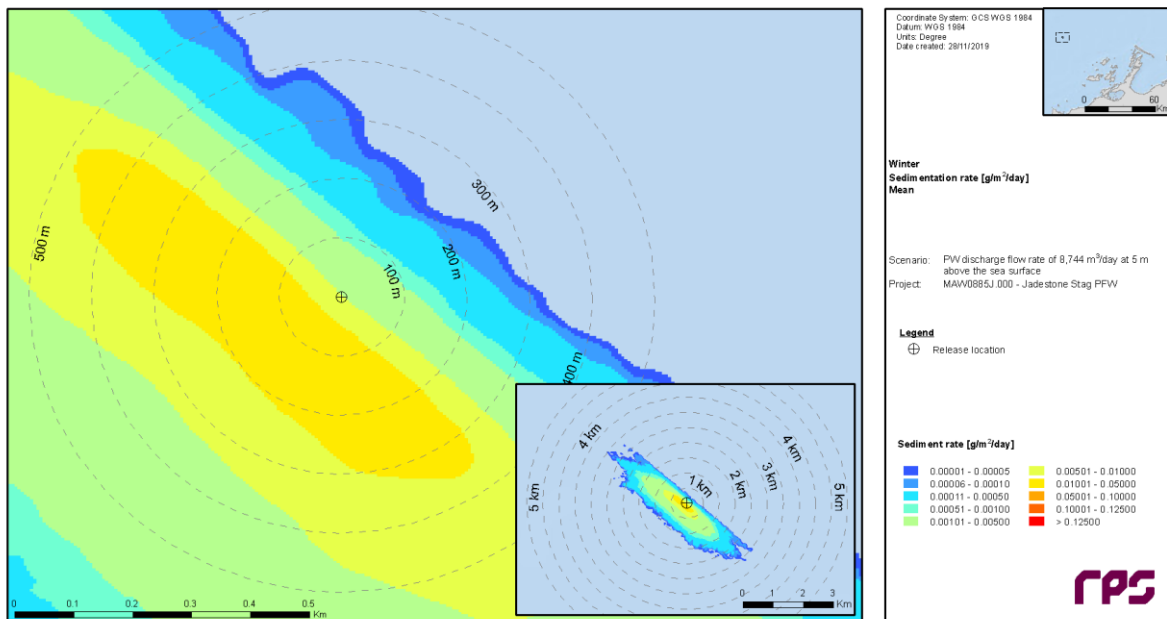


Figure 6-10: Contours of the maximum daily (top) and average daily (bottom) sedimentation rate (g/m²/d) due to produced water discharged from the CPF during winter

The estimated daily deposition rates were highly skewed with average daily rates exceeding 0.01 g/m² (or 3.65 g/m²/y) for an area extending approximately 400 m from the CPF discharge point along the tidal axis and 200 m across this axis. Average daily rates were calculated at up to 0.1 g/m² (36.5 g/m²/y) as small patches that might occur within 100 m of the CPF discharge point along the tidal axis.

The sediment loadings predicted are extremely light: 3 g of sediment is approximately three teaspoons of fine particulate material distributed across a one square metre area per year. This degree of loading will be extremely difficult to detect in the open marine environment particularly when accounting for open environment fate processes such as resuspension and redistribution.

Area of Impact

Using the 95th percentile water column far field mixing results for the 1:332 dilution contour and the 0.01 g/m²/d sedimentation contour, modelling indicates that the predicted area of impact for produced water discharge is an area up to 125 m radius from the discharge point in surface waters and up to 400 m at seabed from the CPF discharge point.

In applying the discharge modelling results presented above, marine water quality and sediment quality perturbations due to produced water discharge are not predicted beyond 250 m distance of the CPF discharge point.

Verification of Modelling

Field validation of hydrodynamic predictions and water and sediment quality sampling were undertaken by a third-party marine consultancy in 2014 (Oceanica, 2015). The study aimed to validate the area of impact as predicted by the modelling and included evaluating current predictions, dilution fields and sedimentation footprints, as these form the basis of the defined area of impact. The in-field monitoring occurred between the 2nd and 5th of November 2014. At the time of sampling, the produced water discharges at the CPF were as shown in **Figure 6-11**. As indicated by **Figure 6-11**, the produced water discharges from the CPF at the time of in field monitoring fell within a period of routine discharge operations.

The study undertaken by Oceanica (2015) included the following activities:

- Currents were measured in the field using drogues to evaluate the accuracy of the predictions obtained from the hydrodynamic model and used as the basis for produced water dispersion modelling;
- Water sampling was undertaken to determine the concentration of contaminants at distances away from the discharge location, including within, at the edge and beyond the predicted area of impact. This activity underpinned the assessment of whether contaminants associated with the produced water discharge were at or below predicted concentrations and if ANZECC/ ARMCANZ (2018) 95% species protection trigger values for water quality were met at the edge of the area of impact; and
- Sediment sampling was undertaken to determine the concentration of contaminants at distances away from the discharge location, including within, at the edge and beyond the predicted area of impact.

Figure 6-12 shows the monitoring locations used during the in-field monitoring campaign.

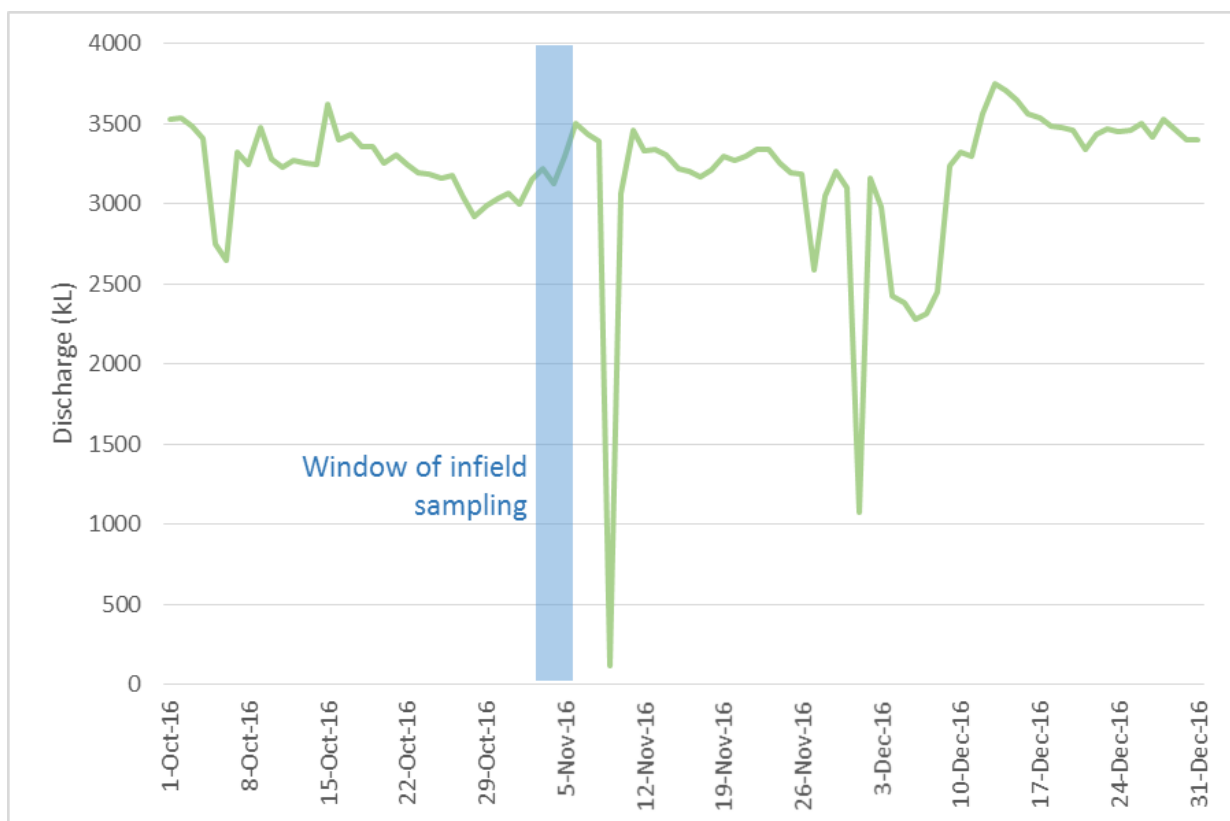


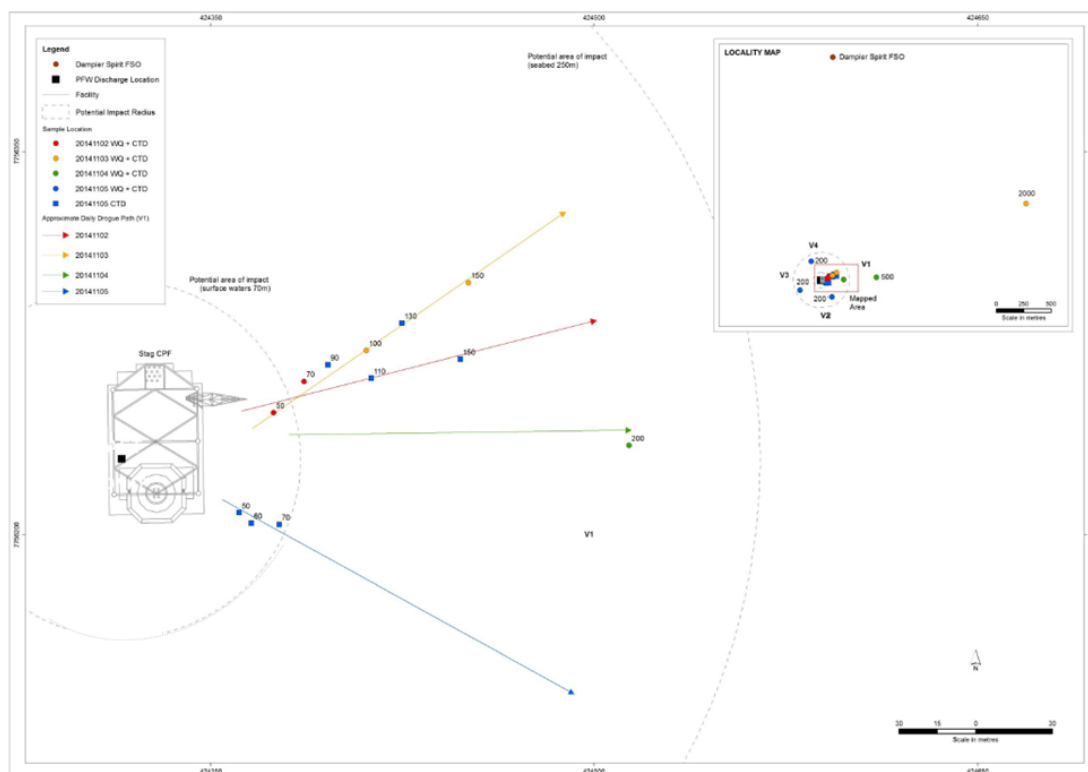
Figure 6-11: Produced water discharge rates from the Stag CPF during infield monitoring (highlighted blue) in relation to daily discharge rates over Q4 2016

Oceanica (2015) summarised the study findings as follows:

At a distance of ≥ 50 m from the discharge point, the produced water plume could not be differentiated from background based on temperature/ salinity/ dissolved oxygen/ pH characteristics. All water quality analytes were below their respective ANZECC/ARMCANZ guidelines (where applicable). Slightly elevated ammonia,

total phosphorus, barium and iron concentrations near the discharge point on Vector 1 [one of four transect monitoring lines] compared to the opposite and perpendicular vectors provided confidence that the sampling captured the produced water plume. The influence of the produced water on nutrient and trace metal levels within the water column was generally limited to ≤ 200 m from the discharge and did not exceed ANZECC/ARMCANZ triggers. Concentrations of all hydrocarbons (TPHs, BTEX, PAHs) were below the laboratory limits of reporting. Considering that these compounds could not be detected in the receiving waters suggests that they pose little risk to the environment. A dilution of 280- to 350-fold at 50–70 m from the discharge was estimated from barium levels, which is similar to the predicted 332-fold dilution by the modelling.

The sediments were all of similar grain size and dominated by sand sized particles. Shells and other biota were present in the majority of samples. There was little variation in the sediment particle size distribution along the vector. Concentrations of all contaminants in sediments were below their respective ANZECC/ARMCANZ ISQG-Low and -High levels (where applicable). Zinc concentrations were elevated in the vicinity of the CPF, decreasing to background levels by 250 m from the CPF similar to previous monitoring undertaken in 2000 (IRC 2001). Lead and barium concentration results were similar to those reported in 2000; however, the copper and chromium results were slightly lower than those measured in 2000.



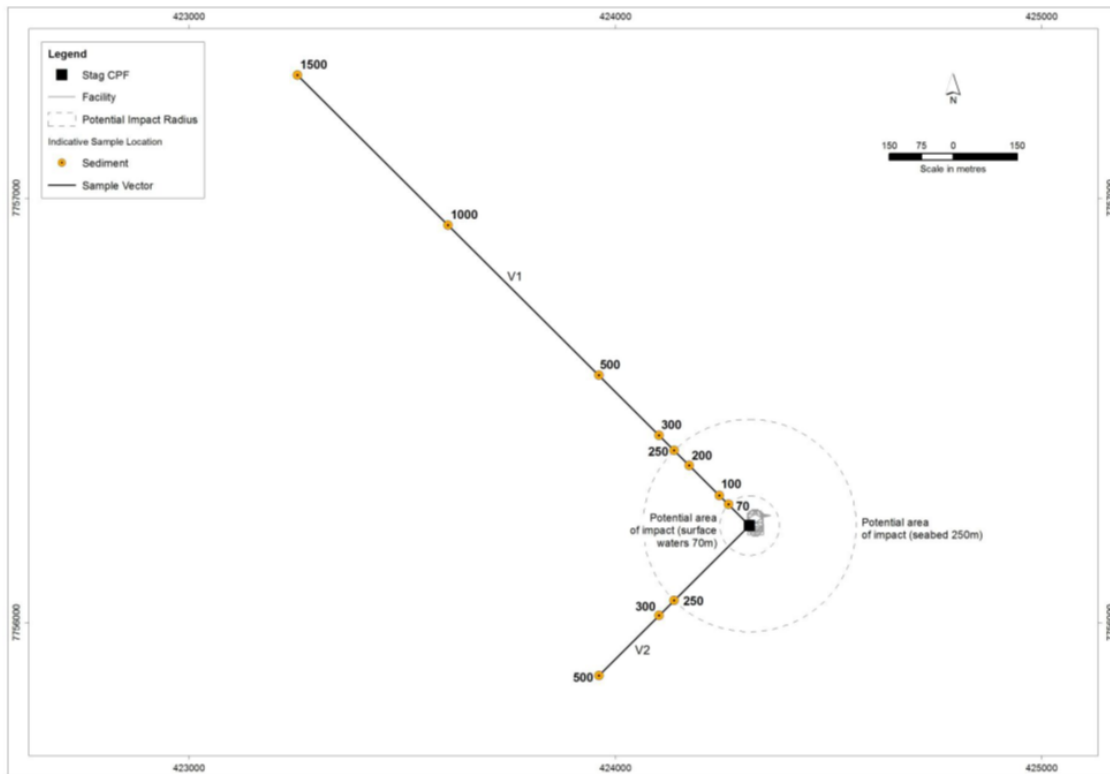


Figure 6-12: Location of in-field monitoring locations for water quality monitoring (top) and sediment quality monitoring (bottom)

The organic content of the sediments were low and at least one order of magnitude lower than recorded in 2000. All hydrocarbon concentrations were below their limits of reporting, suggesting that there has been no hydrocarbon contamination in these sediments resulting from activities associated with the CPF. This is consistent with the previous sediment quality monitoring at the Stag Oilfield in 2000 (IRC 2001).'

The study, commissioned by Quadrant Energy, was undertaken to verify the hydrodynamic model used to predict the environmental footprint for produced water discharge. While extensive data was collected during this study, particularly around local water and sediment quality, further information particularly relating to the hydrodynamics of the local receiving environment will provide further certainty as to the accuracy of the environmental footprint of the produced water discharge stream.

Tracer Dye Study and Particle Size Distribution (PSD) Study

The previous EP committed to undertake a dye tracer study, which was completed in 2018 (RPS 2018b). In addition, Jadestone undertook an extensive study of the Stag CPF PW, sampling PSD on a weekly basis over the period May 2019 to March 2020 (Jacobs 2020). The results of these studies are compiled here to provide further verification of the model, and of the predicted environmental footprint for soluble and particulate components of the produced water discharge stream (i.e. water column and seabed areas of impact).

It was determined that the PSD of the Stag CPF PW was similar over time with a high concentration of particles in the silt and clay fractions (average 98%). The chemically active fraction of sediment is usually cited as that portion which is smaller than 63 µm (UNEP/WHO 1996). Problem contaminants are most often associated with fine sediment because this fraction consists of particles with relatively large ratios of surface to volume and may be charged (e.g. clay particles such as those found in the Stag reservoir formation material, glauconite), which increase the sorptive capacity for contaminants (Power and Chapman 1992). Sediment deposition requires suitable hydrodynamic conditions, which depend on the type of sediment. Fine sediments cannot settle in high-energy environments (strong waves and/or strong currents). Temporary settling is possible when currents are weak (neap tide, slack tide) and in the absence of strong wave action.

However, in situations where low-energy and high-energy conditions alternate, these temporary deposits will disappear. In high energy environments the sediment is composed of medium to coarse sand (Van Oyen et al. 2013).

Data from the LISST instrument used during the 2018 dye tracer study of the PW from the Stag CPF measured suspended sediment in the surface water outside the plume of the size of fine sand at approximately 220 µm and thus RPS (2018b) concluded that over durations of several hours to days, very fine sand particles will be subject to movement and dispersion with the prevailing drift currents that would push particles down-current of the tidal axis; hence, very fine sand particles of the observed size range would not tend to sink along this axis to build up over the longer term but will be more widely dispersed in all directions. In addition, the clay and silt sized particles in the produced water plume would not permanently settle out of the water column unless they were in very deep water or in areas where hydrodynamic conditions were very weak and did not continuously resuspend the particles (Dr. Graeme Hubbert, pers com).

Medium sized sand particles may fall to the sediment close to the Stag CPF facility, under slack tidal conditions; however, it is unlikely that any contaminants are associated with this material. This is corroborated by the in-field water and sediment quality monitoring of the Stag CPF (BMT Oceanica 2014) in which concentrations of all metal/metalloid contaminants in sediments were below their respective guideline values.

6.4.2 Impacts

Beyond temporary perturbation to water quality, no environmental impacts due to the discharge of produced water are expected.

Provided below is an overview of the risks and potential impacts associated with discharge of produced water to the marine environment.

Produced water constituents

Potential impacts to sensitive receptors from discharged produced water may be attributable to dissolved hydrocarbons and suspended oil droplets, naturally occurring radioactive materials (NORM), dissolved metals and nutrients as well as low residual concentrations of a small number of process chemicals such as corrosion and scale inhibitors and biocides. Hydrocarbons however are considered the constituent of most concern to marine fauna, particularly polycyclic aromatic hydrocarbons (PAHs).

Hydrocarbons: hydrocarbon exposure may lead to mortality in marine organisms as well as sub-lethal chronic (long exposure) effects such as decreased genetic diversity in communities, decreased growth and fecundity, lower reproductive success, respiratory problems, behavioural and physiological problems, decreased developmental success and endocrine disruption (Neff *et al.*, 2011a). It is generally agreed that within produced water the components of greatest threat to the environment are the more persistent hydrocarbons, primarily PAHs (Neff *et al.*, 2011a), which can bioaccumulate within marine organisms (i.e. increase in tissue of marine organisms over time; see *Bioaccumulation* below).

Metals: as with hydrocarbons, dissolved metals may create impacts to marine organisms if present at high enough concentrations. Some metals also have the potential to bioaccumulate within marine organisms. ANZECC/ARMCANZ (2018) guidelines suggest the heavy metals mercury, selenium and cadmium have the greatest potential for bioaccumulation and secondary poisoning, although bioaccumulation may occur for a range of metals.

Metal bioaccumulation is a complex process and depends upon the concentration and bioavailability of metals and physiology of individual species and can vary greatly among species in the same environment (Luoma and Rainbow, 2005).

Heavy metals in produced water undergo a series of chemical reactions once they enter seawater and ultimately precipitate out as metal hydroxides or sulphides. Metals present in marine sediments as hydroxides or sulphides are not generally available for biological uptake.

Nutrients: elevated nutrient levels can lead to increased bacterial and phytoplankton production (e.g. phytoplankton blooms). In nutrient poor waters such as those in offshore marine environments, introduction of dissolved nutrients such as ammonia and nitrate to surface waters where high light levels are available will lead to rapid uptake by phytoplankton with associated increased biomass. Increased biomass will be a highly localised feature (within tens of metres) associated with the availability of dissolved nutrients.

NORM: the environmental risk around radioisotopes in produced water is due to ionising radiation (alpha, beta and gamma radiation). Within produced water the radioisotopes of primary concern are ^{226}Ra and ^{228}Ra , which are more likely to be dissolved within produced water than other NORM, and which have the relatively longest half-lives of 1,601 and 5.7 years, respectively (i.e. they show greatest persistence in the marine environment).

The principal radionuclide of concern is ^{226}Ra for which studies into health and ecological impact have been carried out (OGP, 2005). A foodweb study by Brookhaven National Laboratory in the Gulf of Mexico concluded that there would be no detectable impacts on fish, molluscs and crustaceans and the environmental risk of discharge within Gulf of Mexico is small (OGP, 2005). The MARINA II study conducted in the North Sea determined that the offshore oil and gas industry was the largest contributor of alpha radiation emitters in the North Sea but that the discharges were of insignificant risk to the health of marine life or humans (OGP, 2005).

Impact mechanisms

Bioaccumulation

Chronic exposure to a contaminant can lead to bioaccumulation of the contaminant within marine organisms over time (accumulation of chemicals from the water or from food sources into tissues over time). ANZECC/ARMCANZ (2018) guidelines provide an indication of chemicals for which possible bioaccumulation and secondary poisoning effects should be considered. These include PAHs and the heavy metals mercury, selenium and cadmium.

Uptake of PAHs can occur in all marine organisms to varying levels; however, there is a wide range in tissue concentrations from variable environmental concentrations, level and time of exposure, and species ability to metabolise these compounds (Meandor *et al.*, 1995). Since the elimination of PAHs is generally very efficient in fish and other vertebrates, bioaccumulation of PAH within these taxa do not generally reflect their level of exposure (van der Oost *et al.*, 2003). Instead bioaccumulation of PAH has been mainly recorded within invertebrates which are less efficient at metabolising PAH.

Hydrocarbon taint

Elevated hydrocarbon levels in fish flesh have the potential to impact humans if affected fish species are targeted by fisheries. When present in foods, petroleum hydrocarbons stimulate an olfactory response in humans that causes a tainting of flavour or taste. Connell and Miller (1981) compiled a summary of studies listing the threshold concentrations at which tainting occurred for hydrocarbons. The results contained in their review indicate that tainting of fish occurs when fish are exposed to ambient concentrations of 4–300 ppm (mg/L) of hydrocarbons in the water, for durations of 24 hours or more, with response to phenols and naphthenic acids being the strongest.

Accumulation of contaminants in sediments

While the produced water plumes from Stag CPF primarily influence the quality of localised surface waters, there is the potential for particles within the plume, which may comprise metal oxides and low solubility hydrocarbon droplets (such as higher molecular weight PAHs), to drop out of the plume in the far-field mixing

zone (Neff *et al.*, 2011a). These components of the produced water therefore have the potential to accumulate in sediments.

Results of the model field validation study indicate produced water constituents were not above background concentrations in marine sediments beyond 250 m of the discharge point.

Biomagnification

Biomagnification occurs when concentrations in the tissues of one organism exceed those in its food or in an adjacent trophic level (Reinfelder *et al.*, 1998). Biomagnification of PAHs is possible in invertebrate food webs (Jorgensen, 2010), although unlikely to occur within food chains comprising marine vertebrates (e.g. fish, marine reptiles and mammals and seabirds).

In a field study, PAHs in lower order consumers (molluscs) were shown to be higher than in higher order consumers (fish and decapod crustaceans) indicating biomagnification of PAH was unlikely to be occurring (Takeuchi *et al.*, 2009). Organisms at higher trophic levels tend to show increased ability to metabolise PAHs indicating that biomagnification of PAH up the food chain is unlikely to occur (Takeuchi *et al.*, 2009).

In terms of metals, biomagnification of inorganic mercury (as methyl-mercury) in aquatic food webs has been observed in a number of studies with highest concentrations in the long-lived high order consumers (Cabanna and Rasmussen, 1994, Bowles *et al.*, 2001, Power *et al.*, 2002). However, for other metals biomagnification into higher trophic levels is not believed to occur (Fisher and Reinfelder, 1995, Miramand *et al.*, 1998, Gray 2002). Instead concentration within a trophic level is mainly determined by the feeding strategy of the particular species at that trophic level (Rainbow, 2002).

Potential impacts to sensitive receptors

Pelagic environment

WET testing of Stag produced water has been carried out on six test species (including marine algae and invertebrate test species; refer **Table 6-14**). The WET testing captured potential additive effects of constituents of the produced water. The WET testing determined that after sufficient dilution (assessed as 332:1 dilution) no observable effect (NOEC) to marine species will occur; the spatial scale of the area of impact is described in **Section 6.4.1.4** and it accommodates this dilution for no ecological effect. Further to this, the dilution factor and area of impact required to achieve this level of dilution have been confirmed as being achieved in the marine environment through a field validation study (Oceanica, 2015).

NORM within Stag produced water have been measured at 8.94 Bq/L which is at the lower range of levels recorded in produced water samples worldwide (Neff *et al.*, 2011a). Given that studies from regions of very active oil and gas regions have not concluded significant environmental impacts from NORM it is not predicted that NORM in Stag produced water will lead to significant environmental impacts.

Plankton

Components of the plankton that could be impacted by produced water include micro-invertebrates; eggs; larvae of invertebrates; and fish. Acute effects include lysis of single-celled organisms and narcosis of motile invertebrates leading to impaired swimming ability.

The predicted small scale of the area of impact suggests that exposure impacts (sub-lethal or lethal) from produced water are likely to be insignificant at population or ecosystem scales. There are no nearby hard coral areas that would suggest that impacts from produced water on hard coral eggs and larvae would occur during coral spawning season (peaking in March/April).

Nutrients (N and P) discharged within produced water have the potential to increase the biomass of phytoplankton and bacteria within local waters. The field validation study of the produced water area of impact at the Stag Facility (Oceanica, 2015) found slightly elevated ammonia and total phosphorus near the CPF discharge point. The influence of produced water on nutrient levels within the water column was generally limited to ≤ 200 m from the discharge and did not exceed ANZECC/ ARMCANZ triggers.

Invertebrates

In addition to invertebrates within the plankton assemblage, larger pelagic invertebrates (e.g. jellyfish, squid, salps) will be present around the Stag Facility. Based on WET testing of Stag produced water, impacts could occur to these invertebrates within the area of impact.

Macro-invertebrates present in surface waters are expected to be mobile and while they may be exposed to produced water and may experience sub-lethal effects such as impaired mobility, these effects will be short-term and will recover rapidly once outside the area of impact of the produced water discharge (approximately 50 to 70 m away from the discharge point).

Bioaccumulation of hydrocarbons (e.g. PAHs) and metals is most likely to occur in sessile invertebrates attached to the CPF sub-structure close to the discharge location. These fauna are repeatedly dosed with produced water and thus experience prolonged (chronic) exposure. This is likely to be due to either uptake of dissolved constituents (e.g. volatile, low molecular weight hydrocarbons such as BTEX hydrocarbons) across cellular structures or ingestion (filter feeding) of higher molecular weight hydrocarbons (e.g. PAHs) or precipitated metals which may be bound to organic particulate matter. This impact would be highly localised and particular to organisms attached to the CPF sub-structure within the produced water discharge plume.

Fish

Effects may be experienced by pelagic fish within the produced water area of impact. Pelagic fish are commonly associated with offshore structures and therefore higher abundances are likely to occur around the CPF than in surrounding open waters, especially given the surrounding habitat of flat sediments in depths >50 m.

Impacts to pelagic fish are likely to be caused by exposure to dissolved hydrocarbons (e.g. BTEX hydrocarbons) or metals across gill structures, although impacts could also occur through ingestion of hydrocarbon droplets. PAHs are the hydrocarbon of most concern in terms of long-term exposure to produced water. While PAH concentrations may be elevated in fishes attracted to the CPF the elimination of PAHs is generally very efficient in fish and other vertebrates and bioaccumulation of PAH within these taxa do not generally reflect their level of exposure (van der Oost *et al.*, 2003).

The infield model validation monitoring study (Oceanica, 2015) found that concentrations of all hydrocarbons (TPHs, BTEX, PAHs) measured in marine waters were below the laboratory limits of reporting. Authors of the monitoring report (Oceanica, 2015) concluded that, considering that these compounds could not be detected in the receiving waters suggests that they pose little risk to the environment.

EPBC species

With regards to impacts to MNES, a conservative 1 km search radius from the Stag Facility (double that of the 500 m restricted zone of the Facility) was used to conduct the EPBC MNES search to cover the risk of produced water discharges (Appendix B). For noting, the 1 km radius EPBC MNES search area used is well beyond the 70 m radial distance from the Facility for mixing of produced water discharge in the water column, and the 250 m radial area over which fine particulate material may settle to seabed.

The search found 17 listed/ threatened species and 23 migratory species or species habitat that may occur within the area. Of note was the overlap with Biologically Important Areas (BIAs) for four EPBC listed species: the humpback whale, blue pygmy whale, wedge tailed shearwater and Flatback turtle (**Figure 6-13**). The Whale Shark BIA was approximately 9 km from the 1km search area boundary (**Figure 6-14**).

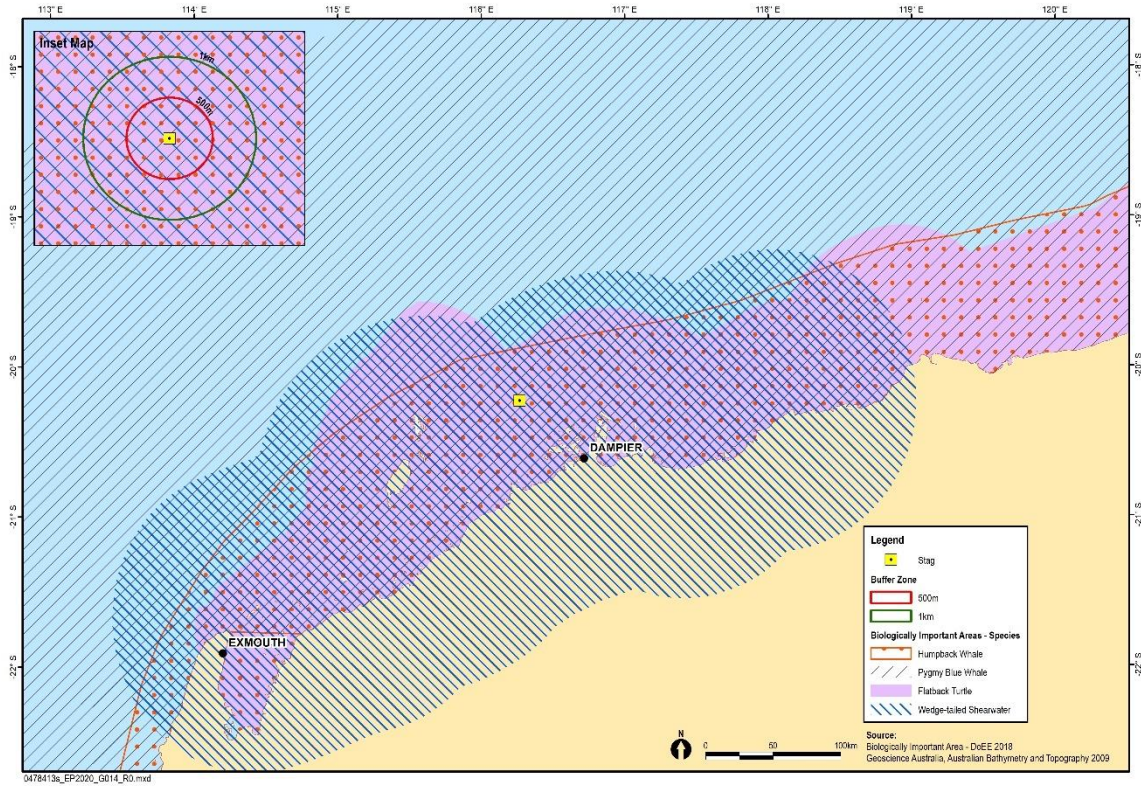


Figure 6-13 Stag Facility with 500m and 1 km radial areas used for EPBC search, showing EPBC species BIA

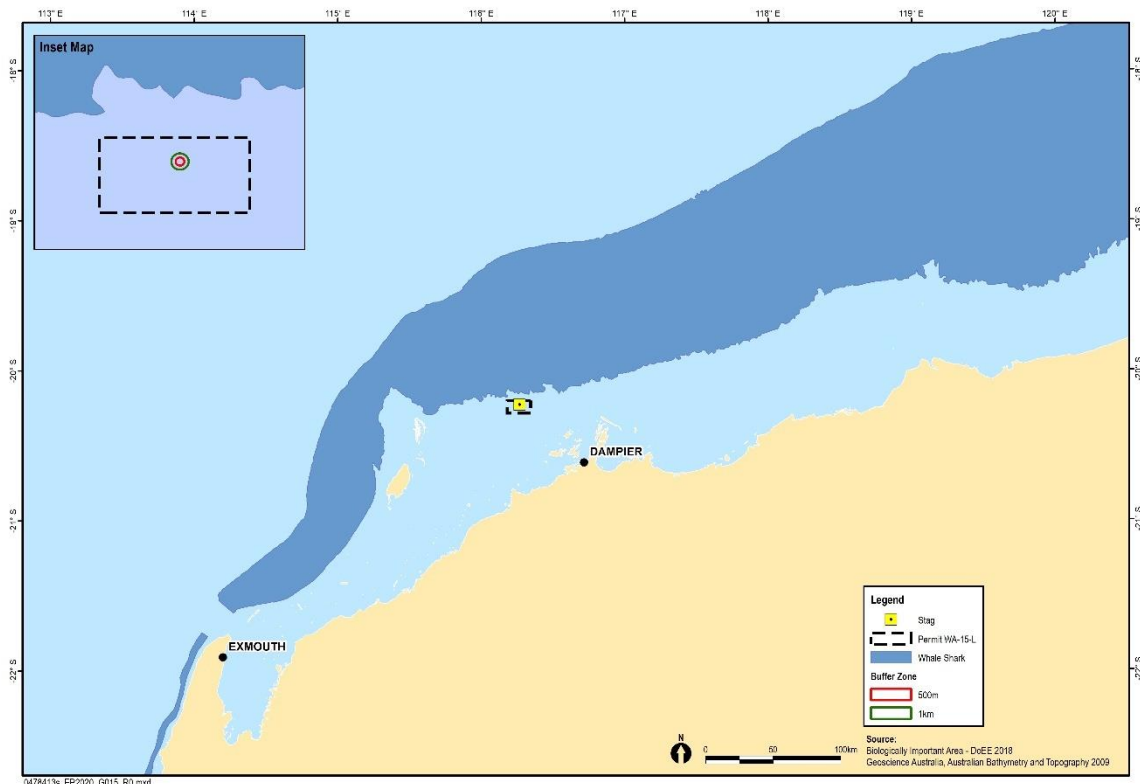


Figure 6-14 Whale Shark BIA adjacent to Stag Facility and permit area

Based on the marine monitoring that has been conducted (Oceanica, 2015) it was concluded that there will not be acute or chronic impacts to marine reptiles, marine mammals or seabirds due to produced water discharged from the Stag CPF. It is noted that the area does overlap with the humpback whale and blue whale migration corridor, shearwater foraging, and the flatback turtle interesting areas which may result in a higher number of these species around the Stag Facility.

The Flatback BIA (inter-nesting areas) overlaps the EPBC MNES search area, and although there may be transient individuals (**Section 3.6.4**) most females inter-nest close to their nesting beaches, typically in shallow (0–10 m) nearshore waters of their nesting beach (Chevron 2008) – unlike the depth of the operational area. The Stag Facility is in 49 m depth, and the nearest significant nesting beaches are 32 km away at Dampier Archipelago.

The bioaccumulation/ biomagnification risk to marine turtles or the impact pathway is through the food chain. However as described above, the BIA area for flatbacks overlapping the Operational Area (and area affected by produced water) is thought to be for inter-nesting. The study by Sperling et al. (2010) concluded that flatback turtles do not feed during the inter-nesting period which greatly reduces the risk of bioaccumulation/ biomagnification. However, if individuals were likely to use this area as foraging grounds, outside of nesting season it would represent an insignificant percentage of all available nesting grounds and not significantly effect individuals or population.

‘Management of oil spills and operational discharges’ is identified as an action in the Turtle Recovery Plan (DoEE 2017). However, the total size of the BIA for Pilbara flatbacks is 35,758,776 km². The areas that may potentially be affected by produced water discharges (water quality a 70 m radial extent largely limited to the top 1 m of water column) represents less than 0.01% of the total area.

Furthermore, the produced water Management Framework (refer **Section 6.4.3**) which involves continual measurements and ongoing monitoring of produced water will ensure there will be no increase in the current or predicted levels of contaminants and risks to flatback turtles remain low.

Blue whale

The area where blue whales are known to be distributed which is part of the species BIA also overlaps the operational area (refer Figure 3-7). Although little is known about their precise migration routes blue whale migration is thought to follow deep oceanic routes (DSEWPaC, 2012d). The blue whale is rarely present in large numbers outside recognised aggregation areas and is unlikely large numbers would be found around the Stag Facility and be exposed to produced water discharges. There is no Conservation advice for blue whale, but the species information (SPRAT Blue Whale, DEE 2017as) does not identify water quality as a potential threat, and no management actions will be compromised due to the release of produced water.

Wedge tailed shear water

The wedge tailed shearwater breeds on the east and west coasts of Australia on offshore islands. The species is common in the Indian Ocean. The species BIA (foraging areas) overlaps the Stag Facility and produced water discharge area (Figure 3-13). However, when foraging at sea the birds are often alone or in small groups and are unlikely to be impacted by change in water quality associated with the produced water discharge plume in the surface metre of the water column. Additionally, like with the turtles BIA, the proportion of foraging area likely to be impacted by produced water discharges (a 70 m radial extent from the discharge point in the top 1 m) is minimal.

The whale shark BIA is approximately 9 km from the Operational Area (**Figure 6-14**). As such it is reasonable to expect individuals to pass through the area. Whale sharks spend the majority of their time in deeper waters, and would avoid the surface produced water plume, however it may have a small indirect effect on plankton which is a food source for whale sharks (Meekan 2008). The predicted small scale of the area of impact however suggests that exposure impacts (sub-lethal or lethal) from produced water is not likely to significantly impact whale shark food sources (as described above in impacts to fish).

The Conservation advice for the whale shark identifies habitat disruption from the resource sector as a minor threat to the species (SPRAT Whale shark, DEE 2017as). However as described above the release of produced water 9 km from the nearest point of the whale shark BIA is not likely to have any impact on the species or habitat used by the species.

Pipefish and seahorse

Although the PMST report for the 1km buffer around the facility found a number of syngnathid 'species or species habitats may occur in the area' – there is no records of them actually occurring. Knowledge about the distribution, abundance and ecology of both syngnathids and solenostomids is limited (DSEWPaC 2012). Almost all syngnathids live in nearshore and inner shelf habitats, usually in shallow, coastal waters, among seagrasses, mangroves, coral reefs, macroalgae-dominated reefs, and sand or rubble habitats (Dawson 1985; Lourie et al. 1999, Lourie et al. 2004; Vincent 1996). In tropical areas species are primarily found among coral reefs (Foster & Vincent 2004; Scales 2010). Given the substrate observed in the produced water EMBA was predominately soft sediments it is considered unlikely for any of these species to be observed in the area.

As described in **Section 6.4.2** contaminant levels from produced water discharge are not considered at a level that would impact on marine organisms such as syngnathids. This is supported by (DSEWPaC 2012) which lists oil pollution from rigs as 'of least concern' to the species.

Fisheries

No fishing is permitted within the 500m restricted zone around the CPF, third-party tanker and other subsea infrastructure. Given that the area of impact for produced water discharge lies within this restricted zone, and recent sediment and water quality surveys (Oceanica 2015) have found that concentrations of hydrocarbons (including PAHs) and mercury were below analytical detection limits, no impact to fish targeted by nearby fisheries is predicted.

Furthermore, for the actively fished commercial fisheries in the area, the approved fishing area is extensive the purposes of flexibility and boundary simplicity, rather than being a true representation of where catch and effort is actually undertaken. Although the habitat within the operational area may represent suitable habitat for some of the commercial species (Table 5.16), in reality fishing effort for these species will be focussed on areas of most suitable habitat and away from constraints such as infrastructure. Although some of the larger fish species may be transient through the operational area and then travel significant distances to active fishing grounds, this was not considered a significant risk.

In summary:

- The Oceanica report found contaminant levels from produced water as not likely to have significant impact on fauna;
- The 70 m of sediment that may have low levels of contamination are not significant feeding grounds for the fish species and represent less than 0.1% of the total fishing boundary; and
- The probability of capture after being in the location is low.

Furthermore, the Produced Water Monitoring Framework (**Section 6.4.3**) which involves continual measurements and ongoing monitoring of produced water will ensure there will be no increase in the current or predicted levels of contaminants and risk of bioaccumulation.

Benthic environment

A water and sediment sampling study undertaken by IRCE (2001) at sites located between 50 and 200 m from the Stag CPF did not detect measurable levels of total petroleum hydrocarbons (TPH), at a 0.1 ppm (mg/L) detection limit, indicating that there had not been significant accumulation of hydrocarbons in sediments as a result of hydrocarbons dropping out of the produced water discharge plume (IRCE, 2001). These results included PAHs which are believed to be the constituent of most concern in discharge produced water due to their persistence in the environment and toxicity (Neff *et al.*, 2011). The IRCE (2001) study determined that concentrations of chromium, copper, lead and zinc were slightly elevated within 50 m of the Stag CPF but below trigger levels defined in ANZECC/ ARMCANZ (2018) interim sediment quality guidelines (IRCE, 2001).

The infield validation study completed by Oceanica (2015) determined that concentrations of all contaminants measured in sediments were below their respective ANZECC/ARMCANZ ISQG-Low and -High levels (where applicable). Zinc concentrations were elevated in the vicinity of the CPF, decreasing to background levels by 250 m from the CPF, similar to previous monitoring undertaken in 2000 (IRCE 2001). Lead and barium concentration results were similar to those reported in 2000; however, the copper and chromium results were slightly lower than those measured in 2000.

Oceanica (2015) also found that the organic content of sediments sampled were low and at least one order of magnitude lower than concentrations recorded in 2000 by IRCE. All hydrocarbon concentrations were below their limits of reporting, suggesting that there has been no hydrocarbon contamination in these sediments resulting from activities associated with the CPF. This is consistent with the previous sediment quality monitoring at the Stag Oilfield in 2000 (IRCE 2001).

Invertebrates

Benthic invertebrates include infauna within sediments such as polychaetes and other worms, molluscs and crustaceans while sessile and mobile epifauna may include crustaceans, cnidarians, molluscs associated with sediments and the Stag CPF structure (e.g. mobile and sessile epifauna and infauna).

Studies into the infauna, metal concentration and hydrocarbon concentration in the vicinity of the Stag platform suggests highly variable infauna abundance and composition amongst sites, with increased lancelet abundance within 200 m suggesting some level of change to infauna from human activity, interpreted to be most likely from drilling activity (IRCE, 2001). However, IRCE (2001) noted that natural changes to infauna community as a whole is likely to be on a larger scale than anthropogenic changes related to activities at the Facility.

NORM within Stag produced water have been measured at 8.94 Bq/L which is at the lower range of levels recorded from samples worldwide (Neff *et al.*, 2011a). On the NWS, a review of produced water impacts and relevant studies by Fandry *et al.* (2006) indicated only one study into NORM at the Cossack-Pioneer offshore facility. This study found produced water discharge was not causing any build-up of radionuclides in sediments around the facility (Colman and West, 2000, cited within Fandry *et al.*, 2006). Impacts due to NORM on benthic invertebrates are not expected.

Fish

Benthic (demersal) fish associated with benthic habitats (i.e. sediments and the lower Stag CPF structure) are less likely to be exposed to dissolved hydrocarbons given that initial discharge modelling of the Stag CPF produced water plume indicates that the plume initially disperses within surface waters. Impacts to benthic fishes may be more due to ingestion of hydrocarbon droplets or precipitated metals on and above sediments although sediment sampling of hydrocarbons below the CPF has not detected the presence of hydrocarbons (IRCE, 2001; Oceanica, 2015).

6.4.3 Environmental Performance

Aspect		Discharge of produced water (EPH-5)					
Performance outcome		Produced water discharges achieve the national marine water quality guidelines for protection of 99% of species, and the sediment quality ISQG-low values, as defined by ANZECC/ ARMCANZ (2018) at the boundary of the area of impact					
		Planned operations		Contingency operations ⁷		Adaptive Management	
ID	Management Control	Performance standard	Measurement criteria	Performance standard	Measurement criteria	Performance standard	Measurement criteria
Discharge							
015	Daily discharge of PW is monitored and recorded	Daily discharge rate from the CPF does not exceed 7,520 kL per day @ 15 mg/L oil in water	Daily report shows the volume of produced water discharged from the CPF did not exceed 7,520 kL and did not record an oil in water concentration greater than 15 mg/L	If the total daily discharge is approaching the volume of 7,520 kL, calculate the total oil load that has been discharged for the day (i.e. [OIW] x volume discharged) and ensure the total load does not exceed 112 kg oil/d ⁸	Daily report shows a total oil load does not exceed 112 kg	If an increase in the total allowable daily discharge load is required, undertake management of change to determine whether there are changes to the environmental risks and impacts (as per Section 4) as provided for in the EP. If new or significant increases to risks and impacts are expected, revise EP and submit to NOPSEMA for acceptance.	Completed Management of Change process
Measurement							
016	PW discharge managed and	Inline analyser continuously	CCR shows alarm was recorded if	Manual sample of produced water	Compare manual sample results with	N/A	N/A

⁷ Note that if the performance standard for BOTH planned operations and the contingency operations is breached, then it is classified as a recordable incident

⁸ The rationale of calculating a discharged daily load of oil recognises multiple components of a discharge contribute to pollution of the environment – as well as the volume it is also the quality of the discharge that needs to be considered when evaluating environmental performance.

Aspect		Discharge of produced water (EPH-5)					
Performance outcome		Produced water discharges achieve the national marine water quality guidelines for protection of 99% of species, and the sediment quality ISQG-low values, as defined by ANZECC/ ARMCANZ (2018) at the boundary of the area of impact					
		Planned operations		Contingency operations ⁷		Adaptive Management	
ID	Management Control	Performance standard	Measurement criteria	Performance standard	Measurement criteria	Performance standard	Measurement criteria
	monitored according to Measurement, Management and Reporting of Produced Water (GA-19-PR-P-00006)	measures oil in water concentrations of produced water stream	the [OIW] >15 mg/L	stream collected and oil in water concentration measured	inline analyser measurement to confirm high concentration		
017				Discharge diverted inboard if [OIW] >30 mg/L within 10 minutes of the exceedance being identified	Once manual sampling results show [OIW] <30 mg/L discharge can recommence	N/A	N/A
018				If slops tanks on the CPF (and any other storage options) are at full capacity and PW remains off spec (i.e. above 30 mg/L OIW) production will cease	Daily reports show OIW results, slops storage volumes and time of shut in	N/A	N/A
019				If inline analyser is not operational, manual sampling to be done at least three times during day shift and three times during night shift	If manual sample results show a concentration above 15 mg/L increase manual monitoring frequency to every two hours	N/A	N/A

Aspect		Discharge of produced water (EPH-5)					
Performance outcome		Produced water discharges achieve the national marine water quality guidelines for protection of 99% of species, and the sediment quality ISQG-low values, as defined by ANZECC/ ARMCANZ (2018) at the boundary of the area of impact					
		Planned operations		Contingency operations ⁷		Adaptive Management	
ID	Management Control	Performance standard	Measurement criteria	Performance standard	Measurement criteria	Performance standard	Measurement criteria
020	PW discharge managed and monitored according to Measurement, Management and Reporting of Produced Water (GA-19-PR-P-00006)	Manual analysis of [OIW] in two manually collected produced water samples per day	[OIW] not to exceed 15 mg/L in a manual produced water sample	If a manual sample has an [OIW] >15mg/L, increase manual sampling frequency to every two hours	Once two consecutive manual samples show [OIW]s <15mg/L reduce sampling frequency to twice per day	N/A	N/A
021		[OIW]s in manual sample and inline analyser measurement at same time are compared within one hour of manual sampling results being available	Measured concentrations of the inline analyser are not to be more than 5 mg/L higher or more than 2 mg/L lower than the manual lab sample	If greater than +5 mg/L or -2 mg/L in concentrations difference is recorded, clean inline analyser	Post-clean measurement shows inline analyser successfully measuring [OIW]s		N/A
Monitoring							
022	BASSnet work instruction details characterisation requirements of PW discharge	Annual characterisation of contaminants (inc. NORM) in produced water	Check contaminant concentrations are acceptable by applying a 1:332 dilution rate to measured concentrations to ensure	If contaminant concentration/s will not be sufficiently diluted to guideline levels undertake WET testing of effluent stream	WET testing results show a 1:332 dilution requirement of discharge stream is still achievable	If WET testing results show the produced water discharge stream(s) can no longer meet the 1:332 dilution requirements, undertake management of change to determine whether there are changes to the environmental risks and impacts (as per Section 4) as provided	Completed Management of Change process

Aspect		Discharge of produced water (EPH-5)					
Performance outcome		Produced water discharges achieve the national marine water quality guidelines for protection of 99% of species, and the sediment quality ISQG-low values, as defined by ANZECC/ ARMCANZ (2018) at the boundary of the area of impact					
		Planned operations		Contingency operations ⁷		Adaptive Management	
ID	Management Control	Performance standard	Measurement criteria	Performance standard	Measurement criteria	Performance standard	Measurement criteria
			contaminant concentrations are less than 99% species protection ANZG 2018 guideline values or equivalent by the edge of the predicted mixing zone. ^{9,10}			for in the EP. If new or significant increases to risks and impacts are expected, revise EP and submit to NOPSEMA for acceptance.	
023		Whole effluent toxicity testing ¹¹ every three years of produced water discharge with the first test to occur within 6 months of	WET testing results do not exceed 2008 results used to determine the mixing zone boundary (i.e.	If WET testing results exceed 2008 test results, re-run mixing zone modelling to determine if the extent of the mixing	Modelling results show no change in areal extent of the produced water discharge plume	If the mixing zone area is predicted to increase in area based on new WET test results, undertake management of change to determine whether there are changes to the environmental risks and impacts	Completed Management of Change process

⁹ The work instruction applies to all measured contaminants. A listing of the contaminants measured is provided in **Appendix F**. The contaminant characterisation suite of analytes used to evaluate toxicity as a complement to ecotoxicity testing methods has been developed from guidance provided by the scientific literature, most notably Neff et al. (2011a)

¹⁰ The work instruction applies to all measured contaminants. A listing of the contaminants measured is provided in **Appendix F**. The contaminant characterisation suite of analytes used to evaluate toxicity as a complement to ecotoxicity testing methods has been developed from guidance provided by the scientific literature, most notably Neff et al. (2011a)

¹¹ For noting, requirements for all WET testing referenced within this EP must include the following: testing will be undertaken by a NATA accredited laboratory; testing will follow protocols as recommended by Warne et al 2018.

Aspect		Discharge of produced water (EPH-5)					
Performance outcome		Produced water discharges achieve the national marine water quality guidelines for protection of 99% of species, and the sediment quality ISQG-low values, as defined by ANZECC/ ARMCANZ (2018) at the boundary of the area of impact					
		Planned operations		Contingency operations ⁷		Adaptive Management	
ID	Management Control	Performance standard	Measurement criteria	Performance standard	Measurement criteria	Performance standard	Measurement criteria
		acceptance of this EP	1:332 dilution of effluent required to meet mixing zone boundary concentrations)	zone increases in area ¹²		(as per Section 4) as provided for in the EP. If new or significant increases to risks and impacts are expected, revise EP and submit to NOPSEMA for acceptance.	
Maintenance							
024	Inline Analyser Operator Manual details maintenance requirements	Inline OIW analyser maintained in accordance with operator manual every 3 months	Completed maintenance records	If inline analyser not operational, increase manual sampling frequency to 6 times per day	Repair/ independent calibration report shows the inline analyser is functional	N/A	N/A
025	CPF laboratory spectrophotometer calibrated as per Preparation of OIW Standards	CPF laboratory spectrophotometer calibrated weekly with oil in water standards set	Completed calibration records	If calibration unsuccessful, raise work order for repair/ independent calibration	Repair/ independent calibration report shows the spectrophotometer is functional	N/A	N/A

¹² The rate of discharge directly affects the nearfield mixing zone, with higher volumes achieving higher initial mixing rates (i.e. smaller footprint here). To a point, changed flows may offset an increased toxicity measurement. The size and boundary conditions of the initial mixing zone in turn affect the farfield mixing zone wherein the spatial extent over which a dilution rate is to be achieved is determined. Therefore discharge rates experienced at the time of re-test will also be applied to the re-model which may in turn affect the size of the environmental footprint.

Aspect		Discharge of produced water (EPH-5)					
Performance outcome		Produced water discharges achieve the national marine water quality guidelines for protection of 99% of species, and the sediment quality ISQG-low values, as defined by ANZECC/ ARMCANZ (2018) at the boundary of the area of impact					
		Planned operations		Contingency operations ⁷		Adaptive Management	
ID	Management Control	Performance standard	Measurement criteria	Performance standard	Measurement criteria	Performance standard	Measurement criteria
	and Calibration of Spectrophotometer (GA-19-PR-P-00027)						
026	Spectrophotometer Operator Manual details calibration requirements	Laboratory spectrophotometer calibrated by Stag Chemist biannually as recommended by the manufacturer to ensure it maintains accurate results	Spectrophotometer successfully calibrated (i.e. reads OIW concentration as per calibration standards)	If calibration unsuccessful, raise work order for repair/independent calibration	Repair/independent calibration report shows the spectrophotometer is functional	N/A	N/A
Production & processing							
027	Chemical Selection and Approval Procedure (JS-70-PR-I-00033) details requirements of risk assessment for production chemicals	Production chemicals and their application is to be assessed and approved for use before application using Chemical Selection and Approval Procedure	Approval record completed prior to use	None – production chemicals and their application must be approved for use prior to application. If a chemical is assessed as unacceptable, an alternative chemical must be found suitable for the proposed application.	Approval record completed prior to use	N/A	N/A

Aspect		Discharge of produced water (EPH-5)					
Performance outcome		Produced water discharges achieve the national marine water quality guidelines for protection of 99% of species, and the sediment quality ISQG-low values, as defined by ANZECC/ ARMCANZ (2018) at the boundary of the area of impact					
		Planned operations		Contingency operations ⁷		Adaptive Management	
ID	Management Control	Performance standard	Measurement criteria	Performance standard	Measurement criteria	Performance standard	Measurement criteria
028		Production chemicals to be added to the system at a dosage rate as prescribed in the chemical approval request	Daily monitoring of chemicals in production system show dosage rates are as per approved rate	None – production chemicals and their application must be approved for use prior to application.	Approval record completed prior to use	N/A	N/A
029	Chemical – Testing, Frequency, Reporting (GA-19-PR-P-00001) procedure details the monitoring and reporting requirements of production chemical	Chemical usage volumes within acceptable rates as per procedure	Stag CPF Monthly Laboratory Report	None – production chemicals and their dosage rate must be approved for use prior to application.	Approval record completed prior to use	N/A	N/A
030	Change management process details the requirement for risk and impact assessment	Production fluids to be processed as per the activity description in the EP	Daily reporting shows production is as per planned activity	N/A	N/A	If a new reservoir section is to be added to the production stream, the impact assessment process for produced water discharges from the CPF must be repeated	Repeat of impact assessment process of new produced water stream to follow Figure 7-15 in Section 7.4. Assessment does
031						If a change to the production processing equipment occurs,	

Aspect		Discharge of produced water (EPH-5)					
Performance outcome		Produced water discharges achieve the national marine water quality guidelines for protection of 99% of species, and the sediment quality ISQG-low values, as defined by ANZECC/ ARMCANZ (2018) at the boundary of the area of impact					
		Planned operations		Contingency operations ⁷		Adaptive Management	
ID	Management Control	Performance standard	Measurement criteria	Performance standard	Measurement criteria	Performance standard	Measurement criteria
	prior to change to operation					the impact assessment process for produced water discharges must be repeated	not find changes to contaminant loads are predicted, and the mixing zone for produced water discharge from the CPF does not change

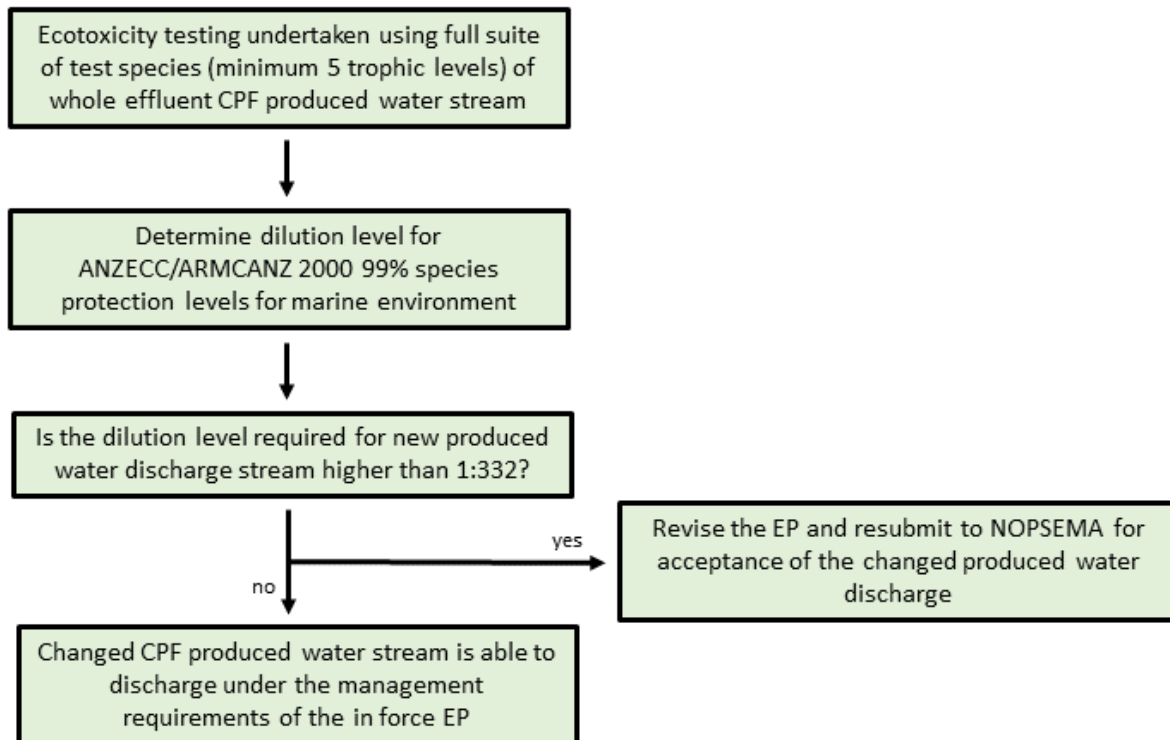


Figure 6-15: Impact assessment process for produced water discharges

6.4.4 ALARP Assessment

On the basis of the impact and risk assessment completed, Jadestone considers the control measures described above are appropriate to manage produced water discharges from the CPF. The residual risk ranking for this potential impact is considered Low, and therefore ALARP has been demonstrated. Further controls considered but rejected are detailed below.

Rejected control	Hierarchy	Practicable	Cost effective	Justification
<u>Reinjection of produced water to the reservoir</u>	Eliminate	No	No	<p>The original Stag project design called for sea water injection into the reservoir to maintain reservoir pressure and to force water to pass through the pores in the reservoir to sweep the oil to the production wells. It was designed such that any produced water (formation and reproduced sea water) would be processed and discharged overboard.</p> <p>In 2008, a Compact Gas Floatation Unit (CGFU) and two new pumps were installed to allow the disposal of produced water with a high oil-in-water content back to the Stag Reservoir. This system allowed approximately 635 m³/d to be injected back to the reservoir. This was initially moderately successful, however, in March 2009, the disposal well 18H was found to be in communication with</p>

				<p>the production wells and the practice of disposing of produced water down-hole ceased.</p> <p>Produced water was not deemed viable as an injection fluid as it is recognised in the industry that reinjection of produced water in reservoirs such as Stag needs to be conducted at fracturing pressure to overcome the plugging of pores by contaminants in the produced water. This fracturing creates channels from the injectors towards the producers that would allow the injection water to bypass the oil contained in the reservoir matrix and result in poor sweep and oil recovery.</p> <p>Therefore, PW reinjection is not a feasible option given the state of the reservoir.</p>
Contain all PW and transfer to shore for onshore treatment and disposal	Eliminate	No	No	<p>7,520kL per day, would require multiple trips. Containment would require storage on tanker for approx. 2 weeks, mooring system would be required and an offtake tanker. Increases risk of vessel collision incident with increased frequency of vessel trips. SIMOPS additional vessel in field, additional costs for treatment and disposal onshore</p>
N/a	Substitute	N/a	N/a	<p>No substitute for the discharge of produced water to the marine environment could be identified.</p>
Process polishing	Engineering	<u>No</u>	<u>No</u>	<p>In terms of reducing the OIW content of produced water, improvements to the current production process have reduced the OIW content of Stag CPF produced water to an average of 9.5 mg/L averaged over a 24 hour period.</p> <p>Other options for reducing OIW content further than current practices would include retrofitting the facilities with further processing equipment. Retrofitting additional produced water processing equipment on the CPF would require additional deck space which is limited. Reducing the OIW content of the produced water would require a sizeable storage vessel in order to facilitate the increased produced water residence time required to reduce OIW content further. Additional purchase and modification of equipment would negatively affect the commercial viability of the Facility and given that it is operating in an environment of low sensitivity (in terms of habitats and species) retrofitting is not considered a practicable option with respect to the environmental benefit it might provide.</p>

Modification to discharge infrastructure	Engineering	<u>No</u>	<u>No</u>	<p>Modelling to evaluate the possible modification of discharge infrastructure such that the produced water stream is discharged to the marine environment with a diffuser at the end of the discharge line has been prepared by APASA (2014). The fitting of a diffuser is intended to improve the initial dilution rate of the effluent stream in the near field mixing zone.</p> <p>Modelling of current discharge arrangements in which the produced water stream is released from an open hole pipe above sea level found a dilution rate of approximately 8 to 20 times within the near field mixing zone; variation in dilution rates was attributable to fluctuations expected in current speeds of the receiving environment.</p> <p>Modelling of the discharge infrastructure with a diffuser in place found that initial dilution rates were reduced compared to current discharge dilution rates to between 1.5 and 13.4 times, the variation again due to current speeds. Similarly, the scenario of a diffuser being fitted along with mixing the produced water stream 50:50 with seawater achieved a dilution rate of 6.7 to 26.1 times, however the horizontal distance travelled in the near field mixing zone increased from 1 to 7.7 m predicted with the current discharge infrastructure, to 1.6 to 18.8 m with a diffuser and pre-mixing with ambient seawater.</p> <p>These modelling results indicate that the current discharge infrastructure is effective at achieving initial dilution of the effluent stream within a reasonable horizontal distance of the marine environment entry point that is cost effective in terms of installation, management and repair requirements. Given the nature of the effluent being fresh, heated and containing oil (which has a specific gravity less than water) the rise through the water column within the initial mixing zone gives an excellent dilution rate which would not be improved upon enough to justify the expense (~100K) of diffuser installation.</p>
Discharge of PW subsea	Engineering	No	No	<p>The discharge outlet currently sits 0.5m above mean sea level, as a result the discharge point is both in and out of the water. The hydrostatic head that would need to be counted for a subsea discharge pipe would require additional pumps (increasing deck space usage), power requirements and result in additional air emissions for little environmental benefit as evidenced by the numerical modelling.</p>
Storage and disposal onshore	Isolation	<u>No</u>	<u>No</u>	<p>This disposal option is not deemed practicable as approximately 2,800 kL of produced water is generated each day. At these volumes, the CPF does not have the capacity to store the produced water with the current slops tanks providing for up to one hour of produced water containment only at normal production levels. Notwithstanding the lack of capacity for the CPF to store the volumes of produced water, the size and frequency of vessels removing produced water from the CPF would</p>

				make the operation impractical. For example, it is estimated that it would take within 30 days to load a vessel with produced water which would then need to unload on a regular basis at a suitable port facility on the mainland. The costs and logistics make this grossly disproportionate to the production rates and economics of the Facility while introducing additional environmental risks associated with the transfer, transport and disposal of produced water.
N/a	Administrative	N/a	N/a	The primary means of reducing the risk of environmental impacts from the composition of these chemicals is through the implementation of Jadestone’s Operations Chemical Selection Evaluation and Approval Procedure (JS-70-PR-I-00033) which promotes the use of environmentally low risk chemicals based on ecotoxicity data and information gathered from ChemAlert. Production chemicals are required to be added to the production process to ensure the process is operating efficiently.
N/a	Administrative	N/a	N/a	The quantity of chemicals used in the production process, and therefore the residual concentration discharged within produced water, is reduced to as low as practicable through routine sampling and assessment from various points in the production process. Concentrations of these chemicals have optimal levels; dosages need to be maintained above certain levels to meet the production requirements but excessive levels are reduced to reduce costs and the potential for environmental impacts from discharge of produced water.
Automatic closure of discharge	Engineering	<u>No</u>	<u>No</u>	<u>CPF</u> The manumatic procedural controlled design of intent of diverting off-spec PW has been in place since the original design of the CPF and has proven to work, where on immediate detection of higher than normal OIW, off-spec water is automatically routed to the slops tank. The slops tanks are sized at 1250 bbl combined, which has a very limited capacity of approximately 120 minutes if slop tanks are empty; before capacity is reached, production is restricted to allow troubleshooting. If not successful production is diverted to the third-party tanker manually. To change to an additional automatic system would involve the installation of a number of new valves, modification to the control system, adding further slop tank capacity or automatic protection to shut down the plant on high volume levels in the slops tanks which actually take us to the condition of the PW upsets, which are at their highest when starting the platform back up from a shutdown. Auto closure of discharge would lead to a greater likelihood of PW upsets. It would additionally remove the tried and tested process of having an operator being dispatched to the slops tank to monitor the upset.

<p>On the basis of the impact and risk assessment completed, Jadestone considers the control measures described above are appropriate to manage produced water discharges from the CPF. Therefore, the residual risk ranking for this potential impact is considered Low, and ALARP has been demonstrated.</p>	
Eliminate	<p><u>Reinjection of produced water to the reservoir</u></p> <p>The original Stag project design called for sea water injection into the reservoir to maintain reservoir pressure and to force water to pass through the pores in the reservoir to sweep the oil to the production wells. It was designed such that any produced water (formation and reproduced sea water) would be processed and discharged overboard.</p> <p>In 2008, a Compact Gas Floatation Unit (CGFU) and two new pumps were installed to allow the disposal of produced water with a high oil-in-water content back to the Stag Reservoir. This system allowed approximately 635 m³/d to be injected back to the reservoir. This was initially moderately successful, however, in March 2009, the disposal well 18H was found to be in communication with the production wells and the practice of disposing of produced water down-hole ceased.</p> <p>Produced water was not deemed viable as an injection fluid as it is recognised in the industry that reinjection of produced water in reservoirs such as Stag needs to be conducted at fracturing pressure to overcome the plugging of pores by contaminants in the produced water. This fracturing creates channels from the injectors towards the producers that would allow the injection water to bypass the oil contained in the reservoir matrix and result in poor sweep and oil recovery.</p>
Substitute	<p>No substitute for the discharge of produced water to the marine environment could be identified.</p>
Engineering	<p><u>Process polishing</u></p> <p>In terms of reducing the OIW content of produced water, improvements to the current production process have reduced the OIW content of Stag CPF produced water to an average of 9.5 mg/L averaged over a 24 hour period.</p> <p>Other options for reducing OIW content further than current practices would include retrofitting the facility with further processing equipment. Retrofitting additional produced water processing equipment on the CPF would require additional deck space which is limited. Reducing the OIW content of the produced water would require a sizeable storage vessel in order to facilitate the increased produced water residence time required to reduce OIW content further. Additional purchase and modification of equipment would negatively affect the commercial viability of the Facility and given that it is operating in an environment of low sensitivity (in terms of habitats and species) retrofitting is not considered a practicable option with respect to the environmental benefit it might provide.</p> <p><u>Modification to discharge infrastructure</u></p> <p>Modelling to evaluate the possible modification of discharge infrastructure such that the produced water stream is discharged to the marine environment with a diffuser at the end of the discharge line has been prepared by APASA (2014). The fitting of a diffuser is intended to improve the initial dilution rate of the effluent stream in the near field mixing zone.</p> <p>Modelling of current discharge arrangements in which the produced water stream is released from an open hole pipe above sea level found a dilution rate of approximately 8 to 20 times within the near field mixing zone; variation in dilution rates was attributable to fluctuations expected in current speeds of the receiving environment.</p> <p>Modelling of the discharge infrastructure with a diffuser in place found that initial dilution rates were reduced compared to current discharge dilution rates to between 1.5 and 13.4 times, the variation again due to current speeds. Similarly, the scenario of a diffuser being fitted along with mixing the produced water stream 50:50 with seawater achieved a dilution rate of 6.7 to 26.1 times, however the horizontal distance travelled in the near field mixing</p>

	<p>zone increased from 1 to 7.7 m predicted with the current discharge infrastructure, to 1.6 to 18.8 m with a diffuser and pre-mixing with ambient seawater.</p> <p>These modelling results indicate that the current discharge infrastructure is effective at achieving initial dilution of the effluent stream within a reasonable horizontal distance of the marine environment entry point that is cost effective in terms of installation, management and repair requirements.</p> <p><u>Automatic closure of discharge</u></p> <p>The manumatic procedural controlled design of intent of diverting off-spec PW has been in place since the original design of the CPF and has proven to work, where on immediate detection of higher than normal OIW, off-spec water is manually routed to the slops tank. The slops tanks are sized at 1250 bbl combined if slop tanks are empty; before capacity is reached, production is restricted to allow troubleshooting. If not successful production is diverted to the third-party tanker manually.</p>
Isolation	<p><u>Storage and disposal onshore</u></p> <p>This disposal option is not deemed practicable as approximately 2,800 kL of produced water is generated each day. At these volumes, the CPF does not have the capacity to store the produced water with the current slops tanks providing for up to two hours of produced water containment only at normal production levels. Notwithstanding the lack of capacity for the CPF to store the volumes of produced water, the size and frequency of vessels removing produced water from the CPF would make the operation impractical. For example, it is estimated that it would take within 30 days to load a vessel with produced water which would then need to unload on a regular basis at a suitable port facility on the mainland. The costs and logistics make this grossly disproportionate to the production rates and economics of the Facility while introducing additional environmental risks associated with the transfer, transport and disposal of produced water.</p> <p>Note that any produced water on the tanker will be stored and disposed of at the cargo receiving facility, and therefore will not be discharged in the operational area.</p>
Administrative	<p><u>Chemical selection</u></p> <p>Production chemicals are required to be added to the production process to ensure the process is operating efficiently. The primary means of reducing the risk of environmental impacts from the composition of these chemicals is through the implementation of Jadestone’s Operations Chemical Selection Evaluation and Approval Procedure (JS-70-PR-I-00033) which promotes the use of environmentally low risk chemicals based on ecotoxicity data and information gathered from ChemAlert.</p> <p><u>Chemical usage</u></p> <p>The quantity of chemicals used in the production process, and therefore the residual concentration discharged within produced water, is reduced to as low as practicable through routine sampling and assessment from various points in the production process. Concentrations of these chemicals have optimal levels; dosages need to be maintained above certain levels to meet the production requirements but excessive levels are reduced to reduce costs and the potential for environmental impacts from discharge of produced water.</p>

6.4.5 Acceptability Assessment

The potential impacts of produced water discharges are considered 'Broadly Acceptable' in accordance with the Environment Regulations, based on the acceptability assessment provided in the table below. In particular, the acceptability assessment provided below presents the risks, acceptable level of impact and an assessment of impact for each of the following environmental values:

- Water;
- Sediment;
- Fauna and habitat;
- Commercial fishing; and
- Principles of ecologically sustainable development.

For each environmental value, a Summary of the acceptable level of impact is provided at the end of each sub-section within the table.

Impact aspect	Acceptable level of impact	Assessment
Water		
Consideration: the key contaminants of concern in produced water are hydrocarbons, naturally occurring radioactive materials (NORM), dissolved metals and nutrients. These contaminants may be associated with the water fraction, and/ or the particulate fraction, of the discharge stream.		
Hydrocarbons are considered the constituent of most concern to marine fauna within produced water, particularly polycyclic aromatic hydrocarbons (PAHs). Hydrocarbon exposure may lead to mortality in marine organisms as well as sub-lethal chronic (long exposure) effects such as decreased genetic diversity in communities, decreased growth and fecundity, lower reproductive success, respiratory problems, behavioural and physiological problems, decreased developmental success and endocrine disruption (Neff <i>et al.</i> , 2011a).	Water quality concentrations for hydrocarbons, metals and nutrients meet the 99% species protection guidelines for contaminants (ANZG 2018) after accounting for the 1:332 required dilution rate. For noting, the 99% species protection limits provide	Components of the plankton that could be impacted by produced water include micro-invertebrates; eggs; larvae of invertebrates; and fish. In addition to invertebrates within the plankton assemblage, larger pelagic invertebrates (e.g. jellyfish, squid, salps) will be present around the Stag Facility. The attached assemblages have an increased frequency and duration of exposure to the discharge stream given their fixed placement in the receiving environment. For motile species within the open water plankton assemblage, the exposure is limited in frequency (perhaps one-off events with the exception of motile species that may return to the artificial structure of the CPF and become exposed again), and duration given they are not held at one point in the environment.

Impact aspect	Acceptable level of impact	Assessment
<p>Dissolved metals may create impacts to marine organisms if present at high enough concentrations and some metals have the potential to bioaccumulate, in particular mercury, selenium and cadmium (ANZG, 2018).</p>	<p>for the management of bioaccumulation/ biomagnification processes.</p>	<p>Pathways of exposure to the contaminants within the produced water stream include uptake of dissolved constituents (e.g. volatile, low molecular weight hydrocarbons such as BTEX hydrocarbons) across cellular structures, ingestion (filter feeding) of higher molecular weight hydrocarbons (e.g. PAHs associated with suspended oil droplets) or precipitated metals which may be bound to organic particulate matter that is small enough to remain buoyant (i.e. <63 µm in size).</p> <p>Impacts include acute effects at high concentrations such as lysis of single-celled organisms and narcosis of motile invertebrates leading to impaired swimming ability. Bioaccumulation of hydrocarbons (e.g. PAHs) and metals (in particular, Hg, Se and Cd) is most likely to occur in sessile invertebrates attached to the CPF sub-structure close to the discharge location experiencing repeated exposure. Included in this assemblage are macroalgae and macroinvertebrates (e.g. tunicates, soft coral, molluscs), as well as small fish with high site fidelity.</p> <p>The area of impact for the water column environment is predicted to be small scale (up to 125 m from the CPF before reaching 99% species protection concentrations) and is therefore unlikely to be significant at population or ecosystem scales for the organisms exposed to the discharge stream.</p>
<p>Elevated nutrient levels can lead to increased bacterial and phytoplankton production (e.g. phytoplankton blooms). In nutrient poor waters such as those in offshore marine environments, introduction of dissolved nutrients such as ammonia and nitrate to surface waters where high light levels are available will lead to rapid uptake by phytoplankton with associated increased biomass.</p>		<p>Increased water column biomass will be a highly localised feature (within tens of metres) associated with the availability of dissolved nutrients. The field validation study of the produced water area of impact at the Stag Facility (Oceanica, 2015) found slightly elevated ammonia and total phosphorus near the CPF discharge point. The influence of produced water on nutrient levels within the water column was generally limited to ≤ 400 m from the discharge and did not exceed ANZG, 2018 99% species protection concentrations.</p>
<p>Summary: monitoring and measurement of the produced water discharge demonstrates that the marine water quality trigger values recommended by ANZG (2018) for the protection of 99% species are met when taking into account a 1:332 dilution, as required by the Area of Impact showing that the discharge has an acceptable level of impact on water quality of the receiving environment.</p>		

Impact aspect	Acceptable level of impact	Assessment																																																									
Sediments																																																											
<p>Consideration: while the produced water plume from Stag CPF primarily influences the quality of localised surface waters, there is the potential for particles within the plume, which may comprise metal oxides and low solubility hydrocarbon droplets (such as higher molecular weight PAHs), to drop out of the plume in the far-field mixing zone and accumulate in the sediments, or remain suspended and disperse into the larger environment on a regional scale (Neff <i>et al.</i>, 2011a).</p>																																																											
<p>Dilution and chemical processes rapidly reduce the concentration of inorganic elements within the produced water stream when entering the sea (Bakke <i>et al.</i>, 2013). Redox-sensitive species are likely to become insoluble, binding to other soluble ions or particles and precipitate upon discharge. Such processes affecting the solubility of contaminants may also influence the behaviour of metals, for example through co-precipitation with other complexes that have formed through changed physio-chemical qualities of the discharge as it moves through the production and discharge stages. Metals present in the marine environment as hydroxides or sulphides for example are not generally available for biological uptake.</p> <p>The study by Azectus-Scott <i>et al.</i> (2007) indicated three different fate pathways for inorganic elements: components that 1) stayed in solution would dilute along with the produced water plume in the receiving environment, 2) oxidise/ precipitate to form insoluble inorganic compounds that would sink, 3) associate with oil droplets that are lighter than seawater and rise to the surface.</p>	<p>Sediment quality concentrations meet the ISQG-high species protection guidelines for contaminants where available, as recommended by ANZG (2018).</p>	<p>For the purpose of estimating sedimentation rates, the average concentration of suspended solids (106.7 mg/L) was applied to the fate modelling undertaken for the produced water stream. Of this mass, the following particle size distribution was applied in the far field fate modelling of particles assumed in the produced water stream at Stag, in the absence of PSD data:</p> <table border="1"> <thead> <tr> <th>Class</th> <th>Particle size (mm)</th> <th>Settling velocity (cm/s)</th> <th>12 ¼ " hole section % passing</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Coarse sand</td> <td>1</td> <td>12.730</td> <td>23.3</td> </tr> <tr> <td>0.5</td> <td>7.500</td> <td>4.0</td> </tr> <tr> <td rowspan="5">Medium sand</td> <td>0.45</td> <td>6.600</td> <td>2.1</td> </tr> <tr> <td>0.4</td> <td>6.000</td> <td>2.4</td> </tr> <tr> <td>0.35</td> <td>5.000</td> <td>2.8</td> </tr> <tr> <td>0.3</td> <td>4.000</td> <td>5.6</td> </tr> <tr> <td>0.25</td> <td>3.100</td> <td>6.7</td> </tr> <tr> <td rowspan="4">Fine sand</td> <td>0.2</td> <td>2.300</td> <td>8.9</td> </tr> <tr> <td>0.15</td> <td>1.600</td> <td>5.6</td> </tr> <tr> <td>0.1</td> <td>0.800</td> <td>4.2</td> </tr> <tr> <td>0.063</td> <td>0.340</td> <td>2.3</td> </tr> <tr> <td colspan="3">Total sands</td> <td>67.9</td> </tr> <tr> <td rowspan="4">Coarse silts</td> <td>0.05</td> <td>0.220</td> <td>2.2</td> </tr> <tr> <td>0.04</td> <td>0.150</td> <td>1.6</td> </tr> <tr> <td>0.035</td> <td>0.110</td> <td>1.6</td> </tr> <tr> <td>0.03</td> <td>0.080</td> <td>2.2</td> </tr> </tbody> </table>	Class	Particle size (mm)	Settling velocity (cm/s)	12 ¼ " hole section % passing	Coarse sand	1	12.730	23.3	0.5	7.500	4.0	Medium sand	0.45	6.600	2.1	0.4	6.000	2.4	0.35	5.000	2.8	0.3	4.000	5.6	0.25	3.100	6.7	Fine sand	0.2	2.300	8.9	0.15	1.600	5.6	0.1	0.800	4.2	0.063	0.340	2.3	Total sands			67.9	Coarse silts	0.05	0.220	2.2	0.04	0.150	1.6	0.035	0.110	1.6	0.03	0.080	2.2
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Impact aspect	Acceptable level of impact	Assessment				
			0.026	0.060	2.1	
		Medium silts	0.02	0.038	2.0	
			0.016	0.026	20.4	
		Total silts				32.1
		<p>The particle size distribution was biased towards coarser sizes ('sands'), which are commonly silica based particles with little binding opportunity for speciated contaminants, however which yield higher deposition rates. The finer particle sizes, the 'silts', while a smaller proportion of the particle size distribution range by mass, contain particles that are more likely to be charged (e.g. oil droplets with attached material, clay particles) and are more likely to contain the majority of contaminants. It is this dichotomy of particle size, likelihood of deposition, and contaminant-containing fraction that allows the impact assessment to interpret the estimated deposition rate in the far field associated with produced water discharges.</p> <p>The sediment loadings predicted by the model around the CPF were extremely light: 3.5 g of particulate material is approximately 3 teaspoons distributed across a one square metre area per year. When also considering that perhaps only 30% of this amount is the proportion with highest contamination potential, and that saltation (the 'jumping' of particles representing resuspension processes in the marine environment due to current movement), the threat to sediment quality due to particle loading from the produced water discharge stream is extremely low and would be very difficult to observe through sediment quality monitoring designed to measure contaminant concentrations.</p> <p>A water and sediment sampling study undertaken by IRCE (2001) at sites located between 50 and 200 m from the Stag CPF did not detect measurable levels of total petroleum hydrocarbons (TPH), at a 0.1 ppm (mg/L) detection limit, indicating that there had not been significant accumulation of hydrocarbons in sediments as a result of hydrocarbons dropping out of the produced water discharge plume (IRCE, 2001). These results included PAHs which are believed to be the constituent of most concern in discharged produced water due to their persistence in the environment and toxicity (Neff <i>et al.</i>, 2011). The IRCE (2001) study determined that concentrations of chromium, copper, lead and zinc were slightly elevated</p>				

Impact aspect	Acceptable level of impact	Assessment
		<p>within 50 m of the Stag CPF but below trigger levels defined in ANZECC/ ARMCANZ (2000) interim sediment quality guidelines (IRCE, 2001).</p> <p>The infield validation study completed by Oceanica (2015) determined that concentrations of all contaminants measured in sediments were below their respective ANZECC/ARMCANZ ISQG-Low and -High levels (where applicable). Zinc concentrations were elevated in the vicinity of the CPF, decreasing to background levels by 250 m from the CPF, similar to previous monitoring undertaken in 2000 (IRCE 2001). Lead and barium concentration results were similar to those reported in 2000; however, the copper and chromium results were slightly lower than those measured in 2000.</p> <p>Oceanica (2015) also found that the organic content of sediments sampled were low and at least one order of magnitude lower than concentrations recorded in 2000 by IRCE. All hydrocarbon concentrations were below their limits of reporting, suggesting that there has been no hydrocarbon contamination in these sediments resulting from activities associated with the CPF. This is consistent with the previous sediment quality monitoring at the Stag Oilfield in 2000 (IRCE 2001).</p> <p>Given that microscopic particles less than 0.5 mm or 500 µm, and colloidal particles, do not sink and are freely suspended (Bochdansky et al., 2010), particulates in the produced water discharge will remain suspended. As a result, contamination of the local benthic environments due to particulates in produced water discharged and accumulating in sediments is not considered a risk at Stag.</p>
<p>Summary: monitoring and measurement of the produced water discharge demonstrates that sediment water quality trigger ISQG-high values recommended by ANZECC/ARMCANZ (2000) have been met, and contamination of the benthic environment is not predicted within the Area of Impact, showing that the discharge has an acceptable level of impact on sediment quality of the receiving environment.</p>		
<p><i>Fauna and habitat values (incl. recovery plans and conservation advices)</i></p>		
<p>Consideration: the Area of Impact for the discharge of the produced water at the Stag Facility coincides with habitats that support fauna with conservation status, or the fauna directly.</p>		
<p>The facility and produced water discharge environment overlaps with the humpback whale and blue whale migration corridor, shearwater</p>	<p>Produced water discharges do not contravene management</p>	<p><u>The Flatback BIA (inter-nesting areas)</u> although there may be transient individuals most females inter-nest close to their nesting beaches, typically in shallow (0–10 m) nearshore waters of their nesting beach (Chevron 2008) – unlike the depth of the operational area. The</p>

Impact aspect	Acceptable level of impact	Assessment
<p>foraging, and the flatback turtle interesting areas which may result in a higher number of these species around the Stag Facility.</p> <p>The Marine Turtle Recovery Plan identifies that the Operational Area is within the Flatback Turtle habitat that is critical to survival. The areas that may be affected by produced water discharges (a 70 m radial extent largely limited to the top 1 m of water column) represents less than 0.01% of the total area. Therefore, this does not represent a threat against the long-term and interim recovery objectives listed for the area identified as habitat critical to survival under the Marine Turtle Recovery Plan.</p>	<p>objectives of fauna and habitat values as identified in bioregional plans, including recovery plans and conservation advice.</p>	<p>Stag Facility is in 49 m depth, and the nearest significant nesting beaches are 32 km away at Dampier Archipelago. The bioaccumulation/ biomagnification risk to marine turtles or the impact pathway is through the food chain. However, the BIA area overlapping the discharge area for inter-nesting. Sperling et al. (2010) concluded that flatback turtles do not feed during inter-nesting which greatly reduces the risk of bioaccumulation/ biomagnification. However, if individuals were likely to use this area as foraging grounds, outside of nesting season it would represent an insignificant percentage of all available nesting grounds and not significantly affect individuals or population. ‘Management of oil spills and operational discharges’ is identified as an action in the Marine Turtle Recovery Plan (DoEE 2017). The total size of the BIA for Pilbara flatbacks is 35,758,776 km². The areas that may be affected by produced water discharges (a 70m radial extent largely limited to the top 1 m of water column) represents less than 0.01% of the total area. Therefore, this does not represent a threat against the long-term and interim recovery objectives listed for the area identified as habitat critical to survival under the Marine Turtle Recovery Plan.</p> <p><u>Blue whale</u> the area where blue whales are known to be distributed which is part of the species BIA overlaps the discharge area. Although little is known about their migration routes blue whale migration is thought to follow deep oceanic routes (DSEWPaC, 2012d). The blue whale is rarely present in large numbers outside recognised aggregation areas and it is unlikely large numbers would be found around the Stag Facility and exposed to produced water discharges. There is no Conservation advice for blue whale, but the species information (SPRAT Blue Whale, DEE 2017as) does not identify water quality as a potential threat, and no management actions will be compromised due to the release of produced water.</p> <p><u>Wedge tailed shear water</u> the wedge tailed shearwater breeds on the east and west coasts of Australia on offshore islands. The species is common in the Indian Ocean. The species BIA (foraging areas) overlaps the Stag Facility and produced water discharge area. When foraging at sea the birds are often alone or in small groups and are unlikely to be impacted by change in water quality associated with the produced water discharge plume in the surface metre of the water column. Additionally, like with the turtles BIA, the proportion of foraging area likely to be impacted by produced water discharges (a 70 m radial extent from the discharge point) is minimal.</p>

Impact aspect	Acceptable level of impact	Assessment
		<p>The whale shark BIA is approximately 9 km from the Operational Area and individuals are known to pass through the area. Whale sharks spend the majority of their time in deeper waters, and avoid the surface produced water plume; however, the discharge may have a small indirect effect on plankton which is a food source for whale sharks (Meekan 2008). The predicted small scale of the area of impact however suggests that exposure impacts (sub-lethal or lethal) from produced water is not likely to significantly impact whale shark food sources. The Conservation advice for the whale shark identifies habitat disruption from the resource sector as a minor threat to the species (SPRAT Whale shark, DEE 2017as). However as described above the release of produced water 9 km from the nearest point of the whale shark BIA is not likely to have any impact on the species or habitat used by the species.</p> <p><u>Pipefish and seahorse</u></p> <p>Although the PMST report for the 1km buffer around the facility found a number of syngnathid ‘species or species habitats may occur in the area’ – there is no records of them actually occurring. Knowledge about the distribution, abundance and ecology of both syngnathids and solenostomids is limited (DSEWPaC 2012). Almost all syngnathids live in nearshore and inner shelf habitats, usually in shallow, coastal waters, among seagrasses, mangroves, coral reefs, macroalgae-dominated reefs, and sand or rubble habitats (Dawson 1985; Lourie et al. 1999, Lourie et al. 2004; Vincent 1996). In tropical areas species are primarily found among coral reefs (Foster & Vincent 2004; Scales 2010). Given the substrate observed in the produced water EMBA is predominately soft sediments it is considered unlikely for any of these species to be observed in the area. Contaminant levels from produced water discharges are not considered at a level that would impact on marine organisms such as syngnathids. This is supported by DSEWPaC (2012) which lists oil pollution from rigs as ‘of least concern’ to the species.</p>
<p>Summary: evaluation of the Area of Impact and quality considerations of the produced water discharge did not identify that either conservation objectives are compromised by the discharge stream, or threaten the fauna of interest, showing that the discharge is acceptable to conservation objectives relevant to the area.</p>		
<p>Commercial fishing values</p>		
<p>Consideration: The Area of Impact for the discharge of the produced water at the Stag Facility coincides with habitats that support commercial fishing interests.</p>		

Impact aspect	Acceptable level of impact	Assessment
<p>Elevated hydrocarbon levels in fish flesh have the potential to impact humans if affected fish species are targeted by fisheries. When present in foods, petroleum hydrocarbons stimulate an olfactory response in humans that causes a tainting of flavour or taste.</p> <p>Connell and Miller (1981) compiled a summary of studies listing the threshold concentrations at which tainting occurred for hydrocarbons. The results contained in their review indicate that tainting of fish occurs when fish are exposed to ambient concentrations of 4–300 ppm (mg/L) of hydrocarbons in the water, for durations of 24 hours or more, with response to phenols and naphthenic acids being the strongest.</p>	<p>Water quality concentrations for hydrocarbons meet the 99% species protection guidelines for contaminants (ANZG 2018) after accounting for the 1:332 required dilution rate.</p>	<p>Effects may be experienced by pelagic fish within the produced water area of impact. Pelagic fish are commonly associated with offshore structures and therefore higher abundances are likely to occur around the CPF than in surrounding open water.</p> <p>Impacts to pelagic fish are likely to be caused by exposure to dissolved hydrocarbons (e.g. BTEX hydrocarbons) or metals across gill structures, although impacts could also occur through ingestion of hydrocarbon droplets. PAHs are the hydrocarbon of most concern in terms of long-term exposure to produced water. While PAH concentrations may be elevated in fishes attracted to the CPF the elimination of PAHs is generally very efficient in fish and other vertebrates and bioaccumulation of PAH within these taxa do not generally reflect their level of exposure (van der Oost <i>et al.</i>, 2003).</p> <p>The infield model validation monitoring study (Oceanica, 2015) found that concentrations of all hydrocarbons (TPHs, BTEX, PAHs) measured in marine waters were below the laboratory limits of reporting. Authors of the monitoring report (Oceanica, 2015) concluded that, considering that these compounds could not be detected in the receiving waters suggests that they pose little risk to the environment.</p> <p>No fishing is permitted within the 500 m restricted zone around the CPF and other subsea infrastructure. Given that the area of impact for produced water discharge lies within this restricted zone, and recent sediment and water quality surveys (Oceanica 2015) have found that concentrations of hydrocarbons (including PAHs) and mercury were below analytical detection limits, no impact to fish targeted by nearby fisheries is predicted.</p> <p>Furthermore, for the actively fished commercial fisheries in the area, the approved fishing area is extensive the purposes of flexibility and boundary simplicity, rather than being a true representation of where catch and effort is actually undertaken. Although the habitat within the operational area may represent suitable habitat for some of the commercial species, in reality fishing effort for these species will be focussed on areas of most suitable habitat and away from constraints such as infrastructure. Although some of the larger fish species may be transient through the operational area and then travel significant distances to active fishing grounds, this was not considered a significant risk.</p>
<p>Summary: evaluation of the Area of Impact and quality considerations of the produced water discharge did not identify that commercial fishing activities are or will be compromised by the discharge stream, or threaten target species, showing that the discharge is acceptable to conservation objectives relevant to the area.</p>		

Impact aspect	Acceptable level of impact	Assessment
Ecologically sustainable development		
Consideration: Jadestone must ensure that discharge of produced water at the Stag Facility does not contravene or perform in conflict with the intent of the principles of Ecologically Sustainable Development.		
a) decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations	The activity does not contravene or perform in conflict with the intent of the principles of Ecologically Sustainable Development.	The Jadestone risk assessment process and the Jadestone business management system both include long-term and short-term economic, environmental, social and equitable considerations when assessing exploration and development activities. The residual consequence ranking for discharge of produced water to the environment from the Stag facility was assessed as a category 1, 'slight effect; recovery in days to weeks; injury to organism' (refer Table 6-1).
(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		No threats of serious or irreversible environmental damage were identified in the impact assessment process for the discharge of produced water to the environment at the Stag facility. Scientific knowledge is available and supports this: produced water has been researched for over 20 years and is well documented in the scientific literature.
(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		As assessed above in the impact pathway overviews, no medium to long term effects are predicted or expected from the discharge of produced water from the Stag facility that will have inter-generational equity considerations.
(d) the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making		No impacts are expected or predicted that will threaten or contravene conservation values for those species that do or may occur in the discharge footprint. The deliberation on this matter is documented above in this table under <i>Fauna and habitat values (incl. recovery plans and conservation advices)</i>
(e) improved valuation, pricing and incentive mechanisms should be promoted		Technical risk assessments for new or changes to activities within Jadestone consider safety, the environment and the economics of the activity prior to approval and implementation. By taking multiple lines of risk into account when planning and implementing activities,

Impact aspect	Acceptable level of impact	Assessment
		Jadestone includes the consideration of improved value, pricing and incentive mechanisms for itself, as well as other beneficiaries.
<p>Summary: evaluation of the Area of Impact and quality considerations of produced water did not identify that discharge from Stag will contravene or perform in conflict with the intent of the principles of Ecologically Sustainable Development, showing that the discharge is acceptable in this regard.</p>		

6.5 Liquid discharges

6.5.1 Description of Hazard

Aspect	<p>Planned discharge of liquids (other than produced water) includes sewage, deck drainage and bilge water, cooling water and desalination brine. During well workover activities, there is the potential for the discharge of milling fluid and excess cement. A summary of each waste type is provided below.</p> <p><u>Sewage</u></p> <p>All sewage (including grey water) generated onboard the CPF is discharged through an inline macerator to comminute solids to a diameter of less than 25 mm. The discharge estimates are based on the known number of personnel on the Facility discharging an estimated 100 l/person/d. The CPF personnel on board (POB) levels are 20–24 during normal production operations although during platform maintenance, upgrade works, or well operations the manning level of the platform can increase to the maximum of 58 POB. This loading includes sewage as well as grey water from laundry, showers and wash basins. Bleach is used as a disinfectant for the sewage discharge rather than chlorine or chloride tablets.</p> <p>Sewage treatment and disposal on support vessels is consistent with Marine Orders (Part 96), MARPOL Annex IV, Navigation Act 2012 and Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (Part IIIB).</p> <p><u>Deck drainage</u></p> <p>The CPF has a drainage system that delivers drainage water, collected from rainwater and deck wash, work areas and machinery spaces to a slops storage tank. Deck drainage may contain minor quantities of oil, grease and detergents from machinery, fresh or waste oil drums and residual cleaning agents if present on the decks (e.g. deck wash). Fluids collected in the slops storage tank are processed through the Second Stage of the Production Separation system and treated to < 30 mg/l OIW prior to discharge. Only drainage from the helicopter landing deck drains directly overboard.</p> <p><u>Fire-fighting foam</u></p> <p>In the event that fire fighting systems are used or require testing with foam, this may be discharged to sea in small quantities.</p> <p><u>Bilge water</u></p> <p>No oily water will be discharged from the support vessels while moored to the CALM buoy. Other vessels in the operational area collect oily water from bilges which is then treated via an oil-water separator in accordance with MARPOL requirements (<15 mg/L (v) oil-in-water). Once separated, the oil and grease will be stored in suitable containers ahead of transfer ashore for recycling and the treated water discharged to ocean.</p> <p><u>Cooling water</u></p> <p>Seawater is used as a heat exchange medium for the cooling of the three onboard power generators. The cooling water is drawn through a segregated cooling system and is therefore not contaminated by engine oils or other liquid discharges from the process. Average discharge rates are up to 108 m³/h for each of the generators. Discharge water is approximately 3°C above ambient marine waters and is discharged at hull level.</p> <p>Seawater is drawn from the ocean and flows counter current through closed-circuit heat exchangers, transferring heat to the seawater. It is then discharged to the ocean via the seawater cooling caisson (i.e. a once-through system) as hot water of varying temperatures dependent upon the generators' workload. This water is drawn through a segregated piping system and is therefore not contaminated by engine oils or other liquid discharges from the process. Discharge is ~3°C above ambient waters and is from hull level which allows air cooling.</p> <p>Biocides are not added to the CPF cooling water system. An industrial grade saltwater chlorinator is used to produce chlorinated water to dose the respective caisson and pumps utilising sea water to prevent the accumulation of marine growth throughout the system.</p>
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	<p>Seawater is used as a heat exchange medium for the cooling of vessel engines and machinery on support vessels.</p> <p><u>Desalination brine</u></p> <p>The freshwater system is designed to produce, store and distribute fresh and potable water throughout the CPF. During normal operations, fresh and potable water is produced via a Reverse Osmosis unit (RO) this process results in a brine discharge of about 35 m³/d approximately 10% higher salinity than the intake seawater, with no increase in temperature. The seawater feed is taken from the main generator seawater cooling return line and forced by pump through a semipermeable membrane and any contaminants are flushed away. Potable water is then directed to a storage tank.</p> <p>Potable water may also be delivered by supply vessel during extended maintenance periods. A unique hose connection is provided to prevent cross contamination by inadvertent transfer of diesel from the supply vessel.</p> <p>Storage is provided in a single Potable Water Tank, T960, of 215 m³ capacity located within the west side of the hull structure. The tank is fitted with high and low level alarms, and trips.</p> <p><u>Milling Fluid and excess cement</u></p> <p>During well operations, specialty milling fluids are used for section milling operations. On completion of this activity the milling fluid is displaced out of the well with clean fluids (treated seawater). This milling fluid is discharged directly overboard at the sea surface. Volumes are approximately 40m³ per section mill, with up to two section mills per well for abandonment.</p> <p>Cementing operations may occur during repair or abandonment of well sections. On placement of the cement surface equipment and the well above the target location are displaced to clean fluids (treated seawater) to ensure there is no excess cement that will cause blockages or future access once set. This excess cement is discharged directly overboard at the sea surface. Volumes are approximately 3m³ per well.</p>
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6.5.2 Impacts

Operational discharges will be small and continuous and dependent on rainfall, the number of persons onboard and machinery activity. Operational discharges will result in a reduction in water quality of the receiving marine waters immediately nearby the discharge outlet. This will be temporary (hours), localised and limited to the surface waters (<5 m), due to the small volumes and warm/ fresh qualities of the discharge streams. The discharges will be dispersed and diluted rapidly with increasing distance from the discharge point, so that temporary changes to ambient conditions are unlikely outside the 500m exclusion zone around the MODU. It is noted that the Operational Area overlaps with the humpback whale migration BIA and pygmy blue whale distribution BIA, shearwater breeding BIA, and the flatback turtle internesting buffer BIA which may result in a higher number of these species in the area. Potential impacts to water quality are likely to be limited to the immediate vicinity (tens to hundred metres) of the release point, and are not expected to affect overall population viability of these protected species. Specific water quality impacts are considered as follows.

Sewage

The routine discharge of sewage is likely to result in localised increases in nutrient concentrations, levels of phytoplankton and bacterial activity, and biological oxygen demand (BOD).

In terms of BOD, the open water conditions and swift currents of the receiving environment will dilute the discharge and prevent environmentally significant reductions of oxygen levels in the water column (Somerville et al., 1987, cited in Swan et al., 1994).

Sewage discharge has the potential to contribute to the organic content of sediments under the CPF. However, sediment monitoring conducted in 2000 by IRCE (2001) did not detect elevated organic content

under the CPF in comparison to locations further away. It is likely that the highly dispersive marine environment and high water column productivity are preventing long term accumulation of organics under the Stag CPF.

Some fish and oceanic seabirds may be attracted to the Stag CPF and vessels by the discharge of sewage. This attraction may be either direct, in response to increased food availability, or secondary, as a result of prey species being attracted to the area. However, given the small quantities and intermittent nature of disposal, any attraction is likely to be minor and is not expected to result in adverse impacts at an ecosystem or population level.

While marine mammals and reptiles may transit through the area there are no feeding, breeding or other aggregation areas nearby. The localised extent of any increases in BOD, nutrients, bacteria or phytoplankton and short visit times of these fauna suggest that any impacts from discharged sewage are unlikely.

Deck drainage and bilge water

Discharges from vessels may include residues of chemicals used for cleaning decks. The potential impact associated with the discharge of treated deck drainage and bilge water is chemical toxicity to marine species within the direct vicinity of the vessel. If not properly managed, the discharge of oily water has the potential to create an oil sheen on surface waters and a temporary highly localised decline in water quality and toxic effects to marine fauna. Toxicity to marine organisms would be from trace amounts of dissolved hydrocarbons in the oily water drainage after treatment. Given that oil and grease residues in oily water drainage will be in low concentrations, the potential for impact is low and would be further reduced due to the strong tidal movements experienced in the region and the naturally turbid environment.

There may be a localised and temporary (hours) reduction in water quality in the immediate vicinity of the release. Toxicity impacts to marine fauna from the release of chemicals and oily water are unlikely to eventuate because:

strong ocean currents result in the discharge being further diluted upon release to the marine environment, so the duration of exposure of chemicals to fauna will be minimal

deck cleaning products planned to be released to sea will meet the criteria for not being harmful to the marine environment according to MARPOL Annex V

potential discharges will be intermittent and temporary within the operational area Dispersion and biodegradation of potentially contaminated oily water drainage is expected to be rapid and highly localised resulting in no long-term or adverse effects on water quality or marine ecology.

Bilge water

If not properly managed, the discharge of oily water has the potential to create an oil sheen on surface waters and a temporary localised decline in water quality and toxic effects to marine fauna. Toxicity to marine organisms would be from trace amounts of dissolved hydrocarbons in the oily water drainage after treatment. Given that oil and grease residues in oily water drainage will be in low concentrations, the potential for impact is low and would be further reduced due to the strong tidal movements experienced in the region and the naturally turbid environment.

Dispersion and biodegradation of potentially contaminated oily water drainage is expected to be rapid and highly localised resulting in no long-term or adverse effects on water quality or marine ecology.

Cooling water

The potential impacts arising from discharge of cooling water include:

- Thermal impacts to marine organisms; and

- Decline in water quality associated with lowered dissolved oxygen concentrations as a result of elevated water temperature.

When discharged to the sea surface, cooling water will initially be exposed to the atmosphere and subsequently air cooled. Upon reaching sea surface cooling water will then be subjected to turbulent mixing and some transfer of heat to surrounding waters. The plume will disperse mainly within surface waters being thermally buoyant, primarily in the direction of prevailing tidal currents (northwest–southeast).

The natural range in sea surface temperature at the Stag facilities location is between a low monthly average of 24°C (winter and spring) and high of 27°C (summer) (APASA, 2013). Assuming that a localised area around discharge locations was raised by 2°C (as modelled at the Van Gogh field) a range of 26 to 29°C may be experienced.

Discharge of cooling water has the potential to cause changes in marine ecology through elevated temperatures, as well as the presence of anti-fouling biocides with trace chemical concentrations of copper and aluminium ions being discharged. These small amounts of biocides will disperse rapidly on discharge to concentrations below levels of environmental concern to marine biota especially demersal fauna.

Fish and plankton are likely to be at greatest risk from cooling water discharge impacts since they are most likely to be attracted to the discharge location (fish) or entrained within the discharge plume (plankton). Fish and plankton are relatively small organisms that may experience increased body temperature and altered physiological processes (e.g. increased respiration rate and oxygen demand). However, given that the area of raised water temperature will be highly localised and within the range of temperature on the North-West Bioregion, significant impacts on a larger ecosystem or population levels to fish or plankton are not expected to occur.

Given the hydro-dynamically active open water environment surrounding the Operational Area, it is expected that the surface discharge of cooling water would rapidly disperse, cool and dilute in the surrounding waters, therefore temperature and biocides leading to changes to water quality or behavioural changes in marine species would be negligible. Only receptors in close proximity to the discharge point have the potential to be impacted with full recovery predicted within weeks.

Desalination brine

The potential impacts of desalination brine discharge on the environment include:

- Alteration of physiological processes of exposed biota; and
- Reduced water quality.

On discharge to the sea, desalination brine will sink and disperse in the currents. Given that discharged brine will have a salinity of ~10% greater than ambient seawater the largest increase of salinity experienced would be approximately 10% in the immediate vicinity of the discharge point. Most marine species are able to tolerate short-term fluctuations in the order of 20–30% (Walker and McComb, 1990), and it is expected that exposed organisms such as plankton, pelagic invertebrates and fish would be able to tolerate short-term exposure to the slight (maximum 10%) increase in salinity caused by the discharged brine. For large marine species that may temporarily use surface waters such as marine turtles, mammals and seabirds, the effect of a slight increase in salinity is expected to be negligible.

Milling fluid and cementing discharges

Environmental receptors have the potential to be impacted by milling and cementing discharges through reduction of water quality (turbidity and toxicological effects), and smothering due to sediment deposition to the benthos from particulates discharged to the water column.

When milling fluids and excess cement are discharged to the ocean, any larger suspended particles form a plume that settles quickly to the seabed. Finer solids, along with a portion of the soluble components of the mud, form a plume in the upper water column that drifts with prevailing currents away from the discharge location. Given the nature and volume of the discharged material it is likely that the material will not settle to the seabed in large volumes.

The plume of suspended fine material remaining near sea surface is diluted rapidly in receiving waters (Neff, 2005). The discharge can be likened to the discharge of drilling muds where in well-mixed ocean waters, drilling muds and cuttings are diluted by 100-fold within 10 m of the discharge point and by 1,000-fold after a transport time of approximately 10 minutes at a distance of about 100 m from a MODU. Because of the rapid dilution of the discharge plume, harm to communities of water column organisms (e.g. plankton, fish) is unlikely and has never been demonstrated.

Boehm et al. (2001) concluded that drilling fluid chemicals diluted rapidly in the water column and, in all but very deep or high-energy environments, much of the drilling fluid and cuttings solids settled rapidly to the bottom near the MODU site. The solids discharged during cementing activities at Stag are much smaller volumes than those discharged from drilling of wells with a MODU, and therefore the area of potential impact is expected to be negligible.

A post drilling survey completed within days of drilling (Eni, 2008) confirmed that water turbidity was low as the wellhead and seabed could be seen from several metres away and epibenthic fauna and infauna burrows were common. Dispersion modelling indicated that cuttings would settle over an area 300 m from the wellhead following disposal at the sea surface with an average thickness of 4 mm on seabed surface with the exception of some localised cuttings mounds.

Studies commissioned by Apache during the drilling of Simpson-3 in 6 m water depth and within 400 m of a coral patch reef concluded that there were no adverse impacts on nearby corals (IRCE, 2004; Saunders et al., 2005). The daily monitoring of turbidity and total suspended solids did not detect differences between drilling and control monitoring sites. Arguably if light attenuation, turbidity and total suspended solids that were measured in the study were not significantly above background for prolonged periods then any impacts to other receptors such as fish and cetaceans (including the pygmy blue whale and humpback whale whose BIAs overlap the operational area) would also be minimal.

Discharge of drilling mud and cuttings at the sea surface has not demonstrated significant harm to water column flora and fauna and is highly unlikely (Neff, 2005). As the chemicals selected for use in milling and cementing operations are highly rated (PLONOR, Gold/Silver or E/D OCNS) or alternatively are risk assessed through Jadestone's Chemical Selection Evaluation and Approval Procedure (JS-70-PR-I-00033) process, as environmentally acceptable, their environmental impact will be insignificant. They are not considered to be toxic to marine fauna including fish, marine reptiles, cetaceans and seabirds that may transit through the area.

Given the discharges will occur at sea surface and will disperse through a water column >50 m deep, impacts to demersal fish that live within 5 to 10 m of the seabed are not predicted.

Cumulative impact assessment

Routine discharges of these liquid waste streams may cause a localised reduction in water quality, including a temporary increase in nutrient concentrations, temperature and salinity.

On entering the marine environment, sewage and cooling water from the CPF and support vessels will be subject to rapid dilution and dispersion by the prevailing currents and waves. Like produced water discharge (refer **Section 6.4**), sewage and cooling water being fresh and thermally buoyant waste water streams will disperse in surface waters primarily in the direction of prevailing tidal currents along a northwest-southeast axis.

Monthly discharges of sewage from the CPF are orders of magnitude less than monthly produced water discharge volumes and thus will be a much lower contributor of nutrients. A study into produced water discharge on water column productivity at the Harriet Alpha platform indicated only a localised effect on water column productivity despite elevated nutrients in produced water (Furnas and Mitchell, 1998). It is therefore expected that nutrient impacts from Stag CPF and support vessels sewage disposal will have very localised effects on water column productivity (e.g. bacteria and phytoplankton).

Modelling of cooling water discharges from *Ningaloo Vision* FPSO at the Van Gogh field on the North-West Shelf was conducted by APASA (2010). Modelling results for the combined discharge source (~7,000 m³/h) indicated that within 50 m from the FPSO a sea temperature increase of 2°C is predicted to occur less than 25% of the time. The scale of impacts from the Stag facilities cooling water discharges are likely to be smaller than this given that the combined volume discharge is approximately an order of magnitude lower (1,000 m³/h) than the volume modelled for the Van Gogh field FPSO, with the discharge coming from the CPF.

Woodside undertook brine wastewater discharge modelling (vertical, horizontal and temperature) for their Torosa South-1 appraisal well drilled near Scott Reef (Woodside, 2008). Modelling indicates that a 100:1 dilution of the discharge stream occurs within approximately 50 m of the discharge point under any condition (Woodside, 2008). Given that the marine environment is highly dispersive at the Stag location, a similarly localised mixing zone is expected to occur at the Stag location.

With high rates of initial mixing in the Stag field area, dilution to background conditions is expected to occur in the immediate vicinity of the discharge streams. As a result, short-term impacts to the environment and associated sensitivities due to discharge of liquid wastes are expected.

6.5.3 Environmental Performance

Hazard		Discharge of liquid wastes (EPH-6)		
Performance outcome		No unplanned discharges of liquid wastes within the Operational Area Emissions and discharges of liquid waste to sea are in accordance with legislative requirements		
ID	Management controls	Performance standard	Measurement criteria	Responsibility
Sewage				
032	Sewage Treatment Plant operated in line with MARPOL requirements (vessels >400T)	Current International Sewage Pollution Prevention Certificate for STP (or equivalent) on vessels which confirms that required measures to reduce impacts from sewage disposal are in place	Valid Certificate ISPP	Operations Manager
033	Maintenance of sewage system: CPF	Sewage system maintained in accordance with the CMMS.	CMMS data indicates maintenance completed as scheduled. 14 day check on sewage treatment plant	Maintenance Technician
Deck drainage and bilge water				
034	Oily water filtering and monitoring equipment	If required under MARPOL Annex I, support vessels have oily water filtering and monitoring equipment that is compliant (e.g. discharges oily water with OIW <15 mg/L) and surveyed/ maintained as per MARPOL Annex I and an IOPP certificate	Maintenance records or a pre-mobilisation inspection report (e.g. OCIMF OVID,	Logistics Lead

Hazard		Discharge of liquid wastes (EPH-6)		
Performance outcome		No unplanned discharges of liquid wastes within the Operational Area Emissions and discharges of liquid waste to sea are in accordance with legislative requirements		
ID	Management controls	Performance standard	Measurement criteria	Responsibility
	fitted and maintained		IMCA CMID, ISM inspection)	
035		A continuous OIW monitor is in place and functioning on the CPF such that an alarm sounds in the CPF central control room if [OIW] is >30 mg/L and automatically diverts PW inboard within 10 minutes of the exceedance being identified.	Maintenance records show the OIW monitor is maintained and functioning Audit as per BASSnet	Stag OIM
Cooling water				
036	Water cooled equipment is certified and maintained	Water cooled equipment/ machinery and heat exchangers on the CPF maintained in accordance with the CMMS	BASSnet shows maintenance has been satisfactorily completed as scheduled	Stag OIM
Desalination brine				
037	Potable water systems maintained	CPF potable water system maintained in accordance with the BASSnet / CMMS	BASSnet / CMMS shows when maintenance has been satisfactorily completed.	Stag OIM

Hazard		Discharge of liquid wastes (EPH-6)		
Performance outcome		No unplanned discharges of liquid wastes within the Operational Area Emissions and discharges of liquid waste to sea are in accordance with legislative requirements		
ID	Management controls	Performance standard	Measurement criteria	Responsibility
038	Production chemicals selected for discharge in accordance with Chemical Selection Evaluation and Approval Procedure (JS-70-PR-I-00033)	Chemicals used are Gold/Silver/D or E rated through OCNS, or PLONOR substances listed by OSPAR, or have a complete risk assessment so that chemicals planned for discharge are environmentally acceptable.	Completed chemical risk assessment forms for new chemicals. Records of OCNS or PLONOR rating of chemicals	Stag OIM
Milling and Cementing Discharges				
039	Cementing and milling chemicals selected for discharge in accordance with Chemical Selection Evaluation and Approval Procedure (JS-	Chemicals used are Gold/Silver/D or E rated through OCNS, or PLONOR substances listed by OSPAR, or have a complete risk assessment so that chemicals planned for discharge are environmentally acceptable.	Completed chemical risk assessment forms for new chemicals. Records of OCNS or PLONOR rating of chemicals	Stag OIM

Hazard		Discharge of liquid wastes (EPH-6)		
Performance outcome		No unplanned discharges of liquid wastes within the Operational Area Emissions and discharges of liquid waste to sea are in accordance with legislative requirements		
ID	Management controls	Performance standard	Measurement criteria	Responsibility
	70-PR-I-00033)			

6.5.4 ALARP Assessment

On the basis of the impact and risk assessment completed, Jadestone considers the control measures described above are appropriate to manage liquid waste discharges from the CPF and support/ supply vessels. The residual risk ranking for this potential impact is considered Low, and therefore ALARP has been demonstrated, no further controls are required. Additional controls considered but rejected are detailed below.

Rejected control	Hierarchy	Practicable	Cost effective	Justification
All wastes stored onboard CPF and tanker and transferred to shore for onshore treatment and disposal	Eliminate	No	No	Costs associated with complete re-engineering such that wastes contained onboard and disposed of onshore, onshore treatment and disposal costs and increase in fuel consumption due to multiple vessel transfers would be disproportionate to the environmental benefit gained given the rapid dilution in offshore water/ atmosphere and low potential impact from discharges/ emissions. In addition, transfers increase the risks of spills/ leaks and safety risks to personnel during transfer operations.
Reduce toxicity of discharges	Substitute	No	No	Provide for further treatment of wastes prior to discharge to sea such as decreasing the oily water concentration below MAPROL requirements, additional treatment of sewage, desalination and cooling water so the discharge is similar to the surrounding ambient sea water. This would require complete re-engineering of equipment and would be disproportionate in cost compared to the environmental benefit gained given the rapid dilution in offshore water and low potential impact from discharges.
Re-engineer equipment to retain wastes onboard	Engineering	No	No	Costs associated with complete re-engineering such that wastes contained onboard and disposed of onshore would be disproportionate to the environmental benefit gained. There is not enough space on board the facility or vessels to have storage tanks for all the waste produced prior to transferring to a vessel for onshore treatment and disposal. Substantial additional costs for re-engineering is grossly disproportionate to the benefit gained.
N/a	Isolation	N/a	N/a	The Activity is located at distance from sensitive receptors and the coastline and no significant impacts on receptors are predicted.
N/a	Administrative	N/a	N/a	Maintenance management system implemented, compliance with relevant and appropriate MARPOL requirements and

				certified equipment ensure discharges meet regulatory requirements.
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6.5.5 Acceptability Assessment

The potential impacts of liquid waste discharges are considered 'Broadly Acceptable' in accordance with the Environment Regulations, based on the acceptability criteria outlined below. The control measures proposed are consistent with relevant legislation, standards and codes.	
Policy compliance	Jadestone's HSE Policy objectives are met.
Management system compliance	Section 9 demonstrates that Jadestone's HSE Management System is capable of meeting environmental management requirements for this activity.
Social acceptability	Stakeholder consultation has been undertaken (see Section 6), and no stakeholder concerns have been raised with regard to impacts from liquid waste discharges on sensitive receptors.
Laws and standards	Liquid waste discharges are compliant with MARPOL and AMSA Marine Orders.
Industry best practice	The APPEA Code of Environmental Practice (CoEP) (2008) objectives are met with regard to offshore production operations.
Environmental context	<p>While there are liquid waste discharges to sea surface immediately around the Stag facility, the impact and risk assessment process indicates that discharges will not result in significant effects to marine fauna.</p> <p>The potential impact is considered acceptable after consideration of:</p> <ul style="list-style-type: none"> - Potential impact pathways - Preservation of critical habitats - Assessment of key threats as described in species and Area Management /Recovery plans - Consideration of North-West Bioregional Plan; and <p>Principles of ecologically sustainable development ESD</p>
Conservation and management advice	<p>No Management Plans identified operational discharges such as those described above as being a threat to marine fauna or habitats. Most of the plans identify pollution and habitat degradation relating to more significant (and usually unplanned) discharges to sea and therefore they were not considered relevant to these discharges which are all in accordance with legislative requirements such as MARPOL.</p> <p>Jadestone has had regard to the representative values of the protected areas within the RISK EMBAs, and the respective management plans and other published information. Impacts from liquid discharges will have a negligible impact on any of the social and ecological objectives and values, of any AMPs, or state MPs. This is consistent with the objectives of the protected area management plans and considered acceptable.</p>
ALARP	The residual risk has been demonstrated to be ALARP.

6.6 Interaction with Other Users

6.6.1 Description of Hazard

Aspect	The presence of the 500 m radius Restricted Zone (the Operational Area) and 3 nm Cautionary Zone (designated by AMSA) creates a localised disturbance for other users of the area including commercial and recreational fishers, and shipping traffic.
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6.6.2 Impacts

Presence of the Stag Facility and the associated restricted and cautionary zones result in the preclusion of other users including commercial and recreational fishers, and commercial shipping traffic, to use the area for their purposes.

While commercial and recreational fishing is permitted to occur in the vicinity of the Operational Area (refer to **Section 5.9.1** for information on State and Commonwealth fisheries permitted to operate in the vicinity of the Operational Area), the placement of the 500 m restricted zone means relevant commercial and recreational fishers are unable to work the area of the restricted zone.

Despite the imposition to commercial and recreational fishers due to the restricted zone, commercial and recreational fishing effort is not anticipated within the Operational Area as the area does not represent important habitat for targeted species, such as natural seabed features (e.g. rocky outcrops or coral reef).

Consequently, waters associated with the Stag Facility do not support significant fishing activity and therefore impact to fishers is predicted to be minimal. Any impacts to commercial or recreational fishing would not be expected to have a significant effect on the catches or income of fishers. No feedback during consultation of relevant persons, including commercial fishers, was received indicating that impact to commercial fishers has or will result from operation of the Stag Facility.

The presence of the Stag CPF 500 m restricted zone, 3 nm cautionary zone, and the movement of support vessels, present obstacles for shipping traffic in the region and are potential navigational hazards and a collision risk. The Stag Facility is located 4 km northwest of the nearest designated shipping route and so it is not anticipated there will be high commercial shipping traffic in the immediate area (refer to **Section 5.9.4** for details on commercial shipping, including designated shipping routes, and Figure 3-20) (AMSA, 2012). Any detour by shipping traffic that may occur is considered negligible in comparison to the area available for vessels to navigate through.

6.6.3 Environmental Performance

Aspect		Interaction with other users (EPH-7)		
Performance outcome		Recreational and commercial fishers, and shipping traffic, are aware of the Stag Facility Operational Area and associated activities		
ID	Management controls	Performance standards	Measurement criteria	Responsibility
040	Stag facility maintains navigational and communication equipment in accordance with legislative requirement	The Stag facility and CALM buoy are chartered on Australian Hydrographic Service (AHS) nautical charts with gazetted PSZ	Annual audit verifies that the facility and CALM buoy are still marked on nautical charts	Stag OIM
041		AIS system on CPF	PMS records show evidence of navigation and communication equipment maintenance	Maintenance Supervisor
042		Continuously manned CPF CCR	CCR log documents continuous manning	Stag OIM
043		Periodic navigation light checks and servicing for CPF recorded in CMMS	CMMS records show evidence of navigation lighting maintenance	Maintenance Supervisor
044		Marine Navigation lights on the CPF shall be provided to ensure at least one light is visible upon approaching the structure from any direction	CMMS records show evidence of navigation equipment presence and maintenance	Maintenance Supervisor
045		A Marine VHF Radio is located and functioning in the CPF radio room and central control room (CCR)	BASSnet and assurance through daily use	Maintenance Supervisor
046	Jadestone Energy Stakeholder Management Plan (JS-70-PR-I-00034) details consultation requirements to ensure other marine users are aware of the activity	Relevant persons identified according to current Regulatory requirements	Consultation records	General Manager
		Relevant persons provided a minimum 4-week period to respond to proposed planned activities		
		If there is a potential change in the risks or impacts to relevant persons due to planned activities relevant persons are to be consulted prior to the activity commencing		

6.6.4 ALARP Assessment

On the basis of the impact and risk assessment completed, Jadestone considers the control measures described above are appropriate to reduce as far as practicable the imposition due to the physical presence of the Stag facility to activities undertaken by relevant persons in the area. The residual risk ranking for this potential impact is considered Low, and therefore ALARP has been demonstrated, no further controls are required. Additional controls considered but rejected are detailed below.

Rejected control	Hierarchy	Practicable	Cost effective	Justification
Removal of facility and vessels	Eliminate	No	No	To not be physically present is not an option for the Stag facility operations. Operation of the facility would not be possible without the replenishment of supplies required for safe operations.
Store oil on CPF to remove requirement for third-party tanker and thereby reduce exclusion area to that around the CPF only	Substitute	No	No	While creating the ability to store oil on the CPF would reduce the spatial footprint of the Operational Area, the costs associated with the modifications required would be disproportionate to the benefit that would be received by other users of the area. Reducing the area of the safety restricted zone would result in minimal environmental gain, while potentially increasing the risk of vessel collision.
Re-engineer to remove requirement for topsides altogether	Engineering	No	No	Costs associated with complete re-engineering of the facility such that the need for topsides infrastructure was not required would be grossly disproportionate to the benefit that would be received by other users of the area.
N/a	Isolation	N/a	N/a	Stag operations is located outside of shipping fairways and is not positioned in highly prized fishing habitat.
Additional activity specific navigational or communications requirements	Administrative	No	No	The vessel navigational management and monitoring measures in place are industry standard and internationally accepted measures to minimise the potential for interference with, or collision between, vessels. Frequent and informative communication with relevant persons regarding activities associated with the Stag facility are undertaken. Additional procedures would provide no further benefit.

6.6.5 Acceptability Assessment

The potential impacts of the Stag facility and associated activities on other users are considered 'Broadly Acceptable' in accordance with the Environment Regulations, based on the acceptability criteria outlined below. The control measures proposed are consistent with relevant legislation, standards and codes.

Policy compliance	Jadestone’s HSE Policy objectives are met.
Management system compliance	Section 9 demonstrates that Jadestone’s HSE Management System is capable of continuously reviewing and updating activities and practices at the Stag facility to reflect the requirements of relevant persons.
Social acceptability	Stakeholder consultation has been undertaken (see Section 6), and no stakeholder concerns have been raised with regards to impacts of the Stag Facility on relevant persons.
Laws and standards	The Stag facility is chartered on Australian Hydrographic Service (AHS) nautical charts, and navigation and communication equipment are in place and operable on the assets, as per AMSA’s requirements.
Industry best practice	Stakeholders have been provided information on the location and operation of the facility and the infrastructure is indicated on navigational charts.
Environmental context	While the Stag facility presents a restricted zone to other users, the impact and risk assessment process indicates that the area of restriction is localised and occurs at a location that is not likely to result in significant penalties to the activities of relevant persons currently active in the area. The potential impact is considered acceptable after consideration of Principles of ecologically sustainable development (ESD).
Conservation and management advice	No management plans identified physical presence as described above as being a threat to other users. Jadestone Energy has had regard to the representative values of the protected areas within the EMBA, and the respective management plans and other published information. Impacts from physical presence will have a negligible impact on any of the social and ecological objectives and values, of any AMPs, or state marine parks. This is consistent with the objectives of the protected area management plans and considered acceptable.
ALARP	The residual risk has been demonstrated to be ALARP.

6.7 Interaction with Fauna

6.7.1 Description of Hazard

Aspect	Physical presence of infrastructure and the movement of vessels and helicopters.
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6.7.2 Impacts

Potential impacts to marine fauna and avifauna may occur as a result of:

- The physical presence of the Stag Facility; or
- Vessel and helicopter movements associated with routine operations.

Potential physical and behavioural impacts may range from temporary and localised displacement to injury or mortality from vessel strike.

Impacts associated with noise are outlined in **Section 6.2**.

Physical presence

Species most susceptible to impacts from physical presence include turtles, birds, and cetaceans. Migratory species such as seabirds may experience localised and short term effects through behavioural changes; such as roosting on platforms, or changed feeding patterns in nearby waters in response to other factors such as attraction of fish to the infrastructure (Verhejen, 1985; Weise *et al.*, 2001). This is predominantly attributed to the observation that structures in deeper water environments tend to aggregate marine life at all trophic

levels, creating food sources and shelter for seabirds (Surman, 2002). Behavioural changes could affect the size and composition of the seabird community in the local area.

The Stag infrastructure is within an area identified as 'species core range' for humpback whales and it is possible that these and other whale species may transit the area during migration periods. Based on evidence outlined in **Section 5.6.2**, during the northern migration, individuals may be in the deeper waters while those in the southern migration tend to stay in shallower waters and so outside the Operational Area. The Operational area is not close to any identified aggregation areas such as resting or calving locations and is within a migration corridor ~200 km wide, so is not considered a restricted corridor. It is assessed that the Stag CPF and third-party tanker do not present large obstacles that would pose an issue to individuals as they will be able to easily swim around the infrastructure with minimal deviation from migratory routes.

The Operational Area is overlapped by the humpback whale migration BIA, pygmy blue whale distribution BIA, flatback turtle internesting buffer BIA and habitat critical to the survival (Table 3-4) and the foraging BIA of the whale shark is 9 km away and as such individuals may transit the area.

Slight deviations by migrating marine fauna including humpback whales, pygmy blue whales and whale sharks, to avoid the Stag Facility may be required, however this impact is considered negligible given the large navigable area available and the relatively small Operational Area. Consequently, the presence of the Stag Facility and associated vessels is unlikely to disrupt important life-cycle events of marine fauna as no aggregation areas are located in the vicinity and so impacts at an individual and population level are considered minimal.

The presence of subsea structures has the potential to provide artificial habitats for marine organisms such as fish, resulting in a local increase in biological productivity and diversity and possible alteration of predator or prey refuges and visual clues for aggregation (Galloway *et al*, 1981). However, it is likely the artificial habitat will have either negligible adverse environmental impact or a low level of positive environmental impact through an increase in species diversity or richness in the area.

Vessel/ Helicopter strike

There is significant vessel traffic transiting from ports in the North-West and so the threat of ship strikes to whales is present throughout the region. Species most susceptible to vessel strike include cetaceans, whale sharks and turtles, and this is reflected as a threat in many of the conservation advice and recovery plans for these species (refer Table 3-5). Other fauna such as birds, fish and sea snakes are more likely to avoid vessels operating in the area and so are considered at low risk of potential strike and will not be discussed further.

Cetaceans including humpback whales demonstrate a variety of behaviours in response to approaching vessels (attributed to vessel noise), including longer dive times and moving away from the vessel's path with increased speed (Baker and Herman, 1989; Meike *et al.*, 2004). These behaviours (discussed in **Section 6.2**) may actually contribute to reducing the likelihood of a vessel strike.

The likelihood of vessel/ whale collision being lethal is influenced by vessel speed: the greater the speed at impact, the greater the risk of mortality (Laist *et al.* 2001, Jensen and Silber 2003). Vanderlaan and Taggart (2007) found that the chance of lethal injury to a large whale as a result of a vessel strike increases from about 10% at 4 knots to 80% at 15 knots. Vessels within the Operational Area will travel no faster than 5 knots, and hence the chance of a vessel-whale collision resulting in lethal outcome is reduced. The US NOAA database (Jensen and Silber, 2003) indicates there are only two known instances of collisions when the vessel was travelling at less than 6 knots and both of these were from whale watching vessels that were deliberately placed amongst whales.

Although the whale shark's skin is thicker and tougher than any other shark species, the species may be more vulnerable to boat strike as they spend a significant amount of their time close to the surface of the water (DEH 2005a). DBCA developed a code of conduct for commercial vessels engaged in whale shark watching

and these measures have been used to develop minimum requirements for support and supply vessels in the Operational Area: vessels shall not approach closer than 400 m from a whale shark.

Given that marine turtles, particularly flatback turtles, whose interesting buffer BIA overlaps the Operational Area, are known to occur in the vicinity of the Stag Facility, there is a risk of potential vessel strike. Hazel *et al.* (2007) suggested that higher vessel speed is more likely to cause impacts particularly in shallow waters where turtles are abundant and the success of avoidance behaviour is a factor of the response time available (i.e. visual observation distance/ vessel speed). By implementing reduced vessel speeds to <5 knots in the Operational Area, the likelihood of a strike and the severity is greatly reduced.

Given the slow operating speed of support and supply vessels as well as the low likelihood of large numbers of aggregating animals being present, the potential for vessel strike to impact significantly on a cetacean, whale shark or turtle population in the Operational Area is assessed to be low.

Helicopter movements have the potential to affect birds through direct strike, however, considering the high visibility and noise levels associated with helicopter movements, birds are expected to avoid collisions with helicopters. The number of helicopter flights required is relatively low averaging two inward/ outward flights per week. Flights also occur in the daylight and not within major roosting areas, thereby reducing potential interactions and subsequent physiological impacts. Though it is recognised that the wedge-tailed shearwater breeding BIA overlaps the operational area, but is a very large area compared to the BIA and given the distance to the nearest breeding and roosting areas (i.e. land) is greater than 32km away, it is unlikely significant numbers will overfly the location. Collisions are therefore considered unlikely.

6.7.3 Environmental Performance

Hazard		Interaction with fauna (EPH-8)		
Performance outcome		No death or injury to EPBC Act listed marine fauna due to operational activities in the Operational Area		
ID	Management Control	Performance standards	Measurement criteria	Responsibility
047	See I.D 011-012 for appropriate performance standards			
048	Vessels operate at speeds in accordance with Stag Marine Facility Operating Manual (GF-90-MN-G-00038) to reduce potential for collision with marine fauna	Vessels operating within the restricted zone must not exceed a speed of five (5) knots.	Sign off sheet completed by Vessel Master	Operations Manager
049	Competency and Training Management System [JS-60-PR-Q-00015] provides a process for ensuring that Contractors and Services Providers have the appropriate level of HSE capability	Online induction includes information on speed limits in the restricted zone and requirements on interacting with marine fauna	Sign off sheet completed by Vessel Master Induction Records (Vessel Contractors)	HR Manager
050	Marine fauna collisions reported to National Ship Strike Database	<p>Any vessel collision with a whale in the operational area is submitted to the National Ship Strike Database at:</p> <p>https://data.marinemammals.gov.au/report/shipstrike</p> <p>Death or injury to EPBC Act listed marine fauna (including cetaceans or whale sharks) from vessel collision are recorded/reported to NOPSEMA and DAWE in line with regulations</p>	Vessel collision incident report Database entry number	HSE Manager

6.7.4 ALARP Assessment

On the basis of the ERA conducted, and the use of relevant tools appropriate to the decision type, Jadestone considers the control measures described above are appropriate to manage the risk of collision between vessels and marine fauna or negative interaction with helicopters. The residual risk ranking for this potential impact is considered Low and therefore ALARP has been demonstrated. Additional controls considered but rejected are detailed below.

Rejected control	Hierarchy	Practicable	Cost Effective	Justification
Removal of vessels and helicopter use	Eliminate	No	No	Vessel and helicopter presence is required during operational activities and there are no practicable alternatives. The potential for interaction between support and supply vessels and fauna cannot be eliminated, however the risk is extremely low given the low volume of vessel activity and speed limits.
Reduce frequency or size of support and supply vessels	Substitute	No	No	Reducing the frequency or size of support and supply vessels would introduce disproportionate operational and safety risks; for example, the vessel is required to be of sufficient size and power to enable efficient and timely supply the necessities/ services to maintain effective operation of the CPF and third-party tanker and to provide support in an emergency, e.g. man overboard.
N/a	Engineering	N/a	N/a	Not relevant
Reduce or remove vessel and helicopter use during key sensitive periods	Isolation	No	No	Reducing or removing vessel and helicopter activities during known migration periods of marine fauna is not a viable option as these activities are necessary for the safe and efficient operation of the facility.
Use of Marine fauna observers on all vessels to identify fauna close to vessels	Administrative	N/a	N/a	Support and supply Vessel Masters will complete an environmental induction which includes the applicable requirements or speed limits and avoiding fauna. The introduction of a specialist marine fauna observer is unlikely to increase detection and the additional cost is considered grossly disproportionate given the low vessel speeds and low potential for impacts on marine fauna.

6.7.5 Acceptability assessment

The potential impacts of the physical presence of infrastructure and vessels are considered 'Broadly Acceptable' in accordance with the Environment Regulations, based on the acceptability criteria outlined below. The control measures proposed are consistent with relevant legislation, standards and codes.

Policy compliance	Jadestone's HSE Policy objectives are met.
Management system compliance	Section 9 demonstrates that Jadestone's HSE Management System is capable of meeting environmental management requirements for this activity.
Social acceptability	Stakeholder consultation has been undertaken (Section 6), and no stakeholder concerns have been raised with regards to impacts from vessel/ helicopter operations on sensitive receptors.
Laws and standards	Aspects of the Environment Protection and Biodiversity Conservation Regulations 2000, Division 8.1 – Interacting with Cetaceans Recovery Plan for Marine Turtles in Australia, (CoA 2017a)

<p>Industry best practice</p>	<p>The APPEA Code of Environmental Practice (CoEP) (2008) objectives are met with regards to offshore production operations.</p> <p>Whale Shark Code of Conduct (DEC)</p>
<p>Environmental context</p>	<p>The Operational Area overlaps the humpback whale ‘species core range’, migratory BIA, the pygmy blue whale distribution BIA, is adjacent to the whale shark foraging BIA and overlaps the flatback turtle internesting buffer BIA and habitat critical to the survival of flatback turtles. However, risk to megafauna is considered low and acceptable as vessels will travel at <5 knots; minimal vessel activity in the area, and risk of mortality from a low-speed vessel strike is low.</p> <p>The potential impact is considered acceptable after consideration of:</p> <ul style="list-style-type: none"> - Potential impact pathways - Preservation of critical habitats - Assessment of key threats as described in species and Area Management /Recovery plans - Consideration of North-West Bioregional Plan; and <p>Principles of ecologically sustainable development ESD</p>
<p>Conservation and management advice</p>	<p>Recovery Plan for Marine Turtles in Australia, (DoEE, 2017).</p> <p>The Recovery Plan for marine turtles in Australia (DoEE, 2017) identifies the following risk - Vessel Disturbance. It requires that risk of vessel strikes is evaluated and, if required, appropriate mitigation measures are implemented. This EP and the proposed controls are consistent with this advice.</p> <p>Conservation Management Plan for the Blue Whale, 2015-2025.</p> <p>The Management Plan identifies the following risk – ‘Vessel Disturbance’. It requires that risk of vessel strikes is evaluated and, if required, appropriate mitigation measures are implemented. This EP and the proposed controls are consistent with this advice.</p> <p>Approved Conservation Advice for <i>Rhincodon typus</i> (whale shark) (TSSC, 2015a)</p> <p>The conservation advice identifies the following risk – boat strike from large vessels. It requires that transit time of large vessels in areas close to marine features likely to correlate with whale shark aggregations (Ningaloo Reef, Christmas Island and the Coral Sea) and along the northward migration route that follows the northern Western Australian coastline along the 200 m isobath are minimised. The location of the operational area is adjacent to the whale shark foraging BIA but vessels do not frequently transit through the BIA as they are likely to mobilise from Dampier to reach the operational area.</p> <p>Other plans that identify vessel strike as a potential threat include the below, though these species are not expected within the operational area.</p> <ul style="list-style-type: none"> - Approved Conservation Advice for <i>Balaenoptera borealis</i> (sei whale) (TSSC, 2015b) - Approved Conservation Advice for <i>Balaenoptera physalus</i> (fin whale) (TSSC, 2015c) - Conservation Management Plan for the Southern Right Whale 2011 – 2021 (DSEWPaC, 2012h) <p>Jadestone has had regard to the representative values of the protected areas within the RISK EMBA, and the respective management plans and other published information. Interactions with fauna may have a minor impact on any of the social and ecological objectives and values, of AMPs, or state MPs. However, with controls in place to minimise the likelihood (to protect protected fauna), this is considered consistent with the objectives of the conservation advice or management plans and considered Acceptable.</p>
<p>ALARP</p>	<p>The residual risk has been demonstrated to be ALARP.</p>

6.8 Physical Footprint

6.8.1 Description of Hazard

Aspect	<p>Following an integrity inspection, it may be necessary to modify the seabed in the vicinity of subsea infrastructure such as the pipeline to correct for free spans (by placing grout bags under the free span) or burial (by jetting or airlifting sediments from on top of the pipeline).</p> <p>As part of facility maintenance, marine growth is periodically removed either using water blasting or manual ROV, divers or bespoke automatic devices.</p>
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No other discharges to the marine environment resulting in disturbance to the seabed are expected due to IMR, corrosion control and integrity, and plant modification activities. Discharges to the environment may occur during milling and cementing operations (during repair and abandonment of wells) as a result of work over and well intervention activities, though these discharges are limited (refer Section 2.2.8) as the work is carried out on wells that are accessed on the topside of the platform. Vessels used for maintenance and integrity activities in close proximity to the facility will maintain station using dynamic positioning, and will not anchor, thereby not causing impacts to the seabed.

For more information on these activities refer to **Sections 2.2.5, 2.2.6, 2.2.8 and 2.2.9.**

6.8.2 Impacts

Disturbance to marine habitats and the seabed may occur in the event subsea infrastructure needs to be modified or repaired. The physical presence of subsea infrastructure creates habitat for organisms that are attracted to and/ or attach to hard substrates.

Potential impacts from the presence of infrastructure over the life of the development are:

- Localised physical damage/ loss to soft sediment benthic habitats and associated biota under and nearby the subsea infrastructure footprint; and
- Provision of artificial habitat for benthic and pelagic organisms.

Temporary or permanent direct loss of benthic habitat and associated biota will occur under the footprint of subsea infrastructure. The Stag CPF, CALM buoy (anchors and chains) and subsea export pipeline have been in place since commissioning in 1998. In the event that the installation of additional or replacement subsea infrastructure (e.g. tie in spools) is required, this will create further disturbance to the seabed in the immediate area of existing infrastructure.

The scale of habitat loss and seabed disturbance from the physical presence of infrastructure is small in comparison to the vast size of soft substrate habitats spanning the North-west Shelf. The impacted benthic habitats and associated biota are well represented in the region and there are no known areas of sensitive habitat (e.g. corals, seagrass) within the Stag Facility area.

The operational area is within a habitat critical to survival for flatback turtles (as referred to in Table 6 of the 2017 National marine turtle recovery plan). However, the total size of the BIA for Pilbara flatbacks is 35,758,775 km². The areas that may potentially be affected by physical presence would represent a very small percentage of the total area.

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

The presence of seabed and floating structures may have a minor positive benefit with reef associated species such as cods and snappers preferring habitat of structural complexity. Similarly, near-surface infrastructure

can support pelagic species that are commonly attracted to fixed and drifting surface structures in areas of open-ocean (Lindquist et al., 2005).

Impacts associated with the provision of artificial habitat from Stag infrastructure are increased biological productivity and diversity, which can result in a localised influence on marine communities. Given the small scale of the artificial habitat created, the potential impacts are expected to be highly localised.

6.8.3 Environmental Performance

Hazard		Physical presence (EPH-9)		
Performance outcome		No unintentional disturbance to the seabed and marine environment in the Operational Area Seabed disturbance limited to planned activities and defined locations		
ID	Management Control	Performance standards	Measurement criteria	Responsibility
051	Management of Change Procedure (MoC) [JS-90-PR-G-00017]	Prior to commencement of integrity, maintenance or repair work on subsea infrastructure, a survey using ROV/ AUV/ diving will be undertaken which will include a visual survey of the seabed within the footprint of the work area.	Survey report	Contract Owner
052	Well control program ensures that minimal fluids are discharged to the marine environment	Pressure test of well control equipment ensures minimal fluids discharged to the marine environment from the workover unit	Pressure test results are undertaken prior to well operations commencing and recorded in the daily report and Well Acceptance Criteria.	Well Services Supervisor
053	Decommissioning framework implemented prior to end of field life	No later than five years prior to the end of field life, Jadestone will have a decommissioning framework that details how JSE will meet the obligations under s.572 of the OPGGS Act. This will include <ul style="list-style-type: none"> - timeframes for acceptance of regulatory approval documents - inventory of all in-field infrastructure - status of all in-field infrastructure - overall decommissioning concept 	Established decommissioning project by 2030 (based on current expected commercial EOFL)	Country Manager
054	Maintenance of inactive infrastructure in accordance with the CMMS	Jadestone will maintain in good condition and repair all active and inactive subsea structures that are, and all subsea equipment and other property that is used in connection with the Stag Operations to ensure they can meet obligations under s.572 of the OPGGS Act.	Inspection records in BASSnet	Engineering & Maintenance Manager

055	Inspection of subsurface infrastructure completed in accordance with the Stag WOMP (GF-50-PLN-W-00001)	Jadestone will inspect subsurface infrastructure every three years in accordance with the Stag WOMP (GF-50-PLN-W-00001)	Inspection records in BASSnet	Drilling Manager
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6.8.4 ALARP Assessment

On the basis of the impact and risk assessment process completed, Jadestone considers the control measures described above are appropriate to manage the impacts to seabed and benthic habitats due to the physical footprint of the operation. The residual risk ranking for this potential impact is considered Low, and therefore ALARP has been demonstrated. Additional controls considered but rejected are detailed below.

Rejected control	Hierarchy	Practicable	Cost effective	Justification
No maintenance of subsea infrastructure	Eliminate	No	No	The facility has been on location since 1998, and therefore the physical footprint is already present. However, additional disturbance due to anchoring is eliminated as dynamic positioning (DP) used by work vessels eliminates the need for anchoring, thereby reducing the risk of impacts to the seabed. Additional disturbance for stabilisation or ROV activities is unavoidable and is required to maintain the integrity of subsea infrastructure.
N/a	Substitute	N/a	N/a	The presence of the CALM buoy minimises the need for anchoring of the third-party tanker, thereby reducing the risk of impacts to the seabed due to anchoring of the third-party tanker to ALARP. No further substitutions are therefore considered.
N/a	Engineering	N/a	N/a	The marine growth prevention systems applied on near-surface submerged structures and internal seawater intake systems, and the maintenance of these systems reduces the potential for providing a significant artificial habitat and decreases the frequency of inspection activities with the consequent cleaning of biofouling communities on external in-water surfaces which may contain remnant anti-fouling paint.
N/a	Isolation	N/a	N/a	The activities are located outside of areas supporting highly valuable benthic habitats.
N/a	Administrative	N/a	N/a	IMR activities include visual ROV surveys of seabed habitat

6.8.5 Acceptability Assessment

The potential impacts of impacts to seabed due to physical footprint are considered 'Broadly Acceptable' in accordance with the Environment Regulations, based on the acceptability criteria outlined below. The control measures proposed are consistent with relevant legislation, standards and codes.

Policy compliance	Jadestone's HSE Policy objectives are met.
Management system compliance	Section 9 demonstrates that Jadestone's HSE Management System is capable of meeting environmental management requirements for this activity.
Social acceptability	Stakeholder consultation has been undertaken (Section 6), and no stakeholder concerns have been raised with regards to impacts from physical footprint on sensitive receptors.

Laws and standards	No applicable laws or standards identified.
Industry best practice	The APPEA Code of Environmental Practice (CoEP) (2008) objectives are met with regards to offshore production operations.
Environmental context	<p>Disturbance is localised to immediately under or near to the footprint of Stag Facility subsea infrastructure within the Operational Area. The impacted benthic habitats and associated biota are well represented in the region.</p> <p>The operational area is within a habitat critical to survival for flatback turtles. However, the areas that may potentially be affected by physical presence would represent a very small percentage of the total area.</p> <p>The potential impact is considered acceptable after consideration of:</p> <ul style="list-style-type: none"> - Potential impact pathways - Preservation of critical habitats - Assessment of key threats as described in species and Area Management /Recovery plans - Consideration of North-West Bioregional Plan; and <p>Principles of ecologically sustainable development ESD</p>
Conservation and management advice	<p>No management plans identified physical presence as described above as being a threat to marine fauna or habitats.</p> <p>Jadestone Energy has had regard to the representative values of the protected areas within the EMBA's, and the respective management plans and other published information. Impacts from physical presence will have a negligible impact on any of the social and ecological objectives and values, of any AMPs, or state marine parks. This is consistent with the objectives of the protected area management plans and considered acceptable.</p>
ALARP	No applicable laws or standards identified

6.9 Spill Response Activities

6.9.1 Description of Hazard

Aspect	<p>In the event of a hydrocarbon spill, contingency spill response activities will be undertaken to reduce the level of impact to sensitive receptors. Section 6.9 outlines the spill response strategies that will be employed in the event of a hydrocarbon spill from Stag Operations. Response strategies that may be used include:</p> <ul style="list-style-type: none"> • Source control; • Operational monitoring; • Surface chemical dispersants; • Containment and recovery; • Protection and deflection; • Shoreline clean-up; • Oiled wildlife response; and • Scientific monitoring. <p>While the aim of responding is to reduce impacts from the spill, there is the potential for response activities to exacerbate or create additional impacts. Poorly selected or implemented spill response activities may therefore do more environmental harm than good.</p>
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6.9.2 Impacts

The OPEP provides detail on how response strategies will be implemented.

For noting: Forward Operating Bases will be located at Dampier/Karratha/Port Hedland to enable efficient delivery of response actions at a central location. The placement of temporary camps at remote locations is not preferred due to safety and environmental considerations; establishment of temporary camps would be in consultation with DBCA and DoT.

Light emissions

Spill response activities will use vessels, which are required at a minimum to display navigational lighting and have night safety lighting. Spill response activities will only occur in daylight hours, although as some vessels may be moored overnight there is limited potential for night light spill from vessels to impact marine and coastal fauna habitats.

Lighting may cause behavioural changes to fish, birds and marine turtles which can have a heightened consequence during sensitive life-cycle activities (refer **Section 6.1.2**), for example turtle nesting and hatching. Turtles and birds, which include threatened and migratory fauna (refer **Section 3.6.4**), have been identified as key fauna susceptible to lighting impacts. These species are also identified as KPIs in the protected areas within the EMBA (Figure 3-15).

Spill response activities may occur on shorelines used by nesting turtles, including flatback, hawksbill, green and loggerhead turtles. Locations particularly important for seasonal turtle nesting include the Lowendal and Montebello Islands, Barrow Island, Dampier Archipelago and Eighty Mile Beach. The Muiron Islands and Ningaloo World Heritage area are also important for seasonal turtle nesting. Light has been identified as a key threat to turtles in the National Recovery Plan (CoA 2017a), and respective species Conservation advice. Although as shoreline spill response operations will only occur in daylight hours, there will be no impact from light.

There are 8 EPBC listed species whose BIA occur in the EMBA. Locations particularly important for seabirds and shorebirds include Lowendal and Montebello Islands, Dampier Archipelago, and Eighty Mile Beach. Eighty Mile Beach is a particularly important area for seasonal aggregations of migratory shorebirds and is a listed Ramsar site. Ningaloo World Heritage Area and Clerke Reef (Rowley Shoals) are also important for seabirds and shorebirds. Light emissions are not identified as a key threat to any of the EPBC threatened species (Table 3-5).

Lighting impacts to fauna during spill response activities are unlikely to be significant enough to cause flow on impacts to reliant industries such as tourism.

Noise

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, generators and vehicles), and for accessing shoreline areas (e.g. vehicles).

Underwater noise from the use of vessels may impact marine fauna, such as fish, marine reptiles and marine mammals more likely causing behavioural changes which may impact key life-cycle process (e.g. spawning, breeding, calving). Underwater noise can also mask communication or echolocation used by cetaceans. Spill response activities using vessels generating noise have the potential to impact migratory marine fauna including species who have BIAs within the EMBA such as the whale sharks, humpback and blue whales. **Section 0** provides further detail on these potential impacts.

Noise and vibration from terrestrial activities on shorelines has the potential to cause behavioural disturbance to coastal fauna including protected and migratory species of shorebirds and seabirds.

Noise and vibration may affect bird breeding and nesting behaviours and disrupt feeding activity. This could potentially impact reproductive success and for migratory shorebirds may negatively impact the ability to replenish energy reserves for migratory flights. However, if the shoreline is oiled, this may be beneficial by acting as a deterrent for coastal fauna and prevent oiling.

There are 8 EPBC bird species whose BIA overlaps the EMBA. Locations particularly important for seabirds and shorebirds include Lowendal and Montebello Islands, Dampier Archipelago and Eighty Mile Beach (where birds are identified as a KPI). Eighty Mile Beach and Clerke Reef are particularly important areas for seasonal aggregations of migratory shorebirds and the former is a Ramsar site.

Noise impacts to fauna during spill response activities are unlikely to be significant enough to also cause flow on impacts to reliant industries such as tourism and commercial fishing.

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 (GHG) such as carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O), along with non-GHG such as sulphur oxides (SO_x) and nitrous oxides (NO_x). Emissions will result in localised decrease in air quality. **Section 6.3** provides more detail on potential impacts.

Atmospheric emissions from spill response equipment will be localised and while there is potential for fauna and flora impacts, the use of mobile equipment, vessels and vehicles is not considered to create emissions on a scale where noticeable impacts would be predicted. Emissions may occur in Protected Areas and/or areas where tourism is important however the scale of the impact relative to potential oil spill impacts is not considered great.

Operational discharges and waste

Operational discharges include those routine discharges from vessels used during spill response which may include:

- Bilge water;
- Deck drainage;
- Putrescible waste and sewage; and
- Cooling water from operation of engines.

In addition, there are specific spill response discharges and waste creation that may occur, including:

- Decanting oily water in offshore containment and recovery operations;
- Cleaning of oily equipment/vessels and vehicles;
- Flushing water for the cleaning of shoreline habitats;
- Sewage/putrescible and municipal waste at camp areas; and
- Creation, storage and transport of oily waste and contaminated organics.

Operational discharges from vessels may create a localised and temporary reduction in marine water quality. Effects include nutrient enrichment, toxicity, turbidity, temperature and salinity increases as detailed in **Section 6.5**. Discharges may impact a different set of receptors than previously described, given vessel use may occur in shallower coastal waters during spill response activities. Discharge could potentially occur adjacent to marine habitats such as corals, seagrass, macroalgae, however discharges will be very localised and temporary.

The decanting of oily water back into the marine environment during containment and recovery activities has the potential to impact marine organisms from the toxic effects from hydrocarbons, however, given the marine environment is already contaminated with hydrocarbons there is limited potential for an increase in impact, unless the discharge spreads the contamination to a previously uncontaminated area.

Cleaning of oil contaminated equipment, vehicles and vessels, has the potential to spread oil from contaminated areas to those 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 back into the marine environment and result in further dispersion of the oil. The process of flushing has the potential to physically damage shoreline receptors such as mangroves and rocky shoreline communities, increase levels of erosion, and create an additional, and potentially higher, level of impact than if the habitat was left to bio-remediate.

Sewage, putrescible and municipal waste will be generated from onshore activities which may include toilet and washing facilities. These wastes have the potential to attract fauna, impact habitats, flora and fauna and reduce the aesthetic value the environment areas. The creation, storage and transport of oily waste and contaminated organics has the potential to spread impacts of oil to areas, habitats and fauna not previously contaminated. The risk of sewage, putrescible and municipal waste is heightened in areas supporting shorebird population where shoreline staging areas may be deployed. Eighty Mile Beach is an area where large-scale shoreline response could occur and is a Ramsar listed site for migratory shorebirds.

Physical presence and disturbance

The movement and operation of vessels, vehicles, personnel and equipment during spill response activities has the potential to disturb the physical environment, marine/ coastal habitats and fauna, and may also impact cultural and heritage values of an area (refer **Sections 6.6.2** and **6.7.2**). The movement of vessels could introduce invasive marine species attached as biofouling or included within ballast water to nearshore areas, while vehicle and equipment movement could spread non-indigenous flora and fauna.

Oiled wildlife response activities may involve deliberate disturbance (hazing), capture, handling, cleaning, rehabilitation and release of wildlife, which could lead to additional impacts to species including EPBC listed species.

The use of vessels may disturb benthic habitats in coastal waters e.g. corals, seagrass and macroalgae, including those within protected areas. Potential impacts to habitats from shoreline/ nearshore activities includes the deployment of anchor/ chain and the grounding of vessels in shallow waters. Booms create a physical barrier on surface waters which can entangle or prevent the passing of marine fauna using surface waters. Vessel use in shallow coastal waters also increases the chance of contact or behavioural disturbance of marine megafauna including EPBC listed species such as turtles, dolphins, dugongs and seabirds. Increased vessel activity further offshore has the potential to disturb migrating humpback whales, whale sharks and blue whales in season. Locations at risk are Lowendal and Montebello Islands, Barrow Island, Dampier Archipelago and Eighty Mile Beach due to high density/ diversity of benthic habitats (e.g. corals, seagrass and/ or macroalgae) and high abundance of marine megafauna using these habitats (e.g. feeding turtles, dugongs and dolphins).

Vehicles, equipment and personnel used during shoreline response activities have the potential to damage coastal habitats such as dune vegetation, samphire and mangroves and habitats important to threatened and migratory fauna including nests of turtles and birds and bird roosting/ feeding areas. Shoreline clean-up may involve the physical removal of substrates that could cause impact to habitats

and coastal hydrodynamics and alter erosion/ accretion rates. Aside from physical damage to important coastal habitat (e.g. mangroves) and turtle/ bird nesting areas, the operation of vehicles, equipment and personnel can create behavioural disturbance to coastal fauna, particularly birds, which may be present and abundant during daytime operations. As discussed with lighting and noise impacts, disturbance from shoreline operations may affect nesting and feeding behaviours, negatively influencing breeding participation/success or altering migratory behaviours. The disturbance to shorebird feeding may have implications on the replenishment of energy reserves and the timing and success of migratory flights. Although, if the shorelines are oiled, this may have a beneficial hazing effect.

Sensitive mangroves areas are a key feature of the Lowendal and Montebello Islands, Dampier Archipelago and Eighty Mile Beach, while locations particularly important for seabirds or shorebirds include Lowendal and Montebello Islands, Dampier Archipelago and Eighty Mile Beach.

Aside from disturbance to habitats and marine/coastal fauna, spill response activities may create disturbance to cultural values additional to the spill itself. Shorelines of Dampier Archipelago (Burrup Peninsula) have indigenous significance in terms of traditional use for food resources as well as containing symbolic sites and landscapes. Some shorelines of the Dampier Peninsula are subject to Native Title.

Oiled wildlife response may include the hazing, capture, handling, transportation, cleaning and release of wildlife susceptible to oiling such as birds and marine turtles. While oiled wildlife response is aimed at having a net benefit, poor response can potentially create additional stress and exacerbate impacts from oiling, interfering with key life-cycle processes, hampering recovery and in the worst instance increasing levels of mortality.

Impacts from invasive marine species released from vessel biofouling include out-competition, predation and interference with other ecosystem processes. The ability for a non-native species to establish is generally mitigated in deeper offshore waters where the depth, temperature, light availability and habitat diversity is not generally conducive to supporting reproduction and persistence of the invasive species. However, in shallow coastal areas, such as areas where vessel-based spill response activities may take place, conditions are likely to be more favourable. Impacts from invasive terrestrial species are similar in that the invasive species can out-compete local species (e.g. weeds) 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 have a relatively undisturbed flora and fauna community.

Disruption to other users of marine and coastal areas and townships

Spill response activities may involve the use of vessels, equipment and vehicles 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.

Shoreline response activities will restrict access and activities along affected shorelines which may include areas popular for tourism. Fisheries and aquaculture activities (e.g. pearl farming) may also be suspended in areas potentially affected by oil without necessarily being contacted by oil. Tourism and fisheries may be important economic drivers for the economies of local townships. Townships may also be impacted through the influx of spill responders using facilities for accommodation and forward operations areas which may negatively impact local businesses.

Chemical dispersant application

While the aim of chemical dispersants is to provide a net benefit to the environment, the use of dispersants has the potential to increase exposure to habitats under the sea surface, including coral,

seagrass and macroalgae, and to marine fauna (particularly fish and invertebrates) by increasing entrained oil concentration. These receptors are generally located in shallow coastal areas of the mainland and offshore islands.

Increased entrained and aromatic hydrocarbon concentration can contact marine fauna, and are most likely to be encountered by plankton, benthic filter feeding invertebrates, fish and sharks. Fish and sharks include threatened/migratory species, which may ingest oil or uptake toxic compounds across gill structures. As a result of increased exposure to marine fauna and subtidal habitats, socio-economic impacts may be felt through industries such as tourism and commercial fishing.

A description of the potential impacts from entrained oil and aromatic hydrocarbons from a maximum credible worst-case spill is provided in **Section 7.5.3** and **Table 7-13**.

Detailed assay information of Stag crude oil was provided to APASA to commission a report, the *Net Environmental Benefit Analysis for the Use of Dispersants* (APASA, 2012c), to assess whether the application of chemical dispersants reduced the probability of contact to shorelines. Key findings of this report include a reduction in the predicted probabilities for shoreline contact, and greater prediction times to sensitive locations following the application of chemical dispersant, particularly effective during the summer months. These key findings support the use of chemical dispersants on Stag crude as they have potential to reduce hydrocarbon contact to sensitive locations, and also increase the time of the hydrocarbon contact to shorelines, thus giving time for other response strategies to take effect and further reduce impacts.

Jadestone commissioned RPS APASA to re-analyse the outcomes of a quantitative spill risk assessment for hydrocarbon spill scenarios at Stag and conduct modelling to assess the effects of hydrocarbon dispersant application (applied as per Jadestone's proposed Chemical Dispersant Plan in Section 10 or the OPEP) for the worst-case scenario (APASA, 2017).

The modelling results suggest oil loading at the closest onshore receptors, may be reduced through the surface application of chemical dispersants particularly in the summer months. The application of chemical dispersants was predicted to result in a localised increase in the concentration of entrained oil above the impact threshold of 500 ppb, particularly at the Montebello and Lowendal Islands in summer.

During a response, the area over which entrained oil will increase will be a function of the area treated with aerial dispersants. The area treated will be a function of the height at which the dispersants were dropped as well as the volume released and the speed at which the aircraft was moving at the time of release, therefore this estimated area is very much estimated and is expected to be in the order of tens to hundreds of metres. The increase in entrained oil concentration will be short term (minutes to hours) as the floating oil moves into the water column after which dispersion of the entrained oil will see concentrations decrease.

Table 6-19 provides a summary evaluation of the selected strategies performance outcomes and controls, and the benefit that will be provided in applying this strategy.

Overall Consequence assessment: Negligible

Table 6-19: Summary evaluation of selected strategies performance outcomes and controls, and associated benefit

Performance Outcome	Control measure	Benefit	Outcome	Evaluation
Overall spill response				
Spill response has an overall net environmental benefit	Spill response activities selected on basis of a Net Environmental Benefit Analysis (NEBA) (OSRA – JS-70-PLN-I-00037)	Ensures the selection of spill response activities is having an overall net benefit to the environment	Adopt	Considered a standard spill response control
	Implementation of the OPEP	Ensures the selection of spill response activities are implemented to reduce the potential impact to the environment to ALARP	Adopt	Considered a standard spill response control
	Competency and Training Management System (JS-60-PR-Q-00015) ¹	Ensures spill response activities are undertaken by competent personnel	Adopt	Considered a standard control
	DoT and DBCA consulted with on shoreline operations location(s) in State waters as per Section 6	Prevents additional impacts to shoreline locations and fauna	Adopt	If a temporary camp is required, then will be determined in consultation
	Response operations conducted during daylight hours only	Reduces potential for behavioural disturbance	Adopt	Accepted on safety, operational effectiveness and environmental grounds.
	Waste Management Plan – Oil Spill Response Support (JS-70-PR-I-00037)	Prevents secondary contamination and litter	Adopt	Considered a standard control

¹ The Competency and Training Management System outlines the framework and requirements for maintaining staff competency and training specifications for Jadestone. It provides an overview of the requirements for staff and contractors to meet their training obligations and the context within which the system operates.

Performance Outcome	Control measure	Benefit	Outcome	Evaluation
Light emissions				
Light spill onto shorelines and coastal waters is reduced to ALARP during spill response	Response vessels stand-off at night with lighting required for safety only	Reduces potential for behavioural disturbance	Adopt	Accepted on safety, operational effectiveness and environmental grounds.
	Review vessel lighting to a type (colour) that will reduce impacts to fauna	Reduces potential for behavioural disturbance	Reject	Not required given vessel restrictions at night High cost associated with change-out of vessel lighting Time delay in spill response
	Review shoreline lighting to a type (colour) that will reduce impacts to fauna	Reduces potential for behavioural disturbance	Reject	Response operations conducted during daylight hours only
Noise				
Noise emissions reduced to ALARP during spill response	Support vessel and aircraft compliance with EPBC Act Regulation 8 (cetacean interactions) (Stag Marine Facility Operating Manual GF-90-MN-G-00038, Aviation Procedure JS-83-PR-G-00010)	Reduces potential for behavioural disturbance to cetaceans	Adopt	A standard control (regulatory requirement)
	Use of noise reduction barriers for portable equipment on shorelines	Reduces sound level	Reject	Sound levels from portable equipment not expected to warrant additional costs and potential delays related to applying specialised sound control barriers
Atmospheric emissions				
Spill response vessel emissions meet MARPOL requirements	If required under MARPOL, Vessels will maintain a current International Air Pollution Prevention (IAPP) Certificate.	Reduces level of air quality impacts	Adopt – must accept this regulatory requirement	Considered a standard control (regulatory requirement) – given low impact of atmospheric emissions further control evaluation not deemed necessary.

Performance Outcome	Control measure	Benefit	Outcome	Evaluation
Operational discharges and waste				
Impacts from spill response operational discharges are reduced to ALARP	Deck cleaning products released to sea are non-hazardous, readily biodegradable and non-bio-accumulative.	Reduces potential toxicity impacts to marine organisms	Reject	Vessel owners and operators are responsible for their own operational products
	Vessels meet applicable MARPOL and Marine Park sewage disposal requirements	Reduces water quality impacts in nearshore environment	Adopt	Considered a standard control (regulatory requirement)
	Vessel meet applicable MARPOL requirements for oily water (bilge) discharges	Reduces water quality impacts in nearshore environment	Adopt	Considered a standard control (regulatory requirement)
	Zero bilge discharge policy	Reduces water quality impacts anywhere from bilge water	Reject	Given regulatory requirements exist to protect nearshore locations, zero discharge may potentially delay or interrupt vessel mobilisation/activity for negligible benefit
	Decant oily water from offshore containment and recovery behind boom	Prevents spreading of oily water	Adopt	Considered a standard control
	Obtain approvals from relevant Jurisdictional Authority prior to commencing decanting operations	Prevents spreading of oily water	Adopt	Considered a standard control (regulatory requirement)
	Offshore Equipment washdown confined to hot zone	Prevents spreading of oily water	Adopt	Considered a standard control
	Use of environmentally friendly degreaser for offshore washdown	Reduces toxic impacts within water column	Adopt	Can be achieved with minimal cost
	Onshore equipment washdown in defined area	Prevents spreading of oily water	Adopt	Considered a standard control

Performance Outcome	Control measure	Benefit	Outcome	Evaluation
	Low pressure flushing of shoreline habitats using ambient temperature seawater	Reduces habitat damage, penetration of oil into sediments and erosion	Adopt	Considered a standard control
	Use of booms to contain shoreline flushing liquids	Reduces spread of oily water	Adopt	Will be accepted on a case by case basis – may be preferred if remobilisation of oil could further impact sensitive habitats. May not be applied if impacts from deploying booms exceed potential benefit
Prevention of secondary contamination of oily waste and litter during spill response	Compliance with controlled waste and disposal regulations	Prevents secondary contamination from oil waste	Adopt	Considered a standard control (regulatory requirement)
	Municipal waste containers present onsite	Prevents litter	Adopt	Considered a standard control
	Compliance with local government municipal waste requirements	Prevents incorrect disposal	Adopt	Considered a standard control (regulatory requirement)
Physical presence and disturbance				
Disturbance to habitats, fauna and culturally sensitive areas during spill response is reduced to ALARP	Use of shallow draft vessels for shoreline and nearshore operations	Reduce seabed and shoreline habitat disturbance	Adopt	Considered a standard control
	Conduct shoreline assessment	Reduce seabed and shoreline habitat disturbance	Adopt	Considered a standard control
	Establish demarcation zones for vessel, boom and skimmer usage	Reduce seabed and shoreline habitat disturbance	Adopt	Accept based on potential for spill to enter sensitive shoreline locations and can be adopted during planning with minimal cost
	Maintenance and inspection personnel assigned to boom sets	Reduce seabed and shoreline habitat disturbance	Adopt	Considered a standard control
	IMT assessment/selection of vehicles appropriate to shoreline conditions	Reduce coastal habitat and fauna disturbance	Adopt	Considered a standard control

Performance Outcome	Control measure	Benefit	Outcome	Evaluation
	Establish demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/roosting areas and turtle nesting habitat	Reduce coastal habitat and fauna disturbance	Adopt	Considered a standard control
	Operational restriction of vehicle and personnel movement to limit erosion, compaction and disturbance to birdlife	Reduce coastal habitat erosion and compaction and disturbance to birdlife	Adopt	Considered a standard control
	Access plans for shoreline operations will prioritise use of existing roads and tracks	Reduce coastal habitat and fauna disturbance	Adopt	Considered a standard control
	Use of landing barges	Reduce coastal habitat and fauna disturbance	Adopt	Will be assessed as part of site evaluation
	Use of Specialist Advisor if Operational Area overlapped with potential areas of cultural and heritage significance	Reduce disturbance to cultural and heritage significant sites	Adopt	Specialised knowledge may be required to identify cultural and heritage significant sites
	Pre-cleaning and inspection of equipment	Prevent introduction of invasive species	Adopt	Minimal costs and good practice considering potential for high value nature reserves and remote areas, with relatively undisturbed environments, to be accessed
	Use airborne vehicle deployment (helicopters) where onshore access not feasible	Reduce coastal habitat and fauna disturbance	Reject	High costs, logistical constraints and high safety risk Landing barges will be utilised where possible
	Interstate and International vessels comply with the Marine Biosecurity Manual (JS-70-MN-G-00001)	Reduce risk for introduction of invasive marine species as part of vessel biofouling	Adopt	Considered a standard control

Performance Outcome	Control measure	Benefit	Outcome	Evaluation
	Locally sourced vessels comply with Vessels comply with the Marine Biosecurity Manual (JS-70-MN-G-00001)	Small reduction in IMS risk given most vessels are local and already operate in the region Greatest risk is international and interstate vessels	Reject	Minimal benefit in terms of risk reduction is outweighed by the delays in implementing Vessel Check over the many local vessels that would be required to mobilise rapidly.
	Ballast water management plan review requirement for interstate and international vessels (only)	Improve water quality discharge to marine environment to ALARP Reduce risk of introduced marine species	Adopt	Considered a standard control Vessels likely to be sourced from within WA waters
Oiled Wildlife Response				
Additional impacts from oiled wildlife response are reduced to ALARP	Implement WA Oiled Wildlife Response Plan and Regional Oiled Wildlife Response Plans	Reduce unnecessary disturbance and stress to wildlife from hazing, capture, handling, cleaning, rehabilitation, release and euthanasia	Adopt	Considered a standard control
Chemical dispersant application				
Additional impacts from dispersant application are reduced to ALARP	Chemical dispersant selected after having been risk assessed through Jadestone Chemical Selection, Evaluation and Approval Procedure (JS-70-PR-I-00033) The evaluation must find the chemical acceptable for use prior to application.	Reduce impacts on fauna / flora from toxicity of the dispersant	Adopt	A standard procedure Jadestone Chemical Selection, Evaluation and Approval Procedure (JS-70-PR-I-00033) used for chemical selection
	Field trial undertaken of dispersant efficacy	Ensures dispersants are not added for no potential benefit	Adopt	Considered a standard control
	Dispersant application location and volume assessment undertaken in IAP	Reduces impacts from dispersant and oil (entrained and dissolved)	Adopt	Considered a standard control

Performance Outcome	Control measure	Benefit	Outcome	Evaluation
		to sensitive shallow water habitats		
	Selection of correct equipment for application	Ensures correct dosage	Adopt	Considered a standard control
	Operational monitoring of oil and oil in water during dispersant application	Provides information to inform NEBA analysis	Adopt	Considered a standard control
	No dispersant application	Prevents any potential impacts from dispersant or chemically dispersed oil	Reject	Dispersant modelling indicates that dispersant has the potential to reduce shoreline loading and spatial extent of oil in some scenarios. Therefore, it is better to have in the toolbox and decision for application will be subject to the NEBA.
Disruption to other users of marine and coastal area and townships				
Reduce and control disruption to other users of marine and coastal areas and townships during spill response is reduced to ALARP	Stakeholder consultation (Refer Section 6)	Early awareness of spill response activities which reduces potential disruption	Adopt	Considered a standard control
	Localised Risk Management Assessment to be conducted if the response is of significant size in comparison to the size of the coastal community	Reduces potential impact due to higher utility demands causing disruptions to local community	Adopt	Considered a standard control

6.9.3 Environmental performance

The OPEP contains environmental performance measures for the spill responses, this table outlines the spill response preparedness measures only.

Hazard		Oil Spill Response Activities (EPH-10)		
Performance Outcome		Spill response has an overall net environmental benefit		
ID	Management Controls	Performance Standard	Measurement Criteria	Responsibility
Overall spill response				
Spill response preparedness				
056	Contracts valid and maintained in accordance with Jadestone Energy Contractor Management Framework (JS-90-PR-G-00002) to ensure access to competent personnel and appropriate equipment	Contracts in place and current with competent providers and suppliers	Contractor assessment records	Supply Chain Manager
057	AMOSC MSC/AMSA MOU valid for life of the EP	AMOSC membership allowing access to mutual aid arrangements for spill response crew and equipment via a Master Services Contract (MSC) AMSA MOU (access to NRT and resources)	Current AMOSC membership and MSC AMSA MOU valid for 5 years from 2017	Country Manager
058	Response personnel competent and trained in accordance with Jadestone Energy Incident Management Team Response Plan (JS-70-PLN-F-00008)	Assessment of response personnel as being competent and trained according to the requirements of response roles (JS-70-PLN-F-00008)	Response personnel competency and training records	HR Manager
059	Jadestone Energy Audit Manual (JS-90-PR-G-00003) includes emergency response and spill preparedness	Audit of Jadestone’s emergency response and spill preparedness requirements as scheduled	Audit schedule Audit reports	ER Lead

Hazard		Oil Spill Response Activities (EPH-10)		
Performance Outcome		Spill response has an overall net environmental benefit		
ID	Management Controls	Performance Standard	Measurement Criteria	Responsibility
060	OPEP maintained to ensure spill response is appropriate to nature and scale of risk	Spill response planning and preparedness aligned with nature and scale of risk	Stag OPEP	ER Lead
061	Shipboard Oil Pollution Emergency Plan valid and tested to ensure ability to respond to spills as required by MARPOL	In line with MARPOL Annex 1, vessels over 400 gross tonnage will have a current Shipboard Oil Pollution Emergency Plan (SOPEP)/ Shipboard Marine Pollution Emergency Plan (SMPEP) and International Oil Pollution Prevention (IOPP) certificate	Current SOPEP and exercise schedule	Operations Manager
062		Spill exercises are conducted in accordance with the SOPEP		
063	Personnel aware of roles and responsibilities in the event of a response in accordance with Stag Incident Response Plan (GF-00-PR-F-00041)	Instructs offshore response roles and responsibilities and training requirements.	Exercise records Training and induction records	Stag OIM
064	Labour hire contract in place for life of EP to source labour for spill response	Labour hire contract in place to provide access to personnel	Labour hire contract	HR Manager
065	Vessel availability for containment and recovery activity is monitored monthly via Jadestone's nominated vessel broker	Monitor the availability of vessels that are suitable for deployment of the Containment and Recovery strategy as defined in the OPEP	Monthly monitoring reports	Supply Chain Management
066	Maintain contract with Jadestone's Waste Management Contractor for life of the EP	Waste management contract is maintained which enables access to waste storage facilities and waste transport	Contractor assessment records	Logistics Lead

Hazard		Oil Spill Response Activities (EPH-10)		
Performance Outcome		Spill response has an overall net environmental benefit		
ID	Management Controls	Performance Standard	Measurement Criteria	Responsibility
067	Maintain contract with tracker buoy provider for life of the EP	Contract is maintained which enables access to tracking buoy services	Contract valid and current	ER Lead

6.9.4 ALARP Assessment

The purpose of implementing spill response activities is to reduce the severity of impacts from an oil spill to the environment. However, if the strategies do more harm than good (i.e. they are not having a net environmental benefit) then the spill response is not ALARP. The key process in determining if the strategies employed are having a net benefit is the net environmental benefit analysis (NEBA). A NEBA is conducted for each operational period during a response to ensure the best strategies are being implemented and the ALARP principle is regularly tested (refer to the OPEP for further detail).

It is best practice to ensure all possible response strategies have been evaluated and, if there is the potential to produce a net environmental benefit, to have them in the toolbox ready for implementation if determined feasible for the scenario, (IPIECA (2016) Contingency planning for oil spill on water: good practice guidelines for the development of an effective spill response capability).

For each of the environmental hazards associated with spill response strategies an ALARP evaluation was conducted as part of the hazard identification workshop (HAZID). A number of controls were identified as industry and/ or Jadestone standard controls that will be considered during a spill response while additional controls were evaluated and either accepted or rejected on the basis of the ALARP principal, i.e. a decision was based on whether the additional control would have a cost/effort disproportionate to the level of impact reduction it would provide. Results of the evaluation are shown in **Table 6-19** and reflected in **Section 8.5.7**.

Note that some of the potential impacts to fauna from spill response activities can be beneficial in the prevention of oiling by acting as deterrents. For example, if shoreline operations are being undertaken at a turtle nesting or bird breeding site, fauna may avoid the location as disturbed by noise or people and thereby not be oiled.

6.9.5 Acceptability Assessment

The potential impacts of spill response activities are considered 'Broadly Acceptable' in accordance with the Environment Regulations, based on the acceptability criteria outlined below. The control measures proposed are consistent with relevant legislation, standards and codes.	
Policy compliance	Jadestone’s HSE Policy objectives are met.
Management system compliance	Section 9 demonstrates that Jadestone’s HSE Management System is capable of continuously reviewing and updating activities and practices at the Stag facility, including spill response arrangements.
Social acceptability	Stakeholder consultation has been undertaken (see Section 6), including engagement with the State and National response agencies of DoT and AMSA, nearby operators, AMOSC, as well as commercial and recreational fishing industry bodies and fishers. No stakeholder concerns have been raised with regards to impacts of the spill response activities on relevant persons. During any spill response, a close working relationship with key regulatory bodies (e.g. DoT, DBCA, AMSA, DER) will occur and thus there will be ongoing consultation with relevant persons during response operations.
Laws and standards	Jadestone is obligated to respond to a hydrocarbon spill under the following legislative instruments: <ul style="list-style-type: none"> • OPGGS Act Section 572A-F – polluter pays for escape of petroleum • AMSA Marine Orders Part 91 • Protection of the Sea (Prevention of Pollution from Ships) Act 1983 • Protection of the Sea (Civil Liability for Bunker Oil Pollution Damage) Act 2008
Industry best practice	Response planning and preparedness undertaken in accordance with: <ul style="list-style-type: none"> • NatPlan (AMSA, 2020)

	<ul style="list-style-type: none"> • AMOSPlan (AMOSC, 2017) • NOPSEMA Guidance Notes (e.g. Oil Pollution Risk Management Guidance Note July 2021) • DoT Offshore Petroleum Industry Guidance Note, Marine Oil Pollution: Response and Consultation Arrangement July 2020 • DoT OSCP (2015) • State Hazard Plan – Maritime Environmental Emergencies (MEE), 2020) • Fingas, M.F. (2012) The Basics of Oil Spill Clean-up. CRC Press. Florida, United States of America. • ITOPF Technical Information Papers including: <ul style="list-style-type: none"> ITOPF (2014) Technical Information Paper Dispersant Use ITOPF (2020). ITOPF Members Handbook 2020/2021 ITOPF (2014) Technical Information Paper Clean-up of oil from shorelines ITOPF (2013). Technical Information Paper Use of Booms in oil pollution response · • IPIECA International Association of Oil and Gas Producers Good Practice Guide Series including: <ul style="list-style-type: none"> IPIECA-IOGP. (2015) A Guide to Oiled Shoreline Clean-up Techniques: Good practice guidelines for incident management and emergency response personnel IPIECA-IOGP (2015) Oil spill preparedness and response: an introduction IPIECA-IOGP (2015) Contingency planning for oil spills on water Good practice guidelines for the development of an effective spill response capability • Oil Spill Response (OSRL) handbooks including: <ul style="list-style-type: none"> Shoreline operations handbook Containment and recovery handbook Dispersant application field guide
<p>Environmental context</p>	<p>The worst-case credible spill scenario for the Stag facility operating activities is as a result of loss of pipeline integrity. The release of oil occurs over 30 minutes and the area of dispersion over which the oil travels is between Eighty Mile Beach to the north, and to Ningaloo in the south. The oil is primarily floating and sensitive receptors at risk include seabirds, shorebirds, marine fauna and coastal habitats.</p> <p>While some response strategies (e.g. application of chemical dispersants and booming operations) may pose additional risk to sensitive receptors, to not implement response activities would likely result in greater negative impact to the receiving environment and a longer recovery period. Response activities are undertaken in accordance with controls which reduce and/or prevent additional risks.</p> <p>The mutual interests of responding and protecting sensitive receptors from further impact due to response activities is managed through the use of a net environmental benefit analysis during response strategy planning in preparedness arrangements as well as during a response.</p> <p>The potential impact is considered acceptable after consideration of:</p> <ul style="list-style-type: none"> - Potential impact pathways - Preservation of critical habitats - Assessment of key threats as described in species and Area Management /Recovery plans - Consideration of North-West Bioregional Plan; and - Principles of ecologically sustainable development ESD
<p>Conservation and management advice</p>	<p>Jadestone Energy will have regard to the representative values of the reserves and other information published and endeavour to ensure that priority is given to the social and</p>

	<p>ecological objectives and values, of any AMPs, or state MPs impacted by spill response activities to ensure that the objectives of the management plans are not contravened.</p> <p>Noting 'Emergency response' is permitted in all AMPs and State MPs.</p> <p>Actions required to respond to oil pollution incidents, including environmental monitoring and remediation, in connection with activities authorised under the OPGGS Act may be conducted in all zones. The Director will be notified in the event of an oil pollution incident that occurs within, or may impact upon, an Australian MP and, so far as reasonably practicable, prior to a response action being taken within a MP.</p> <p>The Management Plans for EPBC protected species that identify light, noise and other risks through Sections 6.1 – 6.8 apply here.</p> <p>The 'Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species' will be applied/used as guidance in the event of an oil spill.</p>
ALARP	The residual risk has been demonstrated to be ALARP.

7. ASSESSMENT – UNPLANNED EVENTS

This section of the EP describes the potential risks and environmental impacts from accidental events that may arise during the operation of the Stag Facility and associated mitigation and management measures that will be implemented to reduce impacts to an acceptable level.

The environmental risk assessment process identified five accidental environmental risks. The pre-treatment and residual risk rankings are summarised in **Table 7-1** and presented in detail throughout this section.

Table 7-1: Summary of the environmental risk assessment ranking for accidental events

Hazard	Consequence	Likelihood	Ranking
IMS introduction	Moderate	Rare	Low
Unplanned release of solids	Minor	Likely	Medium
Unplanned release of non-hydrocarbon liquids	Minor	Unlikely	Low
Unplanned release of Stag crude oil	Major	Unlikely	Medium
Unplanned release of diesel	Minor	Unlikely	Low

The presentation of impacts and risks identified during the assessment process for hazards associated with unplanned activities is provided as follows:

- Description of the hazard;
- Impacts and risks – a discussion and assessment of the environmental impacts and risks associated with accidental events that may arise;
- Environmental performance – a description of a measurable level of performance required for the management of environmental aspects to ensure that the environmental impacts and risks will be of an acceptable level; and a statement of performance required of a control measure. This includes a description of the control measures in place to reduce the impact and control the risk; and
- Demonstration of ALARP and Acceptability – a demonstration that the environmental impacts and risks will be reduced to ALARP and will be of an acceptable level, and the rationale for these statements.
- A review of the potential unplanned impacts was undertaken in August 2022.
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7.1 Invasive Marine Species Introduction

7.1.1 Description of Hazard

Aspect	Ballast water is taken up and discharged at the Stag location by third party vessels, these vessels may be sourced from both international or domestic locations.
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7.1.2 Impacts and Risks

The introduction and establishment of invasive marine species (IMS) can result in a localised impact on native marine fauna and flora, including:

- Competition, predation or displacement of native species;
- Alteration of natural ecological processes;
- Introduction of pathogens with the potential to impact human and/or ecological health;

- Reduction and/or competition with commercial fish and aquaculture species; and
- Increased requirement for maintenance of vessels and marine infrastructure.

Potential sources for the transfer and establishment of IMS include:

- Biofouling on vessels on external surfaces and other external niches (e.g. sea chests, propulsion units, steering gear and thruster tunnels);
- Biofouling of vessels within internal system niches (e.g., strainers, seawater pipe work, anchor cable lockers);
- Biofouling on equipment that routinely becomes immersed in water (including but not limited to equipment such as conductor casing and ROVs); and
- Discharge of high risk ballast water taken up at international or domestic sources.

There are four key steps involved for a successful IMS incursion:

- Colonisation and establishment of the marine pest on a vector (e.g. vessel) in a donor region (e.g. home port);
- Survival of the organism on the vector during the voyage from the donor to the recipient region;
- Transfer from the vector to habitat in the recipient region; and
- Colonisation (e.g. reproduction or dislodgement) of the recipient region by the marine pest, followed by successful establishment of a viable new population (Commonwealth Government, 2009).

Colonisation requires there to be suitable environmental conditions for the particular species, including aspects such as water temperature, water depth, salinity, food availability and habitat type. Marine pest species also tend to be coastal species, and as such, most exotic marine pests introduced to Australian waters have distributions restricted to shallower coastal habitats.

It is unlikely that any IMS entering the Operational Area would establish on the natural benthic habitat (soft sediments at the seabed). The depth of the Operational Area (49 m), low-nutrient open ocean conditions and lack of available light at this depth provides a very different environment to that within sheltered ports and shallow coastal areas which are the typical sources of, and which have historically been colonised by IMS. Subsequently the likelihood of a potential introduction of IMS is considered low. However, there exists a risk that the field infrastructure may harbour IMS. Should such a situation exist, this would represent a subsequent risk of transfer of IMS to vessels visiting Stag, or potentially as a reservoir for spread of invasive species to Australian coastal areas via natural processes of dispersion and range expansion.

To act as a harbour for introduced marine species, a number of links in a sequential chain of successive processes would need to be properly aligned, with these summarised as follows:

- An exotic species would need to be successfully conveyed to the Stag field, such as via vessel biofouling;
- The exotic species would need to successfully transfer from its arrival vector to the field infrastructure, and establish on that new substrate; and
- The habitat conditions presented by the Stag field infrastructure and wider environment would need to be conducive to the enduring survival of that species.

It is to be remembered that not all exotic marine species present as 'invasive' or 'pest' species. To be considered as 'invasive', the introduced species must be able to survive and establish in the new location, and subsequently manifest as some form of nuisance or pest (NOPSEMA 2018). Furthermore, even if an exotic species had established on the Stag infrastructure, it would only then represent any tangible threat to

Australian waters in the event that it was able to further its range, either through natural processes such as larval dispersion, or by transfer to another vector, such as by subsequent biofouling of a work vessel operating in the Stag field. Without this secondary transfer mechanism any exotic species colony which may be established at Stag would represent an isolated community of no wider significance or ecological consequence (PGM Environment, 2021).

Following their establishment, eradication of marine pest populations is often impossible, limiting management options to ongoing control or impact minimisation. For this reason, increased management requirements have been implemented by Commonwealth and State agencies via the development of Australia's National System for the Prevention and Management of Marine Pest Incursions which looks at managing biofouling and ballast water.

Ballast water

The Department of Agriculture Water and Environment (DAWE) is the lead agency for management of ballast water from vessels operating in Australian waters. DAWE introduced the Australian Ballast Water Management Requirements Version 8 (DAWE 2020) that are enforced under the *Biosecurity Act 2015*. The requirements provide guidance for vessel operators on best practice policies and apply to all vessels operating internationally and domestically in Australia.

Key points for vessels intending to discharge ballast within Australian waters, as detailed within the Australian Ballast Water Management Requirements Version 8 include:

- All vessels must carry a valid ballast water management plan;
- All vessels must carry a valid International Ballast Water Management certificate;
- Vessels with a ballast water management system (BWMS) must carry a Type Approval Certificate specific to the type of BWMS installed; and
- All vessels must maintain a complete and accurate record of all ballast water movements.

Biofouling

Under the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (DAWR, 2009), a risk assessment approach is recommended to manage biofouling. The marine biosecurity risk arising from vessel biofouling is subject to control under the Biosecurity Act 2015, although DAWE does not impose specific vessel biofouling regulations.

The potential biofouling risk presented by vessels within the Operational Area relates to the length of time vessels are in Australian waters or operating outside Australian waters, the length of time spent at these location(s) and whether the vessels have undergone hull inspections and cleaning and the age of the antifouling coating, prior to entering Australian waters.

Any vessel or marine infrastructure destined for WA waters from interstate or overseas is also required to meet the aquatic biosecurity standards set out under the *Fisheries Resources Management Act 1994*, as administered by the DPIRD. In some circumstances, a Marine Biosecurity Inspection for the presence of known and potential IMS is required to ensure compliance with Regulation 176. No target marine species of concern to WA waters should be detected during any such inspection. In accordance with marine pest management guidelines (as enforced under the *WA Fish Resources Management Act 1994*; and *Fish Resources Management Regulations 1995*):

- Immersible equipment and the vessel hull, sea chests and other niches must be 'clean'¹⁴ before any vessels enter WA waters and ports; and
- The suspected or confirmed presence of any marine pests or disease must be reported within 24 hours by email (biosecurity@fish.gov.au) or telephone (FishWatch tel: 1800 815 507). This includes any organism listed on the WA Prevention List of Introduced Marine Pests, and any other non-indigenous organism, that demonstrates invasive characteristics.

The risk of biofouling transfer from vessels to isolated, hard anthropogenic substrates has been assessed previously (URS 2013), with the conclusion that the likelihood of such transfer was minimal for sessile species. It was considered that any such transfer is more likely for swimming and other mobile species, such as crabs. Any inherent risk of transfer from a vessel of invasive mobile and swimming species can be minimised by managing vessel hulls to have only minimal fouling, thus denying mobile species suitable habitat for their own colonisation and sustenance.

Stag Field IMS Status

As an initial IMS risk screening and management focus measure, species listed or assessed as invasive by DAWE were considered in the context of their potential to be able to establish on the Stag infrastructure, following possible transfer to the field by ships. These candidate species were primarily drawn from those considered as presenting tangible risk via the process of development of the Australian Priority Marine Pest List (ABARES 2019). This field of candidate species was further refined, based upon work by Australian Government agencies (MPSC 2020; NIMPIS 2008; Richmond et al. 2010) by dismissing those which would require habitat conditions not available in the Stag field, with subsequent concentration upon those which could theoretically establish upon Stag and present tangible risk of further spread to Australian coastal waters.

In accordance with NOPSEMA guidance (NOPSEMA 2018), video ROV footage captured during structural assessment surveys of Stag field infrastructure in February and July 2020 was reviewed as a means of detecting any invasive species which may have established (PGM Environment, 2021). Notwithstanding the inherent limitations of in-water surveys, and the difficulties of detecting mobile species such as crabs, the review of ROV video footage did not detect any listed IMS nor indicate their likely presence (PGM Environment 2021). In general terms, the biofouling assemblage observed on the Stag field infrastructure was representative of that which would be expected of any structure immersed for an extended period in the waters in that region.

Should any IMS establish in the Stag field, other than being an isolated colony of note, they would only represent any specific biosecurity hazard to Australian waters if they were able to transfer from Stag to a nearby location of some ecological, social or economic significance and then establish in that latter location. Those locations exhibiting potential significance or vulnerability to invasion include nearby ports and conservation areas. The closest coastal areas to Stag are Dampier archipelago approximately 32km away, and the nearest marine protected areas or significant regional features are the Glomar Shoals and the Montebello Islands, which are 100km and 75 km, respectively, from Stag at their closest points. Any IMS located at Stag could only reach any of these locations following spread and dispersal by mechanisms such as currents or carriage by vessel.

Currents in the Stag field are semi-diurnal and predicted to have average speeds of approximately 0.25 knots up to 0.5 knots. The oscillating nature of the currents suggests that it would take somewhat in excess of three days, as a minimum, for floating larvae to reach the coastal locations in closest proximity to the Stag field,

¹⁴ With 'clean' implied by DPIRD as free of listed IMS

and somewhat longer to reach the closest conservation significant areas. Spread of IMS from the Stag field could also be conceivably accomplished by larval colonisation of vessels operating in the Stag field, or by mobile species swimming across to such a vessel, with subsequent vessel-mediated transfer to other locations. Although theoretically possible, such transfer has been reviewed and deemed to present a low likelihood of occurrence (URS 2013).

On the basis of the species risk evaluations and review of available video footage, it may be stated that the Stag field infrastructure, as at the time of the reviewed ROV surveys, presented no evidence of having been colonised by listed marine pest species of concern to DAWE, and with no indicators of likely presence. Accordingly, and within the limitations intrinsic to such surveys, it may be concluded that Stag infrastructure is unlikely to harbour IMS of concern and thus represents minimal risk as a haven or staging point for subsequent further spread of IMS (PGM Environment, 2021).

It is well recognised by Australian authorities that IMS can have deleterious effects upon marine areas, including conservation areas, in a number of ways such as by:

- Out competing;
- Predating upon or displacing native species;
- Altering natural ecological processes;
- Harbours pathogens which can impact upon ecological or human health; or
- Degrading commercial fisheries and aquaculture enterprises.

Determination and description of the potential effects and consequences of IMS colonisation of conservation dependent areas in the vicinity of Stag would be species dependent and require considerable research and analysis for minimal, if any, substantive return or benefit to the tailoring of adopted management measures and is not a standard industry practice nor one required by the responsible Commonwealth or State/Territory regulators. However, if IMS were established it may have a ‘moderate’ impact - Local effect; recovery in months to a year; impact to localised community.

There are increased concerns regarding fishery impacts following the introduction of IMS into Australian waters. Should IMS be introduced, they have the potential to outcompete and displace native species which may in turn affect the local marine ecosystem, and potentially fisheries operating in the area affected. However, the Operational area does not contain any known critical areas (i.e. feeding, breeding) or highly significant habitat (i.e. coral reef, seagrass) for fish. It is also unlikely that IMS will be able to establish. However, if IMS were established it may have a ‘moderate’ impact - Local effect; recovery in months to a year; impact to localised community.

<i>Overall Consequence</i>	<i>Overall Likelihood</i>	<i>Residual Ranking</i>
Moderate	Rare	Low

7.1.3 Environmental Performance

Hazard		IMS Introduction (EUH-1)		
Performance objective		No introduction of IMS		
ID	Management controls	Performance standards	Measurement criteria	Responsibility
068	All third party tankers are cleaned prior to mobilising to the Stag field	All third party tankers undergo the following prior to disembarkation to the Stag field: <ul style="list-style-type: none"> - hull cleaning, - clean of the chain lockers and all open spaces on deck, - chemical flushing of inboard lines - provision of Ship Sanitation certificate Once confirmed by IMS SME as cleaned, the tanker must disembark within seven days of the cleaning activities being confirmed as completed.	IMS inspection report confirms third party tanker satisfactorily cleaned prior to disembarkation by IMS SME	Marine Superintendent
069	Vessels comply with the Biosecurity Manual JS-70-MN-G-00001*	Biofouling risk assessment to be completed prior to commencement of work within Jadestone operational areas and found to represent a low risk, or an otherwise acceptably low managed risk of potentially introducing IMS. For vessels with a biofouling risk assessment result found to not represent a low or acceptable risk, risk reduction actions must be applied prior to commencement of operation at a Jadestone site such that the subsequent risk is considered low or acceptable.	Biofouling risk assessment completed for vessel prior to commencement of work at Jadestone operated site and found to be low or acceptable risk	Operations Manager
070		For vessels designed to use ballast water, they must have: <ul style="list-style-type: none"> - A valid ballast water management certificate - A ballast water management plan consistent with ballast water management convention, and approved - A ballast water record book consistent with ballast water management convention. 	Ballast water certificate Approved Ballast Water Management Plan Ballast Water Management Certificate Ballast Water Record Book	

* The biosecurity manual applies to all marine vessel operations in Operational Areas and has as its purpose to:
Describe the marine biosecurity management process for Jadestone Energy (Australia) Pty Ltd activities including vessels contracted to perform marine operations.

Prevent the introduction of Invasive Marine Species (IMS) into Australian Waters and the Operational Area through translocation vectors such as marine and petroleum vessels, immersible equipment and ballast water.

Ensure contracted vessels and vessel operators are aware of and apply the marine biosecurity requirements when chartered to execute their scope of work.

Ensure compliance with Commonwealth and State Australian Government legislation.

Detail the risk-based approach and mitigations used to reduce the risk of IMS being introduced to the operational area to As Low as Reasonably Practicable (ALARP).

7.1.4 ALARP Assessment

On the basis of the impact and risk assessment process completed, Jadestone considers the control measures described above are appropriate to manage the risk of IMS being introduced at the Stag facility. The residual risk ranking for this potential impact is considered Low, and therefore ALARP has been demonstrated. Additional controls considered but rejected are detailed below.

Rejected control	Hierarchy	Practicable	Cost effective	Justification
No routine discharge of ballast water from vessels	Eliminate	No	No	Vessel presence is required to carry out operational activities. Ballast exchange is required for safe operation of vessels and eliminating this requirement is not possible.
All vessels to be sourced from Australian waters	Eliminate	No	No	Vessel presence is required to carry out operational activities. Delays to activities caused by delays to contracting vessel(s). Minimal benefit expected given the implemented controls ensure only low IMS risk vessel are contracted.
Follow-up marine pest inspection around 75 days after arrival if the vessel is still in WA waters	Isolation	No	No	The residual risk of IMS is considered low due to inspection and cleaning controls and follow-up inspections of vessels 75 days after arrival is not considered required. In the event that any IMS entered the Operational Area the nearest habitat is the third-party tanker hull or the benthic habitat (soft sediments at the seabed). The anti-fouling coating, depth of the Operational Area (49 m), open ocean conditions and lack of available light at this depth provides a unsuitable or incompatible habitat conditions to those within the sheltered ports and shallow coastal areas which have historically been colonised by IMS.
N/a	Substitute	N/a	N/a	Wherever possible, domestic vessels will be sourced, but this may not always be feasible. However, all vessels are subject to IMS risk assessment and must manage their ballast water in accordance with regulatory requirements.
Application of new anti-foulant coating to vessels prior to contract commencement	Engineering	No	No	Substantial additional cost, potential delay to production operation. Little benefit given recent anti-fouling treatment history for vessels and requirement to complete IMS Risk assessment. Anti-fouling coating on the in-water surfaces of vessels, and the chemical dosing of seachests (marine growth prevention system) will occur. Anti-fouling coatings containing TBT are not considered an option as these biocides are prohibited for use in Australia.
Hull cleaning on every occasion	Engineering	No	No	Additional cost and potential delay to production operation, little benefit since hulls will be inspected and cleaned if required when

				using the IMS Vessel Check tool and inspected/assessed to the standard detailed in applicable DAWE biofouling guidelines (DAWR 2009) (as required).
Ballast water treatment (e.g. biocide or UV)	Engineering	No	No	Dependent upon vessel age and configuration, some may be fitted with a Ballast Water Treatment System (BWTS) able to treat ballast water to the standard required by DAWE. If a vessel is not fitted with a BWTS, then ballast water treatment is not a practicable management option, with alternatives required by DAWE as the regulatory authority.
Transfer of ballast water to separate vessel for discharge outside operational area	Isolation	No	No	Generally, intake and outlet of ballast water will occur at the 'same' location (within 1 nautical mile of the two points). Substantial additional cost would be incurred to go outside of the operational area each time. Potential activity downtime and increase in activity duration as operations would likely need to cease during ballast water transfer. Little benefit given lack of sensitive habitats (shallow water habitats etc.), and potential translocation vectors (static vessels) in operational area. Introduction of additional safety risks to personnel during vessel to vessel transfer operations
N/a	Administrative	N/a	N/a	The implementation of a Biofouling Management Plan and maintaining a Biofouling Record Book consistent with the DAWR (2009) <i>National Biofouling Management Guidance for the Petroleum Production and Exploration Industry</i> . No further administrative controls were considered.

7.1.5 Acceptability assessment

The potential impacts of IMS introduction are considered 'Broadly Acceptable' in accordance with the Environment Regulations, based on the acceptability criteria outlined below. The control measures proposed are consistent with relevant legislation, standards and codes.	
Policy compliance	Jadestone's HSE Policy objectives are met.
Management system compliance	Section 9 demonstrates that Jadestone's HSE Management System is capable of continuously reviewing and updating activities and practices at the Stag facility to reflect the requirements of marine pest management in Australian waters.
Social acceptability	Stakeholder consultation has been undertaken (see Section 6), and no stakeholder concerns have been raised. Jadestone will continue to liaise with DPIRD on current requirements for the management of the risk of marine pest introduction in Western Australian waters.
Laws and standards	While no legislation directly regulates hull/ niche biofouling, vessels associated with the activity will adopt the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (DAWR, 2009).

Industry best practice	Application of guidelines detailed in the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry DAWR, (2009), and in the IMO Guidelines for the Control and Management of Ships' Biofouling to Minimise the Transfer of Invasive Aquatic Species.
Environmental context	<p>It is unlikely that any IMS entering the Operational Area will establish on the natural benthic habitat (soft sediments at the seabed). The depth of the Operational Area (49 m), open ocean conditions and lack of available light at this depth provides a very different environment to that within sheltered port and shallow coastal areas which have historically been colonised by IMS.</p> <p>The potential impact is considered acceptable after consideration of:</p> <ul style="list-style-type: none"> - Potential impact pathways - Preservation of critical habitats - Assessment of key threats as described in species and Area Management /Recovery plans - Consideration of North-West Bioregional Plan; and - Principles of ecologically sustainable development ESD
Conservation and management advice	<p>Application of guidelines detailed in the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (2009), and in the IMO Guidelines for the Control and Management of Ships' Biofouling to Minimise the Transfer of Invasive Aquatic Species.</p> <p>Jadestone has had regard to the representative values of the protected areas within the Operational Area, and the respective management plans and other published information. Impacts from any hypothetical successful establishment of marine pests will not impact on any of the social and ecological objectives and values, of any AMPs, or state MPs. This is consistent with the objectives of the protected area management plans and considered acceptable.</p>
ALARP	The residual risk has been demonstrated to be ALARP.

7.2 Unplanned release of solids

7.2.1 Description of hazard

Aspect	<p>Unplanned releases of solids may occur as a result of overfull and/or uncovered bins, incorrectly disposed items or spills during transfer of waste between the CPF/third-party tanker and support vessels. Disturbance of benthic habitats resulting from dropped objects.</p> <p>A non-hazardous release of solids to the environment has the potential to occur from the following activities:</p> <ul style="list-style-type: none"> • CPF, third-party tanker or supply vessel operations; • Lifting – dropped objects; • Accidental discharge of dry bulk products; and • Accidental discharge of waste. <p>Hazardous wastes, such as chemicals and chemical containers, batteries, waste oil, produced sands, medical wastes and oily wastes, will be generated from Stag operations and disposed of onshore in accordance with a Waste Management Plan. Wetblasting, if performed, will generate a sludge waste comprising blasting medium (water or garnet if used), rust and particles of old surface coatings (e.g. paint, epoxy). Similarly, the waste product from wet blasting is disposed of onshore.</p>
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7.2.2 Impacts and Risks

Non-hazardous solid wastes such as plastics have the potential to pollute marine environments and harm fauna through entanglement or ingestion. Marine turtles and seabirds are particularly at risk from

entanglement. Marine turtles may mistake plastics for food; once ingested, plastics can damage internal tissues and inhibit physiological processes, which can result in fatality. Generally, no toxic effects are expected from non-hazardous solids.

Release of hazardous solid wastes may result in the pollution of the immediate receiving environment, leading to detrimental health impacts to marine flora and fauna. Physiological damage can result through ingestion or absorption and may occur to individual fish, cetaceans, marine reptiles or seabirds. Marine fauna (including seabirds) encountered within the Operational Area are expected to be limited to small numbers of transient individuals, noting however that the area does overlap with the humpback whale and blue whale migration corridor, shearwater foraging, and the flatback turtle interesting areas which may result in a higher number of these species around the Stag Facility.

Benthic habitats have the potential to be impacted with accidental spills of solid wastes resulting in possible damage to or loss of soft sediment communities within the area affected. The potential impact may be short term to long term depending on the waste type, its degradation rate, and the amount lost to the marine environment.

In the event of a buoyant solid waste being accidentally released to the marine environment, it may create a navigational hazard.

The benthic habitats and associated biota that would be impacted in the accidental event of a non-buoyant dropped object are well represented in the region and there are no known areas of benthic primary producer habitat (e.g. corals, seagrass), KEF habitat (nearest KEF ~70 km N) or protected area habitat within the Operational Area. This is confirmed by Kinhill (1997, 1998) and potential losses represent a very small fraction of the widespread available habitat.

The operational area is within a habitat critical to survival for flatback. The risk to marine turtles or impact pathway is through reduction in available feeding grounds. However, the study by Sperling et al. (2010) concluded that flatback turtles do not feed during the inter-nesting period. If individuals were likely to use this area as foraging grounds, outside of nesting season it would represent an insignificant percentage of all available feeding grounds and not significantly effect individuals or population. This is confirmed by Kinhill (1997, 1998) and potential losses represent a very small fraction of the widespread available habitat.

Produced sands are generated on the Stag CPF from the Stag reservoir, consisting of fine sand and glauconite containing oil, some heavy metals and low levels of naturally occurring radioactive materials (NORM). A third-party assessment of NORM levels in Stag sands – *Radiation Management Plan (JS-90-PR-F-00013)* was undertaken and found that the level of NORM within Stag sands do not put sands in the category of radioactive waste. NORM levels in Stag sands are independently assessed annually and no samples to date have exceeded any regulatory limits for safe handling, storage or disposal. Accidental loss of containment of sand into the ocean may occur from equipment failure, incorrect handling and/or transport and overfilling of sands tanks during handling of this waste.

Supply vessels generate small quantities of similar wastes; these are managed in accordance with the vessels' own waste management plans and procedures.

Overall Consequence	Overall Likelihood	Residual Ranking
Minor	Likely	Medium

7.2.3 Environmental Performance

Hazard		Non-hazardous and hazardous solid wastes (EUH-2)		
Performance objective		No release of non-hazardous or hazardous solid wastes to the marine environment		
ID	Management controls	Performance standards	Measurement criteria	Responsibility
071	CPF: Waste Management Plan (JS-70-PR-I-00034) implemented to ensure correct waste handling	Solid waste materials are stored in fit for purpose storage containers and/or lifting skips, labelled and equipped with lids / covers to prevent loss of material during storage and handling.	For CPF: waste register and vessel manifest	Stag OIM
072	Vessels: Waste management plan implemented to reduce the risk of waste released to sea, in accordance with Marine Orders	Hazardous solid wastes will be managed in accordance with Marine Orders – Part 94 (Marine Pollution Prevention – Packaged Harmful Substances), Navigation Act 2012 and Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (Part III) requirements, and Environmental Protection Regs (controlled waste)	Garbage Record Book shall be maintained in accordance with MARPOL 73/78 Annex V Regulation 9	Operations Manager
073	Bagging Sand Procedure (GA-19-PR-P-00007) ensures produced sand is correctly managed and disposed of onshore	Flexible IBC bags rated to a lifting weight of 2,000kg are used to bag produced sands. All bags are transported off the CPF and sands transported to shore for disposal.	Manifest details produced sand handling	Stag OIM
074		Produced Sands will be double-bagged (bulk bags).		
075	Personnel understand waste management requirements and undertake assessment as required by the Competency and Training Management System [JS-60-PR-Q-00015]	CPF crew and support vessel masters complete an assessment containing basic information on environmental practices	Online induction completion record	Stag OIM
076	Personnel are competent in the Lifting Operations Procedure (JS-90-PR-F-00036)	All personnel involved with lifting equipment operations and maintenance are trained and competent to their level of responsibility	Competency matrix	Stag OIM

Hazard		Non-hazardous and hazardous solid wastes (EUH-2)		
Performance objective		No release of non-hazardous or hazardous solid wastes to the marine environment		
ID	Management controls	Performance standards	Measurement criteria	Responsibility
	which details lifting requirements	JSA is completed for all lifts and approved under the PTW A Lift Plan completed for Complex and/or Engineered Lifts	Completed PTW documentation Approved Lift Plan	
077	Lifting operations and maintenance and testing requirements comply with Safety Critical Element Performance Standards A06537 – PSDS – 018 Offshore Crane (Man Riding)	Man riding operations only performed when a risk assessment has shown that there is no safer way for the task to be performed 3 monthly inspection of lifting gear and colour tag Annual service/inspection/certification of offshore crane Monthly general inspection of workboat Annual test/replacement and inspect of workboat	Inspection records PMS records confirm maintenance and tests conducted	Engineering and Maintenance Manager
078	Lifting operations managed under PTW systems as required by Stag Safety Critical Elements Performance Standards Report (GA-70-REP-F-00007): SCMS-03 Permit to Work	Lifting operations to be managed under the PTW system	PTW records	Stag OIM
079	Lifting equipment maintained in accordance with Stag Safety Critical Elements Performance Standards Report (GA-70-REP-	Annual review of Lifting equipment inspection, repair and maintenance records	Annual compliance audit	Stag OIM

Hazard		Non-hazardous and hazardous solid wastes (EUH-2)		
Performance objective		No release of non-hazardous or hazardous solid wastes to the marine environment		
ID	Management controls	Performance standards	Measurement criteria	Responsibility
	F-00007); PS-05 Cranes & Lifting Equipment			

7.2.4 ALARP Assessment

On the basis of the impact and risk assessment completed, Jadestone considers the control measures described above are appropriate to manage the risk of unplanned solid discharges from the Stag facility. The residual risk ranking for this potential impact is considered Low, and therefore ALARP has been demonstrated. Additional controls considered but rejected are detailed below.

Rejected control	Hierarchy	Practicable	Cost effective	Justification
No use of hazardous materials or production of wastes	Eliminate	No	No	Solid wastes produced onboard are disposed of onshore and are not discharged to the marine environment, therefore there is no planned impact to the marine environment. Complete elimination of waste is not feasible; therefore, the risk of unplanned releases remains
No lifting operations conducted	Eliminate	No	N/a	Lifting operations are an unavoidable activity to ensure the Stag facility is supplied with necessary goods and equipment, to remove wastes and to enable marine inspection and intervention activities to take place and so cannot be eliminated
Substitute any hazardous chemical use with non-hazardous chemical use	Substitute	No	No	Where appropriate selection of chemicals or materials to achieve low or no environmental effect is made. Some hazardous waste is unavoidable from the use of batteries, lights etc. and produced sand, therefore there are limited opportunities for substitution.
N/a	Engineering	N/a	N/a	All waste bins have lids and wastes are segregated at the time of disposal. No other engineering controls were considered.
Increase lifting capacity of cranes to decrease number of lifts required	Engineering	No	No	It is considered that to increase the lifting capacity of the cranes, they would need to be larger which would result in an increase in deck space usage. Whilst larger cranes could result in less lifts being required, it also increases risks to personnel from increased loads, increases risks to the seabed in the event that they are dropped and these are considered grossly disproportionate the risk of dropping objects.
N/a	Isolation	N/a	N/a	The Activity is located at distance from sensitive receptors and the coastline. Lifting areas are over top deck and landing platforms isolating subsea infrastructure including pipelines from dropped load events, therefore no further isolation controls have been identified
N/a	Administrative	N/a	N/a	Maintenance management system implemented, compliance with relevant and appropriate MARPOL and legislative requirements, certified equipment. No further controls were identified.

				Lifting procedures and plans and Permit to Work requirements ensures all lifts are managed and reduces risk of dropped objects.
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7.2.5 Acceptability Assessment

<p>The potential impacts of unplanned non-hazardous and hazardous solid accidental releases to the marine environment are considered 'Broadly Acceptable' in accordance with the Environment Regulations, based on the acceptability criteria outlined below. The control measures proposed are consistent with relevant legislation, standards and codes.</p>	
Policy compliance	Jadestone’s HSE Policy objectives are met.
Management system compliance	Section 9 demonstrates that Jadestone’s HSE Management System is capable of continuously reviewing and updating activities and practices at the Stag facility to reflect the requirements of the Waste Avoidance and Resource Recovery Act and Controlled Waste Regulations.
Social acceptability	Stakeholder consultation has been undertaken (see Section 6), and no stakeholder concerns have been raised with regards to waste management practices at the Stag facility.
Laws and standards	Requirements of the Waste Avoidance and Resource Recovery Act and Controlled Waste Regulations have been adopted.
Industry best practice	The APPEA Code of Environmental Practice (CoEP) (2008) objectives are met with regards to offshore production operations.
Environmental context	<p>Benthic habitats have the potential to be impacted with solid wastes resulting in potential loss of soft sediment communities and harm to marine fauna. The potential impact may be short term to long term depending on the waste type and its degradation rate. If impacted, benthic habitats and associated biota are well represented in the region. The potential scale of environmental harm from accidentally discharged solid waste is small in comparison to the vast size of soft substrata habitats spanning the North-west Shelf.</p> <p>The operational area is overlapped by 4 species BIA. However, the areas that may potentially be affected by accidentally discharged solid waste would represent a very small percentage of the total area. The Operational Area is within a habitat critical to survival for flatback turtles (inter-nesting buffer BIA). However, the potential scale of habitat loss and seabed disturbance from dropped objects is a very small percentage of the total area known.</p> <p>The potential impact is considered acceptable after consideration of:</p> <ul style="list-style-type: none"> - Potential impact pathways - Preservation of critical habitats - Assessment of key threats as described in species and Area Management /Recovery plans - Consideration of North-West Bioregional Plan; and - Principles of ecologically sustainable development ESD
Conservation and management advice	<p>Marine debris is identified as a potential threat to a number of marine fauna species in relevant Recovery Plans and Conservation Advice:</p> <ul style="list-style-type: none"> • Conservation management plan for the blue whale: A recovery plan under the EPBC Act 1999 2015-2025; • Conservation advice <i>Balaenoptera borealis</i> (sei whale); • Conservation advice <i>Balaenoptera physalus</i> (fin whale); • Recovery Plan for Marine Turtles in Australia; and

	<ul style="list-style-type: none"> • Recovery Plan for the white shark (<i>Carcharodon carcharias</i>). • Threat abatement plan for the impacts of marine debris on the vertebrate wildlife of Australia’s coasts and oceans (DoEE, 2018). • Approved Conservation Advice for the Abbott's booby <i>Papasula abbotti</i> (TSSC, 2020a) [specifically plastics] • Approved Conservation Advice on <i>Rostratula australis</i> (Australian painted snipe) (DSEWPaC, 2013b) [specifically plastics] <p>These plans identify marine debris as potential threats to marine turtles, whales and other vertebrate wildlife resulting in potential injury or death and recommend adherence to legislation for the prevention of garbage disposal to prevent impacts. With debris that could float and result in entanglement or injection by marine life, the area of impact may extend beyond the operational area to within the identified EMBA, therefore a number of bird species with marine debris identified as a threat in conservation management plans may be vulnerable to impact.</p> <p>The controls implemented demonstrate that the activity will be conducted in a manner that reduces marine debris and therefore the activity will be conducted in a manner that is acceptable under the relevant Recovery Plans and Approved Conservation Advice to prevent accidental release of non-hydrocarbon solids (marine debris).</p> <p>The limited quantities associated with this event indicate that even in a worst-case release of solid waste, fatalities would be limited to individuals and is not expected to result in a decrease of the local population size for any of the species identified.</p>
ALARP	The residual risk has been demonstrated to be ALARP.

7.3 Non-hydrocarbon Liquids

7.3.1 Description of Hazard

Aspect	A non-hydrocarbon liquid, in particular chemicals, may be released to the environment. The expected spill amounts are small, with the largest instantaneous volume being 1,000 L (the full contents of an IBC instantaneously released to the marine environment).
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There may be accidental releases/ discharges to the marine environment of a variety of potentially hazardous materials and chemicals (liquid) which are stored and utilised or produced at the CPF and/ or vessels during operations. These include:

- Bulk process chemicals including biocide, corrosion inhibitor, scale inhibitor and emulsion breakers. Chemical spills to the marine environment have the potential to occur should non-routine incidents occur during chemical transfer, handling, storage or use and in the event of equipment failure or upset conditions from topsides or subsea infrastructure;
- Cleaning products, solvents and paints on support/ supply vessels;
- Loss of chemicals from chemical injection lines during well intervention/ water injection well set-up and workover activities (for example, during run and pull of ESPs);
- Other non-process chemicals such as fluorescein dye, paints and thinners, laboratory chemicals and cleaning agents. As for bulk process chemicals, spills of non-process chemicals may occur from incidents with storage, handling and transport. However, these are likely to be either of very minor quantity (usually less than 50 L);
- Water foaming agents used in firefighting (aqueous film forming foams (AFFF)) may enter the sea; and

- Accidental release of liquid hazardous materials as a result of dropped objects during bulk material transfer to the CPF/ third-party tanker.

A number of chemicals are used on the Stag CPF during the production process and within water injection and ancillary equipment. These chemicals are used to:

- Aid oil and water separation from the collected well fluids;
- Treat produced water for the removal of hydrocarbons;
- Control corrosion and scale;
- Prevent the growth of marine organisms within the equipment;
- Treat seawater prior to injection into the Stag reservoir;
- Treat potable water;
- Aid in leaks detection in pipelines and hoses; and
- Assist analytical determinations in the CPF laboratory.

For instance, scale and corrosion inhibitors are injected downhole in the wells to protect the well tubing and internal process piping integrity. Sea water is injected into the reservoir to maintain downhole pressures in the reservoir. This seawater is de-aerated (with oxygen scavenger) prior to pumping through the five dedicated wells back into the reservoir. Biocide is added to pipework and slops tanks to minimise the formation of sulphur reducing bacteria (SRB). Other water clarifiers and emulsion breakers are used in the produced water treatment circuit for the removal of oil. Similarly, a range of chemicals are added to the Reverse Osmosis Unit (RO) to assist with drinking water treatment.

Fluorescein dye sticks can be added to water when used for pressure testing pipelines and hoses, to assist in leak detection.

The production chemicals are soluble in produced water and oil to varying extents and the dissolved fractions are ultimately either retained within the crude oil or discharged with the produced water. For example, chemicals such as the demulsifiers are very hydrophobic (octanol/water partition coefficient >4 considered very hydrophobic) and stay within the oil fraction, whereas chemicals such as the biocides are very hydrophilic (octanol/water partition coefficient <1 considered hydrophilic) and stay within the produced water fraction.

7.3.2 Impacts and Risks

The impacts associated with the accidental discharge of liquid hazardous materials is related to the nature of the material spilled, the volume and its behaviour in the marine environment (sink/ float/ disperse etc.).

Chemicals, for example solvents and detergents, are typically stored in small containers of 5–25 L capacity and used in areas that are bunded. Leaks and spills of non-hydrocarbon liquids are contained within the immediate storage/ use area or on board. Small spills cleaned up using spill kits as per general housekeeping requirements, or the Shipboard Oil Pollution Emergency Plan (SOPEP) (or equivalent for vessels <400 DWT). Non-hydrocarbon liquids may also enter the marine environment during transfer operations (offloading or backloading) – for example, a dropped object event. The maximum possible volume that may enter the marine environment is 1,000 L, this volume would be contained within an IBC which is assumed to be damaged during the lifting/ drop event such that the full volume is instantaneously released.

If hazardous materials are accidentally lost overboard, potential impacts will include a temporary and highly localised decline in water quality with limited potential for toxicity to marine fauna due to the temporary exposure and low toxicity resulting from the rapid dilution in the marine environment. It is noted that the Operational Area overlaps with the humpback whale migration BIA and pygmy blue whale distribution BIA, wedgetail shearwater breeding BIA, and the flatback turtle internesting buffer BIA which may result in a higher number of these species in the area. Potential impacts to water quality are likely to be limited to the

immediate vicinity (tens to hundred metres) of the release point, and are not expected to affect overall population viability of these protected species in the event of an unplanned release.

All production chemicals are selected in accordance with the Chemical Selection Evaluation and Approval Procedure (JS-70-PR-I-00033), which promotes the use of environmentally low risk chemicals based on ecotoxicity data and information gathered from ChemAlert.

Further impacts associated with the release of hydrocarbons are discussed in **Sections 7.4.2.1 and 7.6.**

<i>Overall Consequence</i>	<i>Overall Likelihood</i>	<i>Residual Ranking</i>
Minor	Unlikely	Low

7.3.3 Environmental Performance

Process chemicals are stored within bunded areas on the platform and metered to their various application points throughout the process. The bunds, in turn, drain to large capacity tanks with a design capacity exceeding the volume of the stored chemicals.

Hazard		Non-hydrocarbon hazardous liquids (EUH-3)		
Performance objective		No unplanned discharges to the marine environment.		
ID	Management controls	Performance standards	Measurement criteria	Responsibility
080	Compliance with Hazardous Substances & Dangerous Goods Standards (JS-70-STD-I-00036) ensures appropriate bunding for hazardous liquids	Any hazardous liquid storage on deck must be designed and maintained to have at least one barrier (i.e. form of bunding) to contain and prevent deck spills entering the marine environment.	HSE monthly inspection	Stag OIM
081	Vessels and CPF are compliant with Marine Order 93 to prevent any contaminating liquids and chemicals from entering the marine environment	Chemical management is compliant with Marine Order 93: <ul style="list-style-type: none"> • Having a valid International Pollution Prevention Certificate; • Reporting marine incidents to AMSA – An incident involving a discharge from a vessel of a mixture containing a liquid substance, carried as cargo or as part of cargo in bulk, must be reported to AMSA via AMSA Form 196 (Harmful Substances Report form) within 24-hours; • Enacting a compliant Shipboard Marine Pollution Emergency Plan; • Using a compliant Cargo Record Book; and • Washing vessel tanks in accordance with the Pollution Prevention Act. 	Valid International Pollution Prevention Certificate Valid SOPEP/SMPEP Cargo Record Book	Vessel Master Stag OIM
N/A	Refer Section 8.6.5 for additional management controls and performance standards			
082	Compliance with Hazardous Substances & Dangerous Goods Standards (JS-70-	Safety Data Sheet (SDS) available evaluation of hazard identification and chemical management	SDS Available	Stag OIM Vessel Master

Hazard		Non-hydrocarbon hazardous liquids (EUH-3)		
Performance objective		No unplanned discharges to the marine environment.		
ID	Management controls	Performance standards	Measurement criteria	Responsibility
083	STD-I-00036) and Marine Order 94 (vessels) ensures appropriate and safe chemical handling	Chemicals managed in accordance with SDS in relation to safe handling and storage, spill-response and emergency procedures, and disposal considerations	SDS Available	Stag OIM Vessel Master
084	If there is risk of an unplanned release greater than 80 litres, chemicals will be risk assessed in accordance with Chemical Selection, Evaluation and Approval Procedure (JS-70-PR-I-00033)	<p>For hazardous chemicals, the following standards apply to reduce the risk of an accidental release to sea:</p> <ul style="list-style-type: none"> • Selected chemical substances comply with relevant regulatory requirements and approved activity environment plans; • Selected chemical substances are subject to mandatory risk review and formal approval before procurement; • Transport, storage and handling of chemicals is in accordance with relevant regulations; • Least hazardous chemicals are preferentially selected for use thereby minimising and/ or eliminating potential safety and environmental impacts; • If chemicals required are classified as hazardous and/ or dangerous goods, the control measures for safe transport, storage and handling are deemed adequate; • Selected chemical substances meet technical specifications and are fit for purpose. 	<p>HSE monthly inspection</p> <p>Records of environmental risk assessments for chemicals for operational activities</p>	Stag OIM

Hazard		Non-hydrocarbon hazardous liquids (EUH-3)		
Performance objective		No unplanned discharges to the marine environment.		
ID	Management controls	Performance standards	Measurement criteria	Responsibility
085	Vessel SOPEP valid and tested to ensure ability to respond to spills	Spill kits are: Located near high risk spill areas. Intact, clearly labelled and contain adequate quantities of absorbent materials.	Spill Exercise Reports	Vessel Master
086	Spill exercise conducted in accordance with Stag Incident Response Plan – Offshore component (GF-00-PR-F-00002) to ensure spill preparedness	CPF spill exercise as part of annual incident response drills.	Exercise records	Stag OIM

7.3.4 ALARP Assessment

On the basis of the impact and risk assessment process completed, Jadestone considers the control measures described above are appropriate to manage the risk of non-hydrocarbon liquid hazardous waste. The residual risk ranking for this potential impact is considered Low, and therefore ALARP has been demonstrated. Additional controls considered but rejected are detailed below.

Rejected control	Hierarchy	Practicable	Cost effective	Justification
N/a	Eliminate	N/a	N/a	Industry-standard technologies are not available to eliminate the use of chemicals or hydrocarbons on-board, therefore elimination of hazardous liquid use cannot be eliminated. Hazardous liquid waste produced or used onboard are disposed of onshore and are not discharged to the marine environment, therefore there is no planned impact to the marine environment. Complete elimination of waste is not feasible; therefore, the risk of unplanned releases remains
Substitute any hazardous liquid use with non-hazardous liquid use	Substitute	No	No	Where appropriate selection of chemicals or materials to achieve low or no environmental effect is made. Some hazardous waste is unavoidable from the use of chemicals and through the production process, therefore there are limited opportunities for substitution.
N/a	Engineering	N/a	N/a	Safeguards will be implemented as required, by the <i>Protection of the Sea (Prevention of Pollution from Ships) Act 1983</i> and MARPOL Annex I, II and III. Such safeguards may include (but not limited to) inventory minimisation, designated storage and handling areas, correct stowage, accurate labelling and marking, SDS information, spill clean-up equipment and containment (e.g. bunds). No other potential controls were identified.
N/a	Isolation	N/a	N/a	
N/a	Administrative	N/a	N/a	Procedures are in place for the management of liquids to ensure technical performance is appropriately balanced with environmental performance. Procedures exist for the selection of production chemicals with low environmental risk by following Jadestone's Operations Chemical Selection Evaluation and Approval Procedure (JS-70-PR-I-00033). No additional administrative controls were identified.

7.3.5 Acceptability Assessment

The potential impacts of unplanned non-hydrocarbon liquid hazardous waste are considered 'Broadly Acceptable' in accordance with the Environment Regulations, based on the acceptability criteria outlined below. The control measures proposed are consistent with relevant legislation, standards and codes.

Policy compliance	Jadestone's HSE Policy objectives are met.
Management system compliance	Section 9 demonstrates that Jadestone's HSE Management System is capable of meeting environmental management requirements for this activity.

Social acceptability	Stakeholder consultation has been undertaken (see Section 6), and no stakeholder concerns have been raised with regards to the risk of unplanned liquid waste discharges.
Laws and standards	Relevant legal and regulatory controls have been adopted
Industry best practice	The APPEA Code of Environmental Practice (CoEP) (2008) objectives are met with regards to offshore production operations.
Environmental context	<p>While the risk of unplanned liquid waste discharges could occur from the Stag facility and have an impact on the waters immediately nearby, the impact and risk assessment process indicate that discharges will have a temporary and localised impact on marine waters and will not result in significant impact to marine fauna including those species BIA that overlap the area.</p> <p>The potential impact is considered acceptable after consideration of:</p> <ul style="list-style-type: none"> - Potential impact pathways - Preservation of critical habitats - Assessment of key threats as described in species and Area Management /Recovery plans - Consideration of North-West Bioregional Plan; and - Principles of ecologically sustainable development ESD.
Conservation and management advice	Minimising chemical discharge is an action identified by the Recovery Plan for Marine Turtles in Australia 2017-2027. This requires that best practice industrial management is implemented to minimise impacts to marine turtle health and habitats. A marine chemical spill is unlikely to result in population effects due to the controls in place for secure storage and on-board clean-up of spills, transient nature of marine fauna and the remote open ocean environment. There are no relevant management requirements in the recovery plan to implement for this hazard.
ALARP	The residual risk has been demonstrated to be ALARP.

7.4 Unplanned Release of Hydrocarbon – Scenarios

7.4.1 Maximum Credible Worst-Case Scenarios

Unplanned events may occur during the Stag operations that could result in the release of hydrocarbons to the marine environment.

The hydrocarbon spill scenarios identified during the environmental impact and risk assessment process were modelled according to the type of hydrocarbon – diesel or Stag crude oil – and the potential point of release, sea surface and subsea. The modelling considered the release of the maximum credible worst-case scenarios described (**Table 7-2** and **Figure 7-1**) over all seasons of the year (RPS-APASA, 2020).

Table 7-2: Maximum credible worst-case oil spill scenarios for the Stag facility

Hydrocarbon	Release point	Maximum credible worst-case scenarios
Diesel	At surface	Short term (instantaneous) with total release = 250 m ³
Stag crude oil	At surface	Short-term release (30 mins) with total release volume = 17.2 m ³
	Subsea	Short-term release (30 mins) with total release volume = 86.5 m ³
	Subsea	Long-term release (12 hours) with total release volume = 120 m ³

To determine the maximum worst-case credible spill volumes for each identified spill scenario, Jadestone has based the volumes on the expected pumping rates and known inventories of infrastructure. They have also

adopted the AMSA (2015) guideline: *Technical guideline for preparing contingency plans for marine and coastal facilities*. Jadestone considers that in adopting the AMSA guideline the estimated spill volumes are appropriately conservative given that for the scenarios presented there are multiple barriers/ controls in place; meaning the total volumes evaluated are much greater than what would be released in the event of a spill.

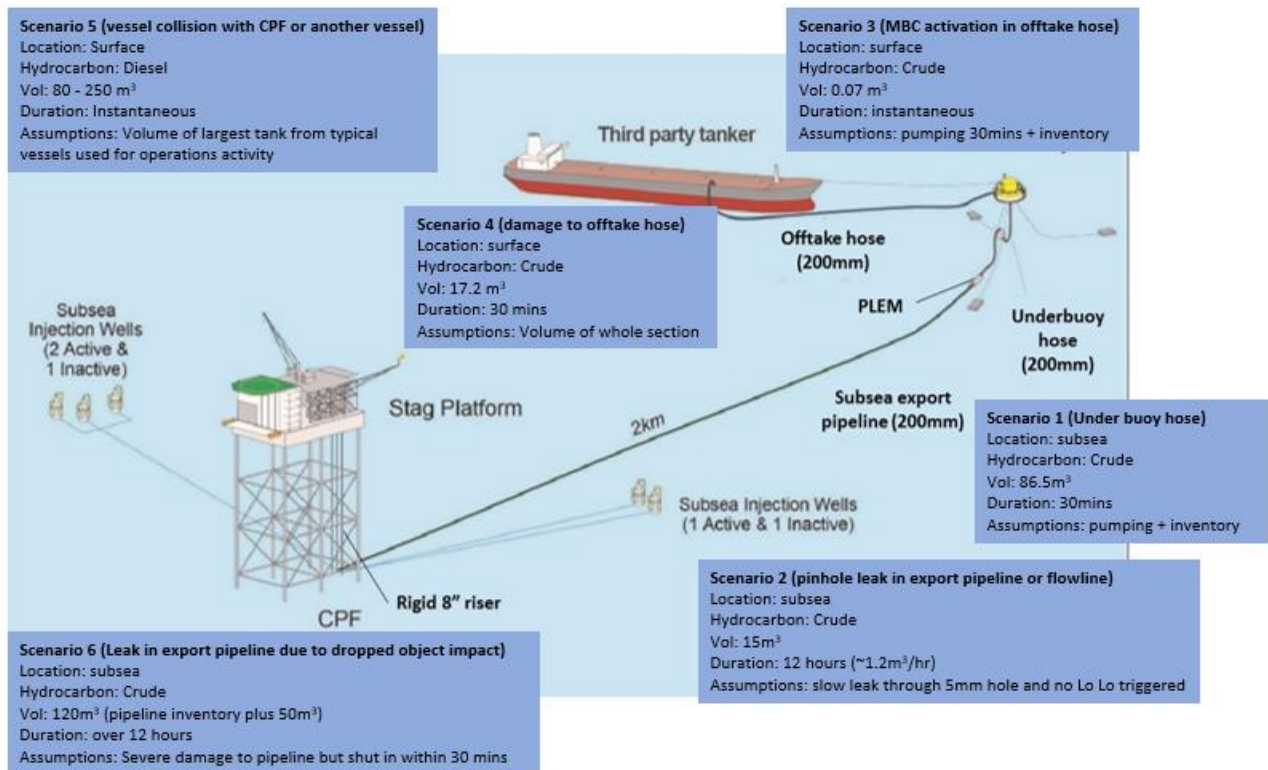


Figure 7-1: Unplanned release of hydrocarbon spill scenarios

7.4.2 Discounted Scenarios

Of the spill scenarios considered, the below were discounted as not credible:

- Release of Stag crude oil due to well blow out

As described in the Stag Well Operations Management Plan (WOMP) (GF-50-PLN-W-00001), through review of the Stag reservoir in November 2011 (Dowling and Betts, pers. comm., 2011) it was determined that the pressure in the reservoir is not sufficient to flow oil to the surface in the event of a loss of all well barriers. As the reservoir has been produced, the pressure has declined with time such that fluids (oil and produced water) will not flow to the surface unless an Electric Submersible Pump (ESP) is running in the well. In the event of a severe loss of well integrity and corresponding shutdown of the Stag artificial lift system, the reservoir pressure will be unable to support a column of well fluids to surface where seawater will effectively kill the well. This is regularly validated through ongoing gas to surface tests conducted prior to workover.

Some wells (Stag 12H and Stag 36H) have experienced positive surface pressures when shut in, which would indicate the wells have the capability of free-flowing limited quantities gas to surface. This is due to the wells experiencing a period of higher gas rates than previously observed. Despite the higher surface pressures, the bottom hole pressures (as measured in the wells) still preclude the ability of the wells to free flow oil and produced water to surface. To further mitigate against the potential for these wells to free-flow, downhole tubing retrievable surface controlled subsurface safety valves (TRSCSSV) has been installed in these wells.

As such a well blow-out during production activities is not deemed a credible scenario and not considered further.

- Release of diesel/ Stag crude oil due to vessel grounding

A release of hydrocarbon due to vessel grounding and subsequent fuel tank rupture resulting from a loss of propulsion or due to navigational error resulting in a vessel running aground in shallow areas was not considered a credible scenario for the Stag operations as the facility is situated in deep water (approximately 50 m) and there are no charted reefs or islands that pose a grounding hazard. This is confirmed by seabed surveys in the operational area and surrounds.

7.4.2.1 Modelling approach

To determine the spatial extent of impacts from a potential hydrocarbon spill (surface and subsurface) and the dispersion characteristics of the oil over time, modelling was completed by Asia-Pacific Applied Sciences Association (RPS APASA, 2020). Oil spill modelling was undertaken using a three-dimensional oil spill trajectory and weathering model, SIMAP (Spill Impact Mapping and Analysis Program), which is designed to simulate the transport, spreading and weathering of specific oil types under the influence of changing meteorological and oceanographic forces.

Near-field subsea discharge modelling was undertaken using OILMAP, which predicts the droplet sizes that are generated by the turbulence of subsea discharges as well as the centreline velocity, buoyancy, width and trapping depth (if any) of the rising gas and oil plumes.

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 which might be affected by a spill.

A summary of the modelling method is described below.

Stochastic approach: stochastic modelling was carried out using an historic sample of wind and current data for the 'study area' that spanned ten years. For each season (March to August and September to February), a large number of replicate simulations (100) were modelled (i.e. 200 in total), each 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.

Contact thresholds: Oil spill models are able to track hydrocarbon concentrations of surface oil, entrained oil and dissolved aromatic hydrocarbons below biologically significant impact levels. Consequently, threshold concentrations are specified for the model to control what contact is recorded for surface oil and subsurface locations (entrained oil and dissolved aromatic hydrocarbons) to ensure that recorded contacts are for biologically meaningful concentrations. Thus, it is important to describe the thresholds used as the boundary of the EMBA will be influenced by the thresholds set in the hydrocarbon spill modelling.

The determination of biologically meaningful impact thresholds 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 mixture making the contact. The toxicity of a hydrocarbon changes over time, due to weathering processes altering the composition of the hydrocarbon. To ensure conservatism in defining the EMBA boundary and the subsequent impact assessment, the threshold concentrations applied to the model are based on the most sensitive receptors that may be exposed, the longest likely exposure times and the more toxic hydrocarbons.

Impact pathways and impact threshold concentrations are detailed in **Appendix H** for floating oil, entrained oil and dissolved aromatic hydrocarbons (DAH).

Data generated: during each simulation (of which there are 100 for each season), the model recorded the location (latitude x longitude x depth) of each of the particles (representing a given mass of hydrocarbon) on or in the water column, at regular time steps.

The collective records from all simulations were then analysed by dividing the study area into a three-dimensional grid. For oil particles classified as being at the water surface, the sum of the mass in all hydrocarbon particles located within a grid cell, divided by the area of the cell provided an estimate of the concentration of oil in that grid cell, at each time step.

For entrained and dissolved hydrocarbon particles, concentrations were calculated at each time step by summing the mass of particles within a grid cell and dividing by the volume of the grid cell. The concentrations of oil calculated for each grid cell, at each time step, were then analysed to determine whether concentration estimates exceeded defined threshold concentrations. The risks were then summarised as follows:

- The probability of exposure at a location was calculated by dividing the number of spill simulations where contact occurred above a contact threshold at that location (defined as per **Figure 7-2**) by the total number of replicate spill simulations. For example, if contact occurred at the location (above a contact threshold) 50 out of 100 simulations, a probability of exposure of 50 per cent is indicated; and

The minimum potential time to a shoreline location was calculated by the shortest time over which oil was calculated to travel from the source to the location in any of the replicate simulations.

Probability contours: the results were presented in terms of statistical probability maps based on 100 simulations, each generated under different environmental conditions. The contours of probability are not representations of a single spill event (APASA (2020)).

Completion of modelling: each of the 100 simulations was run for a period of two to three weeks allowing for the fate of dispersed hydrocarbons to be evaluated. Fate assessment stops once hydrocarbon concentrations fall below the defined contact thresholds. In this manner, the full extent of the spill scenario is assessed against the specified contact thresholds.

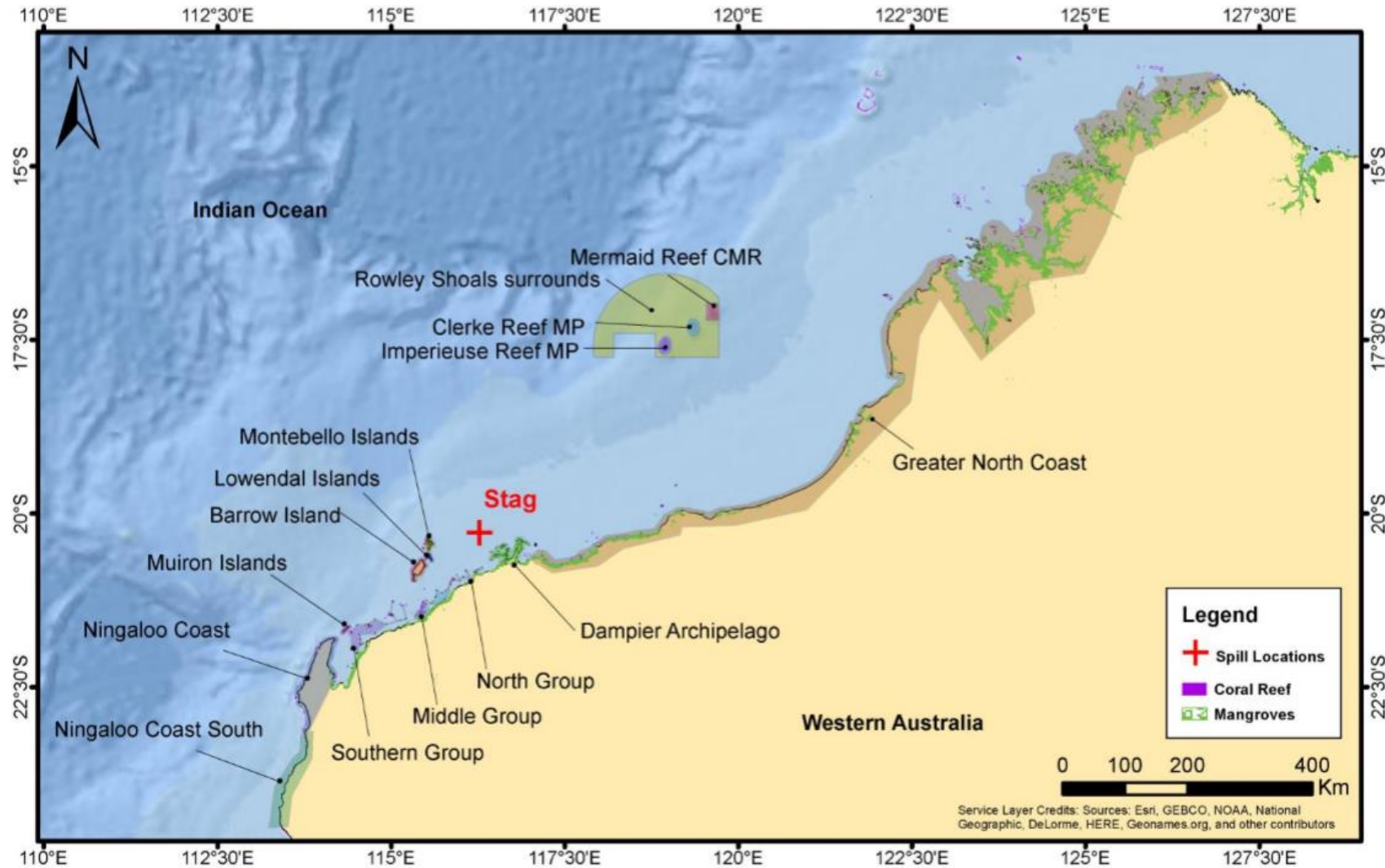


Figure 7-2: Sensitive receptor segments

Modelling Thresholds

To assess environmental effects from an unplanned hydrocarbon release, four separate hydrocarbon components that pose differing environmental risks were evaluated:

- Surface hydrocarbons – hydrocarbons that are ‘on’ the water surface;
- Entrained hydrocarbons – hydrocarbon that is entrained ‘in’ the water;
- Dissolved hydrocarbons – the dissolved component of hydrocarbon in’ the water; and
- Shoreline accumulation – hydrocarbons that accumulate along shorelines.

Threshold concentrations for each of the three hydrocarbon phases were developed and applied to the modelling outputs to define the EMBA for each phase. A receptor was considered ‘affected’ by one of the phases as soon as the threshold for the phase at that location was exceeded (i.e. instantaneous impact approach).

The rationale for the selection of the thresholds is described in Appendix H and a summary of the contact thresholds applied is provided Table 7-3. The EMBA (Figure 3-1) is denoted by the lowest hydrocarbon exposure thresholds to indicate all receptors that may be *contacted* by hydrocarbons of any phase from any scenario. However, for the purposes of impact assessment, higher exposure thresholds are applied, termed as ‘moderate’ in NOPSEMA bulletin #1, to indicate the receptors that could be *affected* (rather than just contacted) and is based on scientific knowledge to determine the potential for impact. A Risk EMBA is then drawn utilising these thresholds (Section 5.7.2) which lies within the overall EMBA.

Table 7-3: Summary of the contact thresholds applied in the hydrocarbon spill modelling

Floating oil (g/m ²)		Shoreline Oil		Entrained oil (ppb)		DAHs (ppb)	
1	Low (approximates range of socio-economic effects and establishes planning area for scientific monitoring)	100	Moderate (Loading predicts area likely to require clean-up effort)	100	High (as appropriate given oil characteristics for informing risk evaluation)	70	Medium (approximates potential toxic effects)
10	Moderate (approximates lower limit for harmful exposures to birds and marine mammals)						

7.4.3 Spill Response Strategies

There are numerous oil spill response strategies available to be implemented in the event of a spill. These are generally based on strategies which have been implemented in the past or considered to be good industry practice.

The evaluation of the suitable response strategies was conducted based on the credible spill scenarios identified and **Table 8-8** is the outcome of the first level screening undertaken. Below are the key considerations for the evaluation:

- The properties and weathering profile of the oil;
- The philosophy of the responses, that is, what is aim of the response based on the hydrocarbon properties. In the case of Stag crude: prevention of shoreline contact and application of chemical dispersant to entrain and enhance biodegradation;
- The net environmental benefit of undertaking the response strategy;
- The nature and scale of the maximum credible worst-case scenario; and
- The potential safety and environmental aspects and impacts involved with the selected responses.

Table 7-4: Spill response strategies considered for the mitigation of contact from hydrocarbon spills

Strategy	Description	Environmental Benefits	Decision
Source control	Implementation of the third-party tanker SOPEP	Reduce the volume of oil entering the marine environment	Adopt
	Implementation of Emergency Pipeline Repair Plan (GF-09-PLN-L-00039)	Cease loss of containment event as soon as practicable.	Adopt
Operational Monitoring	Surveillance actions are used to monitor and evaluate the trajectory and fate of the released hydrocarbon, to determine the effectiveness of response strategies and to identify and report on any potential/actual contacts to flora, fauna, or any other sensitive receptor that occurs. Surveillance results are used to assist in escalating or de-escalating response strategies as required.	<p>There are various specific control measures (vessel/ aerial surveillance, tracking buoys, oil spill modelling, fluorometry) within this response strategy which may be suitable. Their use, in combination or individually, will be determined based on the spill distribution as well as other considerations such as access to locations, environmental and metocean conditions.</p> <p>This strategy is vital to ensure that there is sufficient information to gain situational awareness and make informed decisions on response planning, execution and termination.</p>	Adopt
Surface chemical dispersion	Chemical dispersant is applied to break down the hydrocarbons and allow/enhance dispersion into the water column, thereby preventing/reducing potential shoreline contact and increasing biodegradation.	<p>Surface chemical dispersant may be viable, either by vessel or plane.</p> <p>Based upon previous dispersant efficacy testing undertaken on Stag crude, there is a Window of Opportunity (WoO) up to 72 hours post spill, prior to Stag crude weathering beyond the ability of potential effective chemical dispersion, in which surface chemical dispersant could be applied (refer Section 10 of the OPEP).</p> <p>Chemical dispersants applied at sea surface can reduce the amount of floating oil but increase the oil concentrations in the water column, thereby increasing the risk of exposure to organisms that live in the water column (refer Section 8.5.2 and Table 8-7).</p> <p>Entrained oil concentrations are not constant; they are subject to frequent fluctuations due to metocean influences, mobility of receptors and the dilution of the dispersed oil by the sea. Subsequent potential contact to organisms in the water column and nearshore marine habitats is infrequent, of varying concentration, duration and consequence. Therefore, Jadestone consider that any potential shoreline loading reduction is more beneficial than the potential impact to organisms from entrained oil and this strategy is worth keeping in the toolbox as an option.</p>	Adopt

Strategy	Description	Environmental Benefits	Decision
		Chemical dispersion will only be undertaken when there is a net environmental benefit. Applicability of chemical dispersant is limited to the conditions, locations and circumstances described in the OPEP.	
Physical dispersion	Physical dispersion is undertaken by running vessels through the hydrocarbon plume and using the turbulence developed by the propellers or hydro-blasting from vessel hydrants to break up the slick. Once dispersed in the water column in the form of smaller droplet sizes, biodegradation processes are enhanced.	In general, this strategy is considered an opportunistic strategy; used on targeted, small, breakaway areas, especially patches close to shorelines. Given that oil is expected to emulsify by the time it approaches shorelines, and chemical dispersant application would be preferred as a means of dispersing bulk oil; this strategy has limited effectiveness and is not considered to be a strategy requiring further planning and associated control measures.	Reject
Containment and recovery	Containment and recovery of hydrocarbons can offer a preventive form of protection to sensitive receptors. Skimmers (mechanical) and booms will be used at sea. This strategy is only effective in calm conditions.	For a spill of Stag crude, this is the preferred way to remove hydrocarbons from the water surface before the risk of contacting shorelines/sensitive receptors. Containment and recovery may be applicable once evaporation of highly volatile components has occurred. Based on the Stag crude oil assay, a solidified residual is expected which can be collected using containment and recovery methods. Given that shoreline booming and shoreline clean-up are expected to be difficult across some locations within the EMBA (e.g. Dampier Archipelago and the Montebello's) this strategy is considered important to the overall spill response.	Adopt
Protection and deflection	Protection and deflection activities involve the use of booms to: Protect sensitive receptors; Deflect spills away from sensitive receptors or shorelines; or Deflect spills to an area that provides increased opportunity for recovery activities. This strategy is typically not effective in areas experiencing large tidal variations and associated currents.	Activities are focused on areas of high protection value in low energy environments based upon real time operational surveillance provided the environmental and metocean conditions are favourable for an effective implementation. Consequently, this strategy may not be applicable across all shorelines identified as being contacted by oil.	Adopt
Shoreline clean-up	During a spill response, clean-up of the oiled shorelines will be implemented using suitable methods, provided it will be	Contacted shorelines will be assessed for their shoreline clean-up potential. This response has the potential to cause secondary disturbance associated with the clean-up, so applicability of the strategy is based on aerial surveillance	Adopt

Strategy	Description	Environmental Benefits	Decision
	beneficial to the environment based on the NEBA performed on the affected areas based on actual site conditions.	reconnaissance, shoreline assessments and NEBA in the shoreline clean-up assessment.	
Oiled wildlife response (OWR)	Responding to an oiled wildlife incident will involve an attempt to prevent wildlife from becoming oiled and/or the treatment of animals that do become oiled.	<p>Within the EMBA, areas with importance for wildlife have been identified to be threatened by the oil spill and mobilisation of a wildlife response will likely be necessary. Mobilisation of experts, trained work forces, facilities and equipment will then be needed. Wildlife response activities may take place at sea, on shorelines and in specialised facilities further inland.</p> <p>Options for wildlife management are considered and a strategy determined guided by the Western Australian Oiled Wildlife Response Plan (WAOWRP).</p>	Adopt
In-situ burning	<p>In situ burning is a technique sometimes used in responding to an oil spill. In situ burning involves the controlled burning of oil that has spilled (from a vessel or a facility), at the location of the spill. The oil has to be amenable to lighting e.g. unweathered, high lighter oil fractions and not prone to emulsification.</p> <p>When conditions are favourable and conducted properly, in situ burning will reduce the amount of oil on the water.</p>	<p>Operational and oil constraints expected during a spill from the Stag Operations suggest in-situ burning is not applicable. For in-situ burning to be undertaken, oil has to be thicker than 1-2 mm but diesel tends to have high evaporation rate and spreads into very thin films rapidly. Stag crude is a highly weathered oil, with little light fractions and prone to emulsification. In addition, in-situ burning requires containment.</p> <p>Due to operational constraints and the expected hydrocarbon not being suitable for in-situ burning, this response strategy is deemed inapplicable for Stag Operations.</p>	Reject
Scientific Monitoring	This is the main tool for determining the extent, severity and persistence of environmental impacts from an oil spill and allows operators to determine whether their environmental protection outcomes have been met (via scientific monitoring activities).	Scientific monitoring is especially beneficial for monitoring entrained and dissolved oil impacts as response strategies are generally targeted to manage the surface oil impacts.	Adopt

7.5 Unplanned Release of Stag Crude Oil

7.5.1 Description of hazard

Aspect	Surface release of Stag crude oil from damage to the offtake hose between the CALM buoy and third-party tanker, resulting in a maximum worst-case credible spill of 17.2 m³ ; and Subsea release from the underbuoy hose at the CALM buoy resulting in a maximum worst-case credible spill of 86.5 m³ .
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7.5.1.1 Subsurface Release

Stag crude could be released to subsea due to loss of integrity, process upset, equipment failure, corrosion or damage through dropped objects. A HAZID was undertaken for the Stag Facility activities and the below credible subsea release spill scenarios were identified:

Table 7-5: Subsurface release of Stag Crude Oil – unplanned scenarios

Scenario	Maximum Credible Spill	Release duration	Credibility justification
Damage to pipeline due to dropped object	120m³	12 hours	Assumes a hole size of 20mm due to impact from a dropped object Release rate of 10m ³ /hr through the hole, pipeline inventory is 70m ³ , therefore assumes full inventory loss plus time to shut in pipeline
Damage to flexible underbuoy hose from loss of integrity or damage	86.5m³	30 mins	The volume lost is assumed to be 30 minutes of pumping plus the inventory released from the hose. This scenario assumed a flow rate of 173m ³ /hr over a 30 minute period through a hole size of 15mm.
Pinhole leak in subsea export pipeline or flowline from damage or corrosion	15m³	12 hours	Assumes loss of 15m ³ lost at a rate of approximately 1.2m ³ /hr through a 5mm hole and assume that no Lo Lo is triggered which would result in the pipeline or flowline being shut in.

7.5.2 Stag Crude Oil Characteristics

Stag oil is a medium crude composed of hydrocarbons that have a wide range of boiling points and volatiles at atmospheric temperatures, and which will begin to evaporate at different rates on exposure to the atmosphere. Change in the mass balance calculated for Stag crude weathering under low (5 knots) and constant wind indicates that approximately 14% of the oil volume would evaporate within 12 hours. The remaining oil would weather at increasingly slower rate as the mixture becomes proportionally enriched by compounds with longer carbons chains, hence higher boiling points. Once all volatile compounds have evaporated, only the residual compounds will remain, and weathering rates would slow significantly. After one day approximately 40 to 80% is predicted to remain on the sea surface (% dependent upon wind variability). This reduces to approximately 32 to 68% of the crude remaining on the surface after seven days.

A summary of the physical properties of Stag crude oil is provided in **Table 7-6**.

Table 7-6: Characteristics of Stag crude oil

Hydro-carbon	Initial density	Viscosity (cP) @ 20°C	Component	Volatiles (%)	Semi-volatiles (%)	Low volatility (%)	Residual (%)	Aromatics (%)

	(g/cm ³) @ 15°C							Of whole oil
			BP (°C)	<180	180–265	265–380	>380	<380
Stag crude oil	0.944	115	% of total	0.5	16.0	40.8	42.8	11.3
			% aromatics	0.2	3.0	8.1	-	-
			-	Non-persistent			Persistent	

Source: APASA (2020)

Further detail on Stag crude oil is provided in the OPEP.

Toxicity Testing of Crude Oil

Toxicity testing using the water accommodated fraction (WAF) of Stag oil indicated that the oil would be of low acute toxicity to organisms in the water column (Battelle, 1998). In 96-hour exposure tests, no acute toxicity was observed on two species of tropical fish (a clownfish: *Amphiprion clarkii*, and a silverside: *Menidia beryllina*) in an undiluted solution of the WAF (Table 7-7). Similarly, there was no acute toxicity observed on a tropical prawn (*Penaeus vannamei*) after 96 hours' immersion in the undiluted WAF, while a tropical mysid shrimp (*Mysidopsis bahia*) suffered mortality after 96 hours' exposure in a high-concentrations of the WAF (30% survival in undiluted WAF).

In tests on the potentially more sensitive planktonic larvae of invertebrates (using the larvae of three species of sea urchin: *Arbacia punctulata*, *Dendraster excentricus*, and *Strongylocentrotus purpuratus*), there was no reduction in the rate of normal larval development, or of survival after 60 hours' exposure to undiluted WAF.

In a final test involving relatively long-term exposure of stony corals (a five-day exposure test using *Acropora elysii*) corals survived in an undiluted solution of WAF made from fresh oil; however, growth was inhibited by two thirds. In contrast, five days' immersion in an undiluted WAF solution made from oil weathered for 0.5 to one day had no effect upon the growth of the corals.

Table 7-7: Toxicity testing results of water accommodated fraction (WAF) of Stag crude

Test Species	Test Codes	Exposure Level – Stag Crude	
		% of WAF	mg/L TPH*
Clownfish (<i>A. clarkii</i>)	LC ₅₀ 96hLC ₅₀	>100	>273
Silverside (<i>M. beryllina</i>)	LC ₅₀ 96hLC ₅₀	>100	>273
Mysid Shrimp (<i>M. bahia</i>)	LC ₅₀ 96hLC ₅₀	72	87
Penaid Prawn (<i>P. vannamei</i>)	LC ₅₀ 96hLC ₅₀	>100	>219
Sea Urchin Larvae	EC ₅₀ 96hEC ₅₀	>100	>219
Stony Coral (<i>A. elysii</i>)	EC ₅₀ 120hEC ₅₀	>50	>110

* Test Codes: 96hLC50 Concentration causing mortality to 50% of the test organisms after 96 hours (4 days) exposure; 96hEC50 concentration causing an effect on the rate of normal larval development during 60 hours (2.5 days) exposure; 120hEC Concentration causing a significant reduction in the growth rate during 120 hours (5 days) exposure

Given the low asphaltene content of the weathered residue, Stag crude will have low adherence properties when coming into contact with environmental receptors. The degree to which impacts could occur will depend upon the level of coating (concentration of oil and/or loading of oil on shorelines) and how fresh the oil is, with toxicity from oil contact likely to be more prevalent from 'fresh' oil closer to the Stag Facility.

The viscosity of Stag crude would increase through weathering and the uptake of water to form an oil-in-water emulsion. The maximum water uptake for Stag crude has been measured at 74–81% for fresh and weathered crude, respectively, resulting in a stable emulsion (Battelle, 1998). Consequently, the volume of the slick increases over time through the uptake of water to form a viscous emulsion.

7.5.2.1 Surface Release

Stag crude could be released at the surface from the offtake hose due to damage or from the marine breakaway coupling (MBC) activation.

Table 7-8 lists the credible spill scenarios identified for the release of crude oil to the marine environment at sea surface.

Table 7-8: Credible Stag crude oil spills to the marine environment at surface

Scenario	Maximum Credible Spill	Release duration	Credibility justification
Damage to offtake hose between CALM buoy and third party tanker	17.2m ³	30 mins	The offtake hose is of 200 mm internal diameter with a double carcass construction with built-in flotation. The offtake hose is protected from failure due to over loading by a dry break coupling. The entire volume of the offtake hose could be released due to damage and loss of integrity (e.g. vessel running over the hose, damaged hose). The entire volume is assumed to be lost as a worst-case scenario with no failsafe’s (such as MBC) activating. The release duration is worst case.
MBC activation during offtake activity at offtake hose	0.07m ³	Instantaneous	The MBC activates in the event of overloading. The volume lost is assumed to be 30 minutes of pumping prior to MBC activation (worst case scenario) plus the inventory released at surface.

7.5.2.2 Results – Surface Release of 17.2 m³

The data indicates that 57% of oil would evaporate over time scales of days to weeks if exposed to the atmosphere and approximately 43% would persist in the environment, decaying mainly through biodegradation. Approximately 11% is composed of aromatic hydrocarbons (RPS APASA, 2020). The annualised EMBA is derived from the seasonal stochastic modelling results (i.e. results from all 200 replicates), hence describes a substantially larger area than would be affected during any single spill event. The annualised EMBA is based on thresholds for floating oil (1 g/m² and 10 g/m²), shoreline oil (100 g/m²), entrained oil (100 ppb) and dissolved aromatic hydrocarbon (70 ppb) concentrations. The annualised maximum distance from the spill location to the outer edge of the annualised EMBA is calculated as approximately 295 km.

Floating Oil Results

For spills commencing in September to February, the slicks are most likely to be transported toward the north-east from the release location. Spills commencing during the March to August months are most likely to drift toward the west from the release location.

Results of the worst-case modelling (September to February) indicate that surface sheens of floating oil (>1 g/m² and 10 g/m²) may pass over the following sensitive receptors, with a probability of >1% of reaching these locations, noting that floating oil will not accumulate on submerged features or at open ocean locations (**Table 7-9**).

Floating oil concentrations at or greater than 1 g/m^2 could travel up to 385 km from the release location (September to February), with the distances reducing to 15 km (March to August) as the contact threshold increases to 10 g/m^2 .

Table 7-9: Modelling results for floating oil due to 17.2 m³ Stag crude surface release

Receptor Type	Receptor	>1 g/m ²	>10 g/m ²
Australian Marine Parks	Gascoyne MP	Y	N
	Montebello MP	Y	N
Biologically Important Areas	Marine Turtle BIA	Y	Y
	Seabirds BIA	Y	Y
	Fish and Sharks BIA	Y	Y
	Whales BIA	Y	Y
Islands	Montebello Islands	Y	N
Key Ecological Features	Ancient Coastline at 125m Depth Contour	Y	N
	Continental Slope Demersal Fish Communities	Y	N
	Exmouth Plateau	Y	N
	Glomar Shoals	Y	N
State Marine and National Parks	Barrow Island MMA	Y	N
	Montebello Islands MP	Y	N

Entrained Oil results

Entrained oil concentrations at or greater than 100 ppb could travel up to 101 km from the release location (March to August). Results of the stochastic modelling indicated that entrained oil concentrations greater than 100 ppb were predicted to reach the following locations at greater than 1% probability during the worst case of September–March (**Table 7-10**). For 100 ppb the minimum arrival time is 11 hours to the Montebello Marine Park. The maximum entrained hydrocarbon concentration at any depth in the worst replicate is 408 ppb at the Montebello Islands MP.

Table 7-10: Modelling results for entrained oil due to 17.2 m³ Stag crude surface release

Receptor Type	Receptor
Australian Marine Parks	Montebello Marine Park
Biologically Important Areas	Marine Turtle BIA
	Seabirds BIA
	Sharks BIA
	Whales BIA
Islands	None
Key Ecological Features	None
State Marine and National Parks	Montebello Islands MP

Dissolved Aromatic hydrocarbons

Dissolved aromatic hydrocarbon concentrations at or greater than 70 ppb are not predicted within the modelling domain for this scenario. No receptors are predicted to receive dissolved aromatic hydrocarbon concentrations equal to or greater than 70 ppb during either season.

7.5.2.3 Results – Subsea Release of 86.5 m³ crude

Modelling of two subsea stag crude spills was undertaken in 2020:

A 120m³ Stag crude spill from the subsea pipeline representing the release in the event of a loss of pipeline integrity. This scenario assumed a flow rate of 10m³/hr over 12 hours through a hole diameter of 20mm..

An 86.5m³ spill due to damage from a flexible underbuoy hose, riser or subsea pipeline in the Stag field. This scenario assumed a worst case flow rate of 173m³/hr over a 30 minute period through a hole size of 15mm

When comparing the two EMBA that resulted from both modelling reports, the EMBA was larger from the 86.5m³ spill across all phases of hydrocarbon and resulted in higher volumes of shoreline contact at more locations than the 120m³ spill. The difference in EMBA spread is likely due to the difference in flow rate and hole size between the two scenarios and therefore to ensure conservatism for this EP, the EMBA selected is the 86.5m³ loss of stag crude scenario to represent any of the stag crude loss of hydrocarbon scenarios.

The results of the OILMAP-Deep simulation predicted that the discharge would generate a cone of rising gas bubbles that would entrain the oil droplets and ambient sea water up to a trapping depth (where the gas plume becomes neutrally buoyant and its vertical velocity drops to zero) of approximately 48.7 m above the seabed. The discharge velocity and turbulence generated by the expanding plume is predicted to generate oil droplet sizes between 2,129–7,671 µm. These droplets will be subject to mixing due to turbulence generated by the lateral displacement of the rising plume. The largest droplets have the potential to reach the surface within minutes.

The annualised EMBA is derived from the seasonal stochastic modelling results (i.e. results from all 200 replicates), hence describes a substantially larger area than would be affected during any single spill event. The annualised EMBA is based on Jadestone’s specifications of thresholds for floating oil (1 g/m² and 10 g/m²), shoreline oil (100 g/m²), entrained oil (100 ppb) and dissolved aromatic hydrocarbon (70 ppb) concentrations. The annualised maximum distance from the spill location to the outer edge of the annualised EMBA is calculated as approximately 703 km (**Figure 7-3**).

Floating Oil Results

Results of the worst-case modelling (September to February) indicate that surface sheens of floating oil (>1 g/m² and 10 g/m²) may pass over the following sensitive receptors, with a probability of >1% of reaching these locations, noting that floating oil will not accumulate on submerged features or at open ocean locations (**Table 7-11**).

Floating oil concentrations at or greater than 1 g/m² could travel up to 703 km from the release location (March to August), with the distances reducing to 36 km (September to February) as the contact threshold increases to 10 g/m² (RPS APASA, 2020).

Table 7-11: Modelling results for floating oil due to 86.5 m³ Stag crude subsea release

Receptor Type	Receptor	>1 g/m ²	>10 g/m ²
Australian Marine Parks	Gascoyne MP	Y	N
	Argo-Rowley Terrace MP	Y	N
	Dampier MP	Y	N
	Eighty Mile Beach MP	Y	N
	Montebello MP	Y	N
Biologically Important Areas	Marine Turtle BIA	Y	Y
	Seabirds BIA	Y	Y
	Fish and Sharks BIA	Y	Y

Receptor Type	Receptor	>1 g/m ²	>10 g/m ²
	Whales BIA	Y	Y
Islands	Montebello Islands	Y	N
	Barrow Island	Y	N
	Lowendal Islands	Y	N
Key Ecological Features	Ancient Coastline at 125m Depth Contour	Y	N
	Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula KEF	Y	N
	Continental Slope Demersal Fish Communities	Y	N
	Exmouth Plateau	Y	N
	Glomar Shoals	Y	N
State Marine and National Parks	Barrow Island MMA	Y	N
	Barrow Islands MP	Y	N
	Montebello Islands MP	Y	N

Entrained Oil Results

Entrained oil is most likely to drift to the east for spills commencing during summer and transition months, with drift to the west, followed by the southwest also likely for a spill commencing in the transitional seasons. For a spill commencing in winter months, entrained oil is most likely to drift to the southwest, following the offshore bathymetry of the region. Shoreline contact could occur from entrained oil at the Montebello Islands.

Highest maximum nearshore concentrations of entrained oil are predicted to occur along shorelines of the Montebello Islands at 169 ppb for spills commencing during winter months. And 181 ppb in summer months. For 100 ppb the minimum arrival time is 11 hours to the Montebello Marine Park (in winter months). The maximum entrained hydrocarbon concentration at any depth in the worst replicate is 1,288 ppb at the Montebello Islands MP.

Table 7-12: Modelling results for entrained oil due to 86.5 m³ Stag crude subsea release

Receptor Type	Receptor
Australian Marine Parks	Montebello Marine Park
Biologically Important Areas	Marine Turtle BIA
	Seabirds BIA
	Sharks BIA
	Whales BIA
Islands	Montebello Islands
Key Ecological Features	None
State Marine and National Parks	Montebello Islands MP

Dissolved Aromatic Hydrocarbons

Dissolved aromatic hydrocarbon concentrations at or greater than 70 ppb are not predicted within the modelling domain for this scenario.

No receptors are predicted to receive dissolved aromatic hydrocarbon concentrations equal to or greater than 70 ppb during either season.

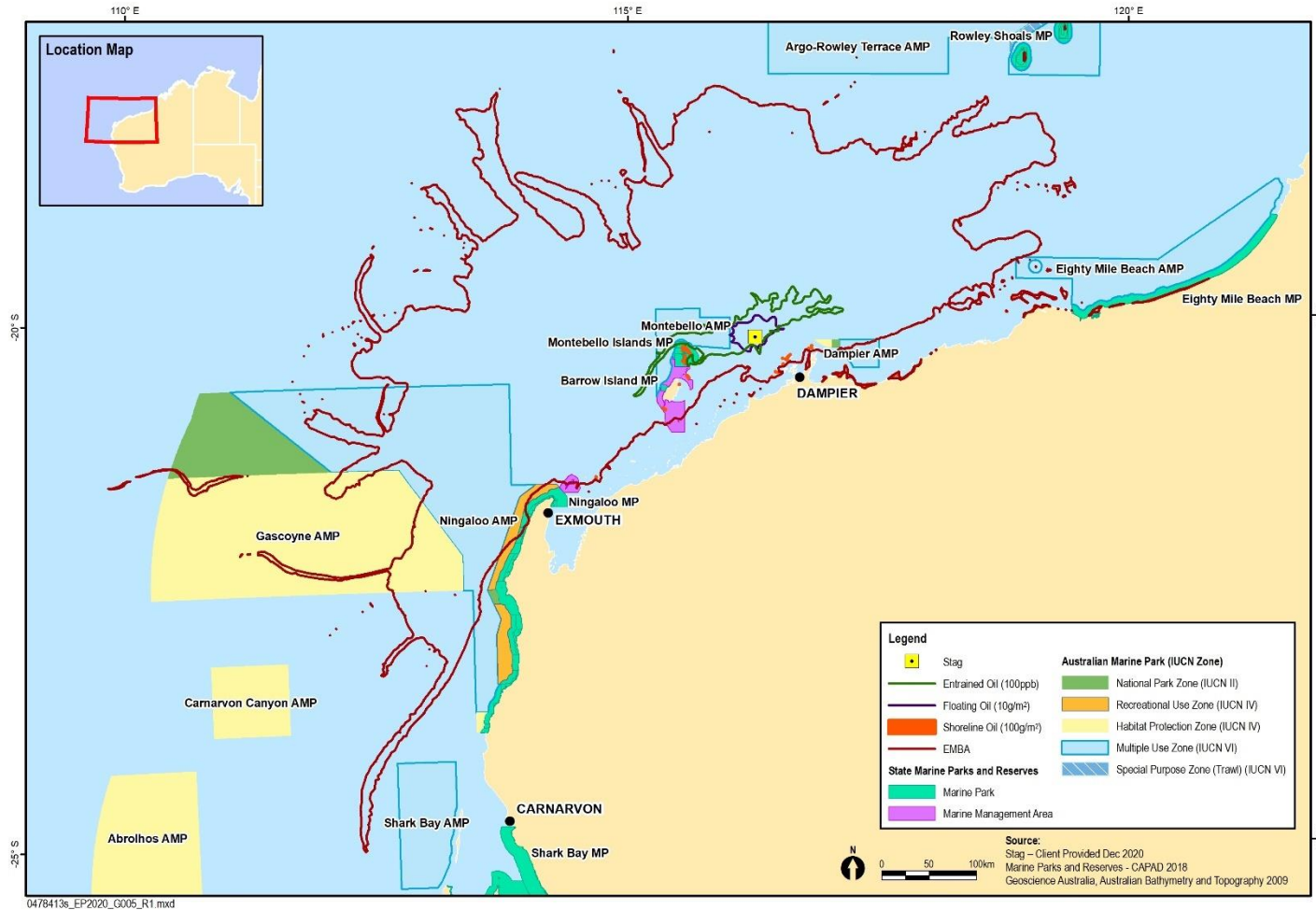


Figure 7-3: Modelled spill trajectories for all seasons for all hydrocarbon phases at moderate exposure thresholds resulting from surface release of Stag crude 86.5 m³ at the Stag Facility within Annualised EMBA of low exposure thresholds

7.5.3 Impacts and Risks

The maximum worst-case credible scenario was used to determine the nature and scale of impacts to sensitive receptors. The following sources of information were used:

- Overlaying the modelled impact from a subsurface release of 86.5m³ oil on known benthic habitats and shorelines in the region;
- A search of the EPBC Act protected matters database; and
- Predictions of Stag crude oil shoreline contact from RPS APASA (2020).

Hydrocarbon spills can cause chemical (e.g. toxic) and physical (e.g. coating of emergent habitats, oiling of wildlife at sea surface and ingestion) impacts to marine species. The level of impact depends on the magnitude of the hydrocarbon spill (i.e. severity, extent, duration etc.) and sensitivity of the receptor contacted. **Table 7-13** identifies the physical and chemical pathways and oil impacts to habitats, marine organisms and socio-economic receptors at locations in the EMBA.

The properties of Stag crude oil relevant to impact considerations are its persistent fraction, low likelihood of entrainment, low toxicity due to its highly weathered state, and its low adherence due to the low asphaltene content of the weathered residue.

In general, the oil floats when released on the sea surface, because it is less dense than seawater. Hence, not a big amount of a surface spill would tend to get deposited on the seabed, especially when dealing with a relatively small surface release like the one assessed in this case for the Stag operations. The modelling results show no prediction of oil deposited on the sediments.

7.5.3.1 Floating Oil

Floating oil impacts may include coating of marine flora, fauna and habitats or ingestion by marine fauna.

Shoreline habitats

Shoreline habitats which have the potential to be contacted by stranded oil include intertidal coral reefs, cays, sandy shorelines, mangroves, rocky shorelines and intertidal mud/sandflats. Fauna associated with these can be exposed to toxic effects from ingestion as fauna attempt to clean themselves (e.g. preening of feathers or licking fur), reduced mobility and inability to thermoregulate due to oil coating, contact to eyes, noses and breathing apparatus (invertebrates) from oil coating can result in irritation and/or inability to breathe or see.

Corals

Contact of floating Stag crude oil could occur with intertidal corals at low tide. The degree to which impacts such as bleaching, mortality or reduced growth could occur will depend upon the level of coating (concentration of oil and/or loading of oil on shorelines) and how fresh the oil is.

Prolonged contact of oil with corals has been observed to lead to tissue death and bleaching to exposed parts of colonies. Dosages of dissolved aromatic hydrocarbons are not predicted to reach levels where hydrocarbons dissolved under floating oil could impact intertidal or subtidal corals. Since Stag crude oil has a persistent fraction, extended contact with hard intertidal corals could occur and recovery of intertidal coral communities could be on scale of multiple years to decades, dependent upon the level of contact. A number of important coral areas could be contacted, dependent upon weather conditions and resultant spill trajectory, including Montebello/ Barrow/ Lowendal Islands, Dampier Archipelago and the Rowley Shoals (marine parks). Coral at these locations have been identified as a KPI in the respective marine park management plans.

Table 7-13: Physical and chemical pathways and oil impacts to habitats, marine organisms and socio-economic receptors

Receptor	Location in EMBA	Physical pathway	Potential impacts	Chemical pathway	Potential impacts
Rocky Shore	Barrow Island, Montebello Island, Ningaloo Coast including North-West Cape, Dampier Archipelago	Shoreline loading and attachment.	Degree of oil coating is dependent upon the energy of the shoreline area and the type of the rock formation Solid consolidated rock is likely to receive a lower degree of persistent oiling	External contact by oil and adsorption across cellular membranes Impacts to flora and fauna as per this table	Impacts to sessile flora and fauna as per this table
Sandy Shore	Eighty Mile Beach, Muiron Islands, Imperieuse Reef, Barrow Island, Montebello Islands, Lowendal Islands, Clerke Reef MP, Dampier Archipelago, Thevenard Island, Bedout Island, Turtle Island	Shoreline loading and water movement may act to drive oil into sediments	Indirect impacts to nesting and foraging habitats for birds and turtles. Direct impacts to in-fauna	Toxicity of sediment and reduced oxygen availability within the sediments as a result of oil smothering and microbial biodegradation	Indirect impacts to nesting and foraging habitats for birds and turtles including EPBC listed species and KPIs within marine parks as per Table 3-10. Direct impacts (mortality) to in-fauna through toxic effects and smothering
Intertidal flats	Eighty Mile Beach (KPI), Barrow Island, Montebello Islands, Dampier Archipelago,	Shoreline loading and attachment to fine substrates	Indirect impacts to foraging habitats for birds & turtles. Direct impacts to infauna	Muddy substrates are likely to promote sedimentation of oil and binding of sediments by oil	Indirect impacts to foraging habitats for birds. Direct impacts (mortality) to in-fauna through toxic effects and smothering including EPBC listed species and KPIs within marine parks as per Table 3-10

Receptor	Location in EMBA	Physical pathway	Potential impacts	Chemical pathway	Potential impacts
Mangroves	Eighty Mile Beach (KPI), Barrow Island (KPI), Montebello Islands, Lowendal Islands, Dampier Archipelago	Smothering of root system reducing air and salt exchange	Yellowing of leaves, defoliation, disease, increased predation, tree death, reduced growth, reduced reproductive output, reduced seed viability	External contact by oil and adsorption across cellular membranes Uptake of dissolved aromatic hydrocarbons across cellular membranes	Yellowing of leaves, defoliation, disease, increased predation, tree death, reduced growth, reduced reproductive output, reduced seed viability, growth abnormalities
Algae and seagrass	Muiron Islands, Imperieuse Reef, Barrow Island (KPI), Montebello Islands (KPI), Lowendal Islands, Clerke Reef MP, Dampier Archipelago, Barrow-Montebello Surrounds, Rowley Shoal Surrounds, Glomar Shoals, Montebello AMP, Dampier AMP, Mermaid Reef AMP	Smothering of leaves/thalli reducing light availability and gas exchange	Bleaching or blackening of leaves, defoliation, reduced growth	External contact by oil and adsorption across cellular membranes Uptake of dissolved aromatic hydrocarbons across cellular membranes	Mortality, bleaching or blackening of leaves, defoliation, disease, reduced growth, reduced reproductive output, reduced seed/ propagule viability
Hard corals	Muiron Islands (KPI), Montebello Islands (KPI), Lowendal Islands, Dampier Archipelago, Barrow-Montebello Surrounds, Thevenard, Airlie and Serrurier Islands, Rowley Shoal MP (Clerke and Imperieuse Reef), KPI Glomar Shoals, Montebello AMP, Eighty Mile Beach AMP, Mermaid Reef AMP	Smothering of polyps reducing light availability	Bleaching, increased mucous production, reduced growth	External contact by oil and adsorption across cellular membranes Uptake of dissolved aromatic hydrocarbons across cellular membranes	Mortality, cell damage, reduced metabolic capacity, reduced immune response, disease, reduced growth, reduced reproductive output, reduced egg/ larval success, growth abnormalities

Receptor	Location in EMBA	Physical pathway	Potential impacts	Chemical pathway	Potential impacts
Invertebrates	All locations including: Eighty Mile Beach, Barrow Island, Dampier Archipelago, Rowley Shoal MP (KPI), Clerke and Imperieuse Reef), Gascoyne AMP, Ningaloo AMP, Montebello AMP, Dampier AMP, Eighty Mile Beach AMP, Mermaid Reef AMP, Argo-Rowley Terrace AMP, Kimberley AMP	Smothering of adults, eggs and larvae - Reduced mobility and capacity for oxygen exchange	Mortality, oxygen debt, starvation, dehydration, increased predation, behavioural disruption	Ingestion and internal adsorption External contact and adsorption across exposed skin and cellular membranes Uptake of dissolved aromatic hydrocarbons across cellular membranes Indirect impact to predators through ingestion of oiled prey	Mortality, cell damage, reduced metabolic capacity, reduced immune response, disease, reduced growth, reduced reproductive output, reduced egg/larval success, growth abnormalities, behavioural disruption
Fish and Sharks (including EPBC species listed in Table 3-3)	All locations including BIA's for: Dwarf Sawfish, Freshwater Sawfish, Green Sawfish; and Whale Sharks (refer Figure 3-6) Additional locations include: Eighty Mile Beach, Muiron Islands, Barrow Island, Montebello Islands, Dampier Archipelago, Barrow-Montebello Surrounds, Rowley Shoal Surrounds (Clerke and Imperieuse Reef), Glomar Shoals, Gascoyne AMP, Ningaloo AMP, Montebello AMP, Dampier AMP, Eighty Mile Beach AMP, Mermaid Reef AMP	Smothering of adults but primarily eggs and larvae - Reduced mobility and capacity for oxygen exchange	Mortality, oxygen debt, starvation, dehydration, increased predation, behavioural disruption	Ingestion and internal adsorption External contact and adsorption across exposed skin and cellular membranes Uptake of dissolved aromatic hydrocarbons across cellular membranes (e.g. gills) Indirect impact to predators through ingestion of oiled prey	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

Receptor	Location in EMBA	Physical pathway	Potential impacts	Chemical pathway	Potential impacts
Birds (including EPBC species listed in Table 3-10)	<p>BIA's for the following bird species: Wedgetail shearwater, Roseate tern, Lesser crested tern, Lesser Frigatebird, Fairy Tern, Brown booby, Little tern, White-tailed tropicbird (refer Figure 3-13)</p> <p>Additional locations include: Argo-Rowley Terrace AMP, Eighty Mile Beach (including Ramsar site), Muiron Islands, Barrow Island, Montebello Islands, Lowendal Islands, Thevenard Island, Bedout Island, Clerke Reef (Bedwell Island), Dampier Archipelago Barrow-Montebello Surrounds Montebello AMP, Rowley Shoal Surrounds, Mermaid Reef AMP, Eighty Mile Beach AMP, Gascoyne AMP, Argo-Rowley Terrace AMP</p>	<p>Smothering - Feather matting and damage, reducing insulation, mobility and buoyancy</p> <p>Secondary smothering of eggs and hatchlings</p>	<p>Mortality, drowning, starvation, dehydration, increased predation, hypothermia, behavioural disruption</p>	<p>Ingestion (during feeding or preening) and internal adsorption</p> <p>External contact and adsorption across exposed skin and membranes</p> <p>Secondary contact and adsorption by eggs and hatchlings</p> <p>Indirect impact to predators through ingestion of oiled prey</p>	<p>Mortality, cell damage, lesions, secondary infections, reduced metabolic capacity, reduced immune response, disease, reduced growth, reduced reproductive output, reduced hatchling success, growth abnormalities, behavioural disruption</p>
Marine reptiles	<p>BIA's for the following turtle species: Flatback, the hawksbill, green, loggerhead and leatherback turtle</p> <p>Additional locations include: Eighty Mile Beach, Muiron Islands, Imperieuse Reef, Barrow Island, Montebello Islands, Lowendal Islands, Clerke Reef MP, Dampier Archipelago, Barrow-Montebello Surrounds, Rowley Shoal Surrounds, Glomar Shoals, Montebello AMP, Eighty Mile Beach AMP, Gascoyne AMP, Mermaid Reef AMP, Argo-Rowley Terrace AMP</p>	<p>Smothering (particularly hatchlings) – reduced mobility and buoyancy</p>	<p>Mortality, drowning, starvation, dehydration, increased predation, behavioural disruption</p>	<p>Inhalation of volatile compounds</p> <p>Ingestion and internal adsorption</p> <p>External contact and adsorption across exposed skin and membranes</p> <p>Indirect impact to predators through ingestion of oiled prey</p>	<p>Mortality, cell damage, lesions, secondary infections, reduced metabolic capacity, reduced immune response, disease, reduced growth, reduced reproductive output, reduced hatchling success, growth abnormalities, behavioural disruption</p>

Receptor	Location in EMBA	Physical pathway	Potential impacts	Chemical pathway	Potential impacts
Marine mammals	<p>BIA's for the following mammal species: the dugong, humpback whale, blue whale</p> <p>Other locations include: Muiron Islands, Imperieuse Reef, Broome to Roebuck, Montebello Islands, Lowendal Islands, Clerke Reef MP, Dampier Archipelago, Barrow-Montebello Surrounds, Montebello AMP, Eighty Mile Beach AMP, Rowley Shoal Surrounds, Dampier AMP, Mermaid Reef AMP, Kimberley AMP</p>	<p>Smothering – fur damage and matting, reduced mobility and buoyancy (for applicable species)</p> <p>Smothering of feeding apparatus in some species (i.e. baleen whales)</p>	<p>Mortality, drowning, starvation, dehydration, increased predation, hypothermia, behavioural disruption</p>	<p>Inhalation of volatile compounds</p> <p>Ingestion and internal adsorption</p> <p>External contact and adsorption across exposed skin and membranes</p> <p>Indirect impact to predators through ingestion of oiled prey</p>	<p>Mortality, cell damage, lesions, secondary infections. Reduced metabolic capacity, reduced immune response, disease, reduced growth, reduced reproductive output, reduced hatchling success, growth abnormalities, behavioural disruption</p>
Socio- economic and heritage	<p>Eighty Mile Beach, Muiron Islands, Imperieuse Reef, Barrow Island, Montebello Islands, Lowendal Islands, Dampier Archipelago, Barrow-Montebello Surrounds, Rowley Shoal and Surrounds, Glomar Shoals, Montebello AMP, Eighty Mile Beach AMP, Mermaid Reef AMP,</p>	<p>Smothering of socio-economic/tourism amenities such as sandy shores.</p> <p>Floating oil on sea surface may prevent vessels (commercial/recreational) from utilising area</p> <p>Economic effect on industry due to restricted zones, impacts to values, impacts to fishery/aquaculture (e.g. pearls, seaweed) stocks</p>	<p>Loss of income, restriction of access, reduction in aesthetic values leading to negative effect on tourism (both short and long term), loss of aquaculture, human health risk</p>	<p>Entrained oil and DAH may be ingested by fish stocks</p> <p>Reduction in water quality can result in impacts to aquaculture</p>	<p>Decrease in fishery stock levels, reduced marketability of product, tainted flesh in fish, perceived reduction in health of habitat, pearl/ seaweed industry tainted stock, loss of income</p>

Corals at the Montebello/ Barrow/ Lowendal islands and Dampier Archipelago have the potential to be impacted by the greatest volumes and more toxic (less weathered crude oil) although it should be noted that Stag crude oil has a relatively low toxicity due to its highly-weathered state.

Impacts to hard corals could be intensified if a spill was to reach shallow coral areas during the peak spawning season of March/ April since floating oil could smother intertidal corals in the process of spawning or could contact floating coral eggs and larvae following spawning events. Dependent on the level of contact, this could diminish coral recruitment, and impact longer term recovery.

Presence of surface oil can affect light qualities and the ability of macrophytes to photosynthesise. Reduced primary productivity could occur while surface oil is present.

Mangroves and salt marshes

Mangrove root systems (including pneumatophores) are sensitive to physical coating by crude oil which may persist for long periods of time given the persistent components of Stag crude oil and the tendency for mangrove root habitat to trap oil. This could have prolonged negative effects on the faunal communities within mangroves. Of the emergent habitat types mangroves are likely to be one the most susceptible and slowest recovering habitat types with recovery potentially on a decadal scale if death of trees was to occur. Mangroves could be impacted at the Montebello, Lowendal, Barrow Islands, Dampier Archipelago and shoreline areas along Eighty Mile Beach. These mangroves are identified as KPI values within many of the respective management plans (**Table 7-13**).

Floating crude oil could reach salt marsh areas (Eighty Mile Beach), which are often landward of mangrove communities, on high spring tides. Salt marshes would likely trap floating crude oil to a certain degree and therefore persistent oil may remain within these areas even after tidal water has receded. This could have prolonged negative effects on the faunal communities within salt marshes. Depending upon the degree of weathering, Stag crude oil may have toxic impacts from physical coating of salt marshes potentially ranging from death to sub lethal stresses such as reduced growth rates and reduced reproductive output/ success. Such impacts would be restricted to the seaward fringes of salt marsh communities.

Fish and sharks

Near the sea surface, fish can detect and avoid contact with surface slicks meaning fish mortalities rarely occur in the event of a hydrocarbon spill in open waters (Kennish, 1997; Scholz et al., 1992). As a result, wide-ranging pelagic fish species of the open ocean generally are not highly susceptible to impacts from hydrocarbon spills. This includes the EPBC listed whale shark (whose foraging and high density BIA overlaps the EMBA (Figure 3-6)), great white and grey nurse shark, oil pollution is identified as a threat in their respective conservation advice (SPRAT whale shark, great white shark and grey nurse shark, DEE 2017as). BIAs for sawfish are also within the EMBA and conservation advice identifies marine pollution as a risk for green sawfish.

Assessment of the effects on Timor Sea fish following the Montara incident indicated that fish collected initially in Phase I and II of monitoring showed evidence of exposure to petroleum hydrocarbons at sites close to the West Atlas drilling rig, with samples collected one year after (Phase III) suggesting an ongoing trend toward a return to normal biochemistry/ physiology (Gagnon and Rawson, 2011).

Most reef fish are expected to be buffered from contact to floating surface slicks by the overlying water column. For example, shallow water reef habitats extend to 15–20m depth along island coastlines allowing reef fish species to seek refuge from floating oil slicks. Reef fish in the shallowest areas are more susceptible to hydrocarbon spill impacts however, as many reef fish are site attached residents on the reef and are unlikely to move away if their territory is impacted. Impacts due to contact with floating oil may include reduced mobility and capacity for oxygen exchange, behavioural disruption or mortality.

Marine mammals

Whales, dolphins and dugongs are smooth skinned, hairless mammals so hydrocarbons tend not to stick to their skin therefore physical impacts from surface oil coating is unlikely. Pinnipeds are more susceptible to physical coating as hydrocarbons tend to adhere to rough surfaces, hair or calluses of animals. Irritation to eyes, ears, airways and/or skin may occur from contact with surface slicks.

Physical impacts due to ingestion are applicable to surface slicks; however, the susceptibility of cetacean and pinnipeds species varies with feeding habits. Baleen whales are more likely to ingest surface slick hydrocarbon than "gulp feeders" such as toothed whales and are particularly vulnerable to hydrocarbon ingestion while feeding. Oil may stick to the baleen while the whales "filter feed" near slicks. Humpback whales, whose migration BIA overlaps the EMBA are more likely to occur in the area during the northern migration period in June/July and southern migration in Sep/Oct so a sea surface plume ($>10 \text{ g/m}^2$) of oil might contact humpback whales as they migrate. Similarly, blue whales may encounter a sea surface plume ($>10 \text{ g/m}^2$) as they pass through the area during their northern migration in May–August as a distribution and migration BIA also overlaps the EMBA.

Marine mammals are at risk of inhaling volatile compounds evaporating from a spill if they surface to breathe in an oil slick (Geraci and St Aubin, 1990).

Marine reptiles

Marine turtles and sea snakes when surfacing to breathe may be affected from surface slick hydrocarbons through damage to their airways and eyes. Turtles and sea snakes may be affected by oil through tainted food source or by absorption through the skin. Risk of contact would likely be greatest along intertidal sections of nesting beaches or within shallow waters adjacent to nesting beaches. Contact might also occur within foraging areas, for example along the Ningaloo and Muiron Islands shorelines and Dampier AMP.

The flatback, green, hawksbill and loggerhead turtle BIAs (including foraging, interesting, nesting and mating) overlap the EMBA, and the Stag facility overlaps a suggested 60 km inter-nesting buffer from the nesting beaches on Dampier Archipelago for the flatback turtle (Figure 3-12). However, while oil may be impacted as described above, oil spills are not identified as a key threat to these species in the conservation advice (SPRAT) or in the recovery plan (EA 2003).

Seabirds

Seabirds are highly susceptible to hydrocarbon spills and oiled birds may experience hypothermia due to matted feathers and an inability to fly. These impacts are primarily attributed to oiling of birds at the surface from slicks. Oiled birds may experience decreased foraging success due to a decline in prey populations following a spill (Andres 1997, NRC 2003) or due to increased time preening to remove oil from their feathers (Burger 1997). During both winter and migration, shorebirds spend much of their time feeding and depend on nonbreeding habitats to provide the fuel necessary for migratory flight (Withers, 2002).

Oil can reduce invertebrate abundance or alter the intertidal invertebrate community that provides food for nonbreeding shorebirds (Andres 1997, NRC 2003) such as at the Eighty Mile Beach Ramsar site. Reduced abundance of a preferred food may cause shorebirds to move and forage in other—potentially lower-quality—habitats. Prey switching has not been documented in shorebirds following an oil spill. However, shorebirds will feed in alternative habitats when the intertidal zone alone cannot fulfil their energy requirements.

A bird's inability to obtain adequate resources delays its pre-migratory fattening and can delay the departure for its breeding grounds. Birds arriving on their breeding grounds earlier realise higher reproductive success through increased clutch size and offspring survival (for a review, see Harrison et al. 2011). If coastal habitats are sufficiently degraded by oil that pre-migratory fattening is slowed and birds delay departure for their breeding grounds, the individual effects could carry over into the breeding season and into distant breeding habitats (Henkel et al. 2012).

The breeding BIA of several EPBC listed bird species overlap the EMBA (Figure 3-13) and may be affected by oil. The wedge tailed shearwater breeding BIA overlaps the Stag facility operational area and oil pollution is identified as a low threat to the species (SPRAT Wedge-tailed shearwater, DEE 2017a).

Socio-economic

Surface oil may impact upon socio-economic receptors including the oil and gas industry, commercial shipping, fisheries/aquaculture, recreation and tourism, resulting in an economic and social impact. Floating and stranded oil can be highly visible and have a resultant negative effect on tourism. A sheen of oil ($1\text{g}/\text{m}^2$) may be visible slightly further than the EMBA for biological impacts boundary and impact on the values of a marine park or tourism beach – in particular Ningaloo coast and Exmouth (Figure 3-14).

Many of the protected areas have ‘wilderness’ and ‘seascapes’ identified as a value, and these would be compromised by the presence of any oil.

Impacts on the values associated with Protected Areas may result in loss of fauna/ habitat diversity and/ or abundance, reduction in commercial/recreational/ subsistence fishing, loss of livelihood and loss of income from reduced tourism and commercial productivity.

There are no thresholds identified at which smothering or volume ashore will result in an impact, however those shorelines with the highest load, and those identified as significant threatened or migratory fauna habitat are the most susceptible to impact. **Table 8-6** lists key potential impacts to sensitive receptors present in the EMBA.

Several of the AMPs, have conservation values associated with biological attributes including migratory seabirds, flatback turtles, humpback whales, freshwater, green and dwarf sawfish, Australian Snubfin, Indo-Pacific Humpback and Indo-Pacific bottlenose dolphins. A concentration of $1\text{ mg}/\text{m}^2$ would not be expected to have any impact on these values but may affect tourism visitation.

7.5.3.2 Entrained Oil

Total oil in the water column has the potential to coat benthic and susceptible shoreline habitats and organisms.

Shoreline habitats

Intertidal and subtidal zones may be exposed to entrained hydrocarbons with impacts similar to coral reefs. Impacts may occur due to increased hydrocarbon levels in the nearshore waters and in sediments above the low water mark. Concentrations of hydrocarbons in nearshore waters and sediments, will fluctuate over short time scales (days to weeks), due to volatilisation, wave and tidal action, biological processes and potential arrival of more oil. Fauna associated with these habitats may experience sub-lethal effects. However, due to the expected weathering of Stag crude, the accessibility of PAHs to aquatic organisms is decreased.

Similar to benthic habitats, recovery of shoreline habitats exposed to entrained hydrocarbons and experiencing impacts would be expected within weeks to months of return to normal water quality conditions.

Benthic

The smothering of submerged benthic habitats and those within tidal zones from water column oil has only been reported where very large oil spill quantities have affected these habitats or very sticky oil slicks have encountered exposed coral surfaces or polyps. Where entrained oil reaches the shoreline habitats of intertidal zones, sub-lethal effects may occur, with mangroves and reef areas being the most sensitive.

Benthic habitats in the EMBA that may be impacted by entrained oil include soft sediments and benthic fauna, coral reef, macroalgae and seagrasses. Recovery of benthic habitats exposed to entrained hydrocarbons and experiencing impacts would be expected within weeks to months of return to normal water quality conditions. Several studies have indicated that rapid recovery rates may occur even in cases of heavy oiling (Burns et al., 1993; Dean et al., 1998).

Coral

There is a paucity of information on the long-term impacts on coral reefs of hydrocarbons entrained in the water column although NOAA (2001) indicate that some effects may be transient whilst others are long-lasting depending on the type of corals, reproduction period and health of the reef. Response to hydrocarbon exposure can include impaired feeding, fertilisation, larval settlement and metamorphosis, larval and tissue death and decreased growth rates (Villanueva et al., 2008).

Entrained hydrocarbon concentrations below parts per million (ppm) concentrations in marine waters have not been associated with any observed stress, degradation or death of corals. Macrophytes, including seagrasses and macroalgae, require light to photosynthesise. Presence of entrained hydrocarbon within the water column can affect light qualities and the ability of macrophytes to photosynthesise. Reduced primary productivity could occur while entrained hydrocarbons are present in the water column.

Waters that contain extensive fringing coral reef may experience impacts from entrained hydrocarbons as described below for benthic habitats. Reefs are often characterised by increased levels of biological productivity, which attracts commercially valuable fish species. Impacts from entrained hydrocarbons will be as described below for reef fish.

Mangroves

Mangrove communities may be impacted through the sediment/ mangrove root interface. Where entrained hydrocarbons include contaminants that may become persistent in the sediments (e.g. trace metals, PAHs), this can lead to effects on mangroves due to uptake, or effects on benthic infauna leading to reduced rates of bioturbation and subsequent oxygen stress on the plants' root systems (Lewis et al., 2011).

Fish and sharks

Reef fish with high site fidelity will experience protracted water quality conditions with entrained hydrocarbon concentrations >500 ppb within the EMBA. Hydrocarbon droplets can physically affect reef fish exposed for an extended duration (weeks to months) by coating of gills. This can lead to lethal and sub-lethal effects from reduced oxygen exchange and coating of body surfaces resulting in increased incidence of irritation and infection. Fish may also ingest hydrocarbon droplets or contaminated food leading to reduced growth (NRC, 2005). Lethal effects to reef fish may be observable within days to weeks. Sub-lethal effects of coral reef fish communities will take weeks to months to become measurable.

Pelagic and demersal fish species (including sharks) exposed to entrained hydrocarbons can result in tainting and contamination of fish flesh by insoluble PAHs associated with the weathered hydrocarbon (refer **Section 8.6.2.3** for further information on tainting).

Whale sharks feed on plankton, krill and bait fish near or on the water surface and it is possible that they may come into contact with entrained oil, or ingest entrained oil if a large-scale spill occurred when they (and their prey) were present in the region (Woodside, 2005).

Whale sharks are known to transit the NW coast and aggregate from late March to June in the vicinity of the Ningaloo coast, (generally peaks in April). If a spill event overlapped with this time, whale sharks may experience entrained hydrocarbon concentrations >100 ppb. While whale sharks may be exposed to entrained hydrocarbons, they could be migrating to aggregation areas beyond the impact zone, in which case exposure would be short term and confined to the EMBA and spill duration/ dispersion periods.

Marine mammals

Impacts to marine mammals from entrained hydrocarbons could result in behavioural (e.g. deviating from migratory routes or commonly frequented feeding grounds) impacts. These impacts may affect individuals within or transiting the spill area during migration.

Whales, dolphins and dugongs are smooth skinned, hairless mammals so hydrocarbons tend not to stick to their skin therefore physical impacts from entrained oil coating is unlikely. Pinnipeds are more susceptible as hydrocarbons tend to adhere to rough surfaces, hair or calluses of animals. Irritation to eyes, ears, airways and/or skin may occur from contact with entrained oil.

Impacts from ingested hydrocarbon can be lethal or sub-lethal. However, the susceptibility of marine mammal species varies with feeding habits as with surface oil (described previously). Entrained oil attached to seagrass can also be ingested by dugongs.

Oil may foul sensory hairs around the mouth and/or contact eyes while surfacing to breathe which may cause inflammation and infections. Similar to cetaceans, inhalation of volatile compounds evaporating from a spill may also result in physiological impacts to dugongs.

Marine reptiles

Turtles and sea snakes may be affected by oil through tainted food source or by absorption through the skin. Turtle hatchlings and turtle/sea snake adults may be exposed to hydrocarbon through ingestion of entrained hydrocarbons and tainted food source. These effects may cause physiological effects such as disruption of digestion. As for other megafauna that may be exposed to entrained hydrocarbons, acute impacts due to exposure to adult turtles are not expected.

Seabirds

Seabirds may come into contact with entrained oil while searching for food (diving) below the sea surface, exposure times would be very short in this scenario limiting the opportunity for oiling of feathers. Short-term physiological effects due to ingestion of entrained oil or contaminated prey may also occur. Ingested oil can have several sublethal toxicological effects, including haemolytic anaemia, reduced reproduction, and immunosuppression.

Socio-economic

Impacts to fish may result in tainted flesh and fishery closure resulting in an economic impact on commercial and subsistence fishing. Entrained oil can also lead to impacts on aquaculture (e.g. pearls, seaweed) due to a decrease in water quality and reduced stock. Reduced marketability of products (perceived or real) could occur for target species. Tourism may be impacted by real or perceived reduction in health or mortality of habitats that support tourism activities.

Table 7-13 lists key potential impacts to sensitive receptors present in the EMBA.

7.5.3.3 Dissolved Aromatic Hydrocarbons

The moderate threshold for dissolved aromatic hydrocarbons is not reached for the crude spill scenarios; however, the detail is provided here as it is reached for the diesel spill scenario (Section 8.6).

While there is some debate in the scientific literature (Barron et al., 1999), the main component of oil generally thought to be responsible for the majority of toxicity to wildlife is the Dissolved Aromatic Hydrocarbons (DAH) compounds that dissolve into the water column following a spill. Various studies indicate that the toxic effects of aromatic compounds result from the narcosis caused in biological receptors following exposure to low molecular weight aromatics including compounds from the BTEX group and 2–4 ring PAHs (French, 2000).

Accumulation of petroleum hydrocarbons by marine organisms is dependent on the bioavailability of the hydrocarbons, the length of exposure, and the organism's capacity for metabolic transformations of specific compounds. Actual toxicity depends on both concentration and the duration of exposure, being a balance between acute and chronic effects.

Acute toxicity

Toxicity to wildlife increases with increased length of exposure; marine organisms can typically tolerate high concentrations of toxic hydrocarbons over short durations (French 2000; Pace et al., 1995).

DAHs have a narcotic effect on organisms, resulting from interference with cell function that occurs as hydrocarbons are absorbed across cell membranes (French-McCay, 2002). The narcotic effect varies among specific hydrocarbon compounds, with these variations thought to be attributable to the lipid solubility of the compounds. Over periods of hours to a few days, the narcotic effect has been found to be additive, both in severity and the number of different soluble hydrocarbons that are present (French, 2000; NRC, 2005; Di Toro et al., 2007).

Because the toxicity of DAH to aquatic organisms increases with time of exposure, organisms may be unaffected by brief exposures to a given concentration but affected at long exposures to the same concentration (French-McCay, 2002). This is due to the fact that the concentrations of hydrocarbons build up in the tissues of biological receptors from either long-term exposure or repeated exposure to sub-lethal concentrations.

Chronic toxicity and accumulation

There is sparse data available on the chronic effects of PAHs in the marine environment. A review of the processes controlling the uptake and persistence of PAH in marine organisms, especially under chronic exposure conditions, highlighted differential mechanisms of uptake, tissue distribution, and elimination (Meador et al., 1995). While vertebrates have a high capacity for metabolising aromatic hydrocarbons including PAHs (through cytochrome P450 1A mediated oxidation), PAHs can accumulate in the body of invertebrates (as they lack a cytochrome P450 1A mediated oxidation system). Organisms that may experience chronic effects include plankton, fish, marine mammals and marine reptiles. **Table 7-13** lists key potential impacts to sensitive receptors present in the EMBA.

Pelagic fish are highly mobile and comprise species such as sharks and migratory whale sharks. The likelihood of pelagic fish being continuously exposed to DAHs for >96 hours is unlikely therefore acute/ lethal effects are not predicted (Luyeye, 2005). However, chronic/ non-lethal effects may be experienced. As a chronic action of PAHs is a neurotoxic effect, chronic exposure of pelagic fish may cause delayed predatory/ avoidance response times, disorientation, swimming action/ efficiency.

Whale sharks migrate along the NW coast from late March to September. If a spill event overlapped with this time period, whale sharks may experience exposure above the DAH threshold as they migrate through the area.

Tainting by DAHs of commercially targeted pelagic fish species may occur. Tainting can have a range of effects from affecting edible quality of the fish and have economic consequences, to containing toxic levels above recommended human consumption guidelines. While tainted pelagic fish will recover naturally over time (months) once water quality conditions have returned to normal, re-opening of a fishery will require an understanding of when recovery from tainting has occurred for the target species of interest.

Marine mammals that may occur within the EMBA for DAHs include dugongs, whales and dolphins in offshore waters. According to Geraci and St Aubin (1990), inhalation of volatile compounds evaporating from a spill at sea surface is the greater risk to cetaceans when surfacing to breathe. For these marine mammals, the potential for chemical effects due to exposure is considered unlikely, particularly for highly mobile species such as dolphins because it is very unlikely that these animals will be constantly exposed to high concentrations for continuous durations (e.g. >96 hours) that would lead to toxic effects.

The majority of publicly available information detailing potential impacts to turtles and sea snakes due to exposure to hydrocarbons is based on impacts due to heavy oils. Impacts due to exposure to DAHs are less understood. One information source provides a case study detailing a spill of 440,000 gallons of aviation gasoline nearby to an island supporting approximately 1,000 green turtles that aggregate and nest at the atoll in the west Pacific Ocean annually (Yender and Mearns, n.d.). Timing of the spill was of concern as it coincided with expected peak hatchling emergence. Population comparisons with a census that had been completed just prior to the spill were undertaken to evaluate impacts; no impacts were reported during the spill response and population effects were not detected.

For marine reptiles that may be exposed to DAHs dosages that exceed the threshold, acute impacts to turtles and sea snakes are not expected. Impacts to turtle hatchlings may occur however due to the risk of them becoming entrained in a parcel of water allowing them to be continuously exposed to toxic hydrocarbons for an extended period.

Socio-economic receptors will be affected by hydrocarbon exposure in three key ways: loss of Income (e.g. reduction in catch for commercial fisheries), restriction of access and reduction in aesthetic values. Impacts to fish may result in tainted flesh and fishery closure resulting in an economic impact on commercial fishing. DAH in the water column can also lead to impacts on aquaculture (e.g. pearls, seaweed) due to a decrease in water quality and reduced stock. Reduced marketability of products (perceived or real) could occur for target species. Tourism may be impacted by real or perceived reduction in health or mortality of habitats that support tourism activities.

7.5.3.4 Receptors

Key ecological features (KEFs)

The crude spill modelling does not indicate contact with any KEFs at moderate thresholds.

Commonwealth and State Marine Reserves

The following state and Australian Marine Parks are located within modelled spill trajectories of a crude oil release at moderate thresholds:

- Montebello Australian Marine Park; and
- Montebello Island Marine Park.

These parks were established to protect both habitats and species groups as described in **Section 3.7.6**. Many of the values are listed as KPI and are considered unique to the protected area and include habitats, fauna or ecological features. Impacts to the values may compromise the management objectives of the managed areas, which may have flow-on effects to tourism revenue of coastal communities that provide access to these marine reserves. The reserves listed above may also support nursery/ feeding/ aggregation areas for fisheries species and therefore may assist in maintaining healthy fish stocks for both commercial and recreational fisheries.

Overall Consequence	Overall Likelihood	Residual Ranking
Major	Unlikely	Medium

7.5.4 Protection Priorities

The Protection Priorities are the most likely to be contacted locations across ALL modelled scenarios, they are used for spill response planning purposes for the initial response capability. In a real event, the IAP, NEBA and planning process takes over; utilising real time operational data and focusing operations on locations to be contacted (which will be a subset of what is planned for). This allows for preparedness and planning for the most credible scenarios whilst retaining flexibility in response to manage an event.

The following Protection Priorities (refer **Section 5.7.5**) for spill response have been determined from the modelling results for both crude and diesel spills:

- Eighty Mile Beach;
- Montebello Islands;
- Dampier Archipelago;
- Barrow Island; and
- Lowendal Islands.

Table 7-14 summarises the rationale for the Protection Priorities selection (also refer to **Section 5.7**) and **Appendix I** details the specific key values and modelled contact of the Protection Priorities. Note that the worst-case value is presented for the receptor as a whole e.g. Montebello Islands includes the marine park, MMA and surrounds, the minimum time to contact/maximum concentration on any one of those receptors is taken. The only exception is that shoreline oil is only reported for receptors with shorelines (i.e. MP boundaries are not reported for shoreline contact). Note that diesel results are also presented to inform the assessment of protection priorities.

An assessment was conducted to determine the Environmental Performance Outcome (EPO) for the locations and the spill response measures that would be required to meet the EPO and thereby reduce impacts associated with spill response to ALARP (**Table 7-15**). These assessments form the basis of determining the required level of spill response resourcing, as detailed in the OPEP and the justification that spill risk has been reduced to ALARP.

7.5.5 Net Environmental Benefit (NEBA)

Net Environmental Benefit Analysis (NEBA) is a structured approach used by the spill response community and stakeholders to select spill response strategies that will effectively remove oil, are feasible to use safely in particular conditions, and will reduce the impact of an oil spill on the environment.

The NEBA process is used during pre-spill planning (Strategic NEBA) and during a response (Operational NEBA). A Strategic NEBA is an integral part of the contingency planning process and is used to ensure that response strategies for scenarios are well informed. An Operational NEBA is used to ensure that evolving conditions are understood, so that the response strategy can be adjusted as necessary to manage individual response actions and end points.

Balancing trade-offs may involve differing and conflicting priorities, values and perceptions of the importance of sensitive receptors. There is no universally accepted way to assign perceived value or importance and is not a quantitative process. Overall, the NEBA process provides an estimate of potential environmental effects which are sufficient to allow the parties to compare and select preferred combinations of response strategies to reduce environmental impacts to ALARP.

Table 7-15 provides a summary of spill response strategies available for each of the Protection Priorities identified and the potential impact that a response strategy has on the environmental values of the area, noting that response strategies are not used in isolation. This information is to be considered in the NEBA process during the development of the Incident Action Plan in a spill response (i.e. an Operational NEBA). An Operational NEBA will also consider feedback from operational and scientific monitoring activities (refer OPEP), real time monitoring of the effectiveness and potential impacts of a response and will also consider accessibility, feasibility and safety of responders.

Table 7-14: Rationale for Determination of Protection Priorities for Spill Response from worst case spill scenarios

 [thresholds – >10g/m² floating oil, >100ppb entrained oil, >70ppb dissolved oil]

Location in Risk EMBA	Stag Crude spill (Subsea 86.5m ³) all seasons	Diesel spill (surface 250m ³) all seasons	Protection Priority?	Rationale
Dampier Archipelago	<p><1% floating oil contact probability above the threshold</p> <p><1% entrained oil contact probability, maximum concentration below threshold</p> <p><1% dissolved oil contact probability, maximum concentration in worst replicate 7ppb</p> <p>Max accumulated volume along shoreline with concentrations exceeding 100 g/m²: 19m³</p> <p>Minimum time to contact for floating oil >10g/m², 165 hours</p>	<p><1% floating oil contact probability above the threshold</p> <p><1% entrained and dissolved oil contact probability above the threshold, maximum concentrations 40ppb</p> <p>Maximum local accumulated concentration in worst replicate 0.3g/m²</p> <p>No contact for floating oil >10g/m²</p>	Y	Some shoreline loading of crude - maximum volume ashore 19m ³ , 165 h to floating oil contact (minimum), <1% probability of contact. Entrained and dissolved diesel contact above thresholds
Middle Pilbara Islands and Shoreline	<p><1% floating oil contact probability above the threshold</p> <p><1% entrained and dissolved oil contact probability above the threshold, maximum concentrations <1ppb</p> <p>No accumulated volume along shoreline with concentrations exceeding 100 g/m² Minimum time to contact for floating oil >10g/m², 561 hours</p>	<p><1% floating oil contact probability above the threshold</p> <p><1% entrained oil above threshold with a maximum concentration of 3ppb</p> <p><1% dissolved oil contact probability above the threshold, maximum concentrations <1ppb</p> <p>Maximum local accumulated concentration in worst replicate 0.3g/m²</p> <p>No contact for floating oil >10g/m²</p>	N	Very low shoreline loading from crude and diesel spills
Greater North Coast / Eighty Mile Beach inc CMR and RAMSAR	<p><1% floating oil contact probability above the threshold,</p> <p><1%, entrained and dissolved oil contact probability above the threshold and maximum concentrations <1ppb</p> <p>Max accumulated volume along shoreline with concentrations exceeding 100 g/m²: 7m³</p> <p>Minimum time to contact for floating oil >10g/m², 430 hours</p>	<p><1% floating oil contact probability above the threshold</p> <p><1% entrained and dissolved oil above threshold with maximum concentration of 15 ppb</p> <p>No accumulated volume along shoreline with concentrations exceeding 100 g/m²</p> <p>No contact for floating oil >10g/m²</p>	Y	Contains 80MB Ramsar site, KPI habitats (mangroves and saltmarsh) within 80MB Marine Park, maximum crude volume ashore 10m ³ , limited diesel volumes
Montebello Islands inc. CMR	<p><1% floating oil contact probability above the threshold</p> <p>2% entrained oil above threshold with a maximum concentration of 181ppb (at the marine park boundary)</p> <p><1% dissolved oil above threshold with a maximum concentration of 34 ppb in the worst replicate (at the marine park boundary)</p> <p>Max accumulated volume along shoreline with concentrations exceeding 100 g/m²: 33m³</p> <p>Minimum time to contact for floating oil >10g/m², 554 hours</p>	<p><1% floating oil contact probability above the threshold</p> <p>40% entrained oil above threshold with a maximum concentration of 5,973ppb (at the marine park boundary)</p> <p>2% dissolved oil above threshold with a maximum concentration of 168 ppb in the worst replicate (at the marine park boundary)</p> <p>Maximum local accumulated concentration in worst replicate 6.6g/m²</p> <p>No contact for floating oil >10g/m²</p>	Y	Shoreline loading - significant turtle nesting beaches identified in recovery plan (2003), intertidal coral habitats (KPI) in marine park, EPBC bird nesting habitat, floating, entrained and dissolved oil contact from crude and diesel spills
Lowendal Island	<p><1% floating oil contact probability above the threshold</p> <p><1% entrained oil contact probability and maximum concentration 28ppb in the worst replicate</p> <p><1% dissolved oil contact probability and maximum concentration 15ppb in the worst replicate</p> <p>Max accumulated volume along shoreline with concentrations exceeding 100 g/m²: 7m³</p> <p>Minimum time to contact for floating oil >10g/m², 563 hours</p>	<p><1% floating oil contact probability above the threshold</p> <p>2% entrained oil contact probability and maximum concentration 424ppb in the worst replicate</p> <p><1% dissolved oil contact probability and maximum concentration 16ppb in the worst replicate</p> <p>Maximum local accumulated concentration in worst replicate 8.1g/m²</p> <p>No contact for floating oil >10g/m²</p>	Y	Low shoreline loading from crude spill, higher entrained diesel volumes
Barrow Island inc. surrounds (MMA and MP)	<p><1% floating oil contact probability above the threshold,</p> <p><1% entrained oil contact probability and maximum concentration 2ppb in the worst replicate</p> <p><1% dissolved oil contact probability and maximum concentration 3ppb in the worst replicate</p>	<p><1% floating oil contact probability above the threshold</p> <p>2% entrained oil contact probability and maximum concentration 544ppb in the worst replicate</p> <p><1% dissolved oil contact probability and maximum concentration 30ppb in the worst replicate</p>	Y	Shoreline loading significant turtle nesting beaches identified in recovery plan (2003), intertidal coral habitats (KPI) in marine park, bird nesting habitat, - maximum volume ashore 6m ³ , 52 hours to floating oil contact (minimum). 544ppb entrained diesel and some dissolved oil contact.

Location in Risk EMBA	Stag Crude spill (Subsea 86.5m ³) all seasons	Diesel spill (surface 250m ³) all seasons	Protection Priority?	Rationale
	Max accumulated volume along shoreline with concentrations exceeding 100 g/m ² : 2m ³ Minimum time to contact for floating oil >10g/m ² , 52 hours	Maximum local accumulated concentration in worst replicate 2.5g/m ² No contact for floating oil >10g/m ²		
Exmouth Gulf (SE & W)	<1% floating oil contact probability above the threshold <1% entrained and dissolved oil contact probability, Maximum concentration of entrained and dissolved oil <1ppb No accumulated volume along shoreline with concentrations exceeding 100 g/m ²	No contact above any threshold	N	low probability floating oil contact above the threshold, very low shoreline loading from entrained only
Karratha to Port Hedland	<1% floating oil contact probability above the threshold <1% entrained and dissolved oil contact probability maximum concentration of entrained and dissolved oil <1ppb No accumulated volume along shoreline with concentrations exceeding 100 g/m ² Minimum time to contact for floating oil >10g/m ² , 289 hours	<1% floating oil contact probability above the threshold <1% entrained oil contact probability and maximum concentration 5ppb in the worst replicate <1% dissolved oil contact probability and maximum concentration 1ppb in the worst replicate No accumulated volume along shoreline with concentrations exceeding 100 g/m ² No contact for floating oil >10g/m ²	N	Low shoreline loading, limited sensitive receptors
Port Hedland to Eighty Mile Beach	<1% floating oil contact probability above the threshold <1% entrained and dissolved oil contact probability maximum concentration of entrained and dissolved oil <1ppb No accumulated volume along shoreline with concentrations exceeding 100 g/m ² Minimum time to contact for floating oil >10g/m ² , 265 hours	No contact above any threshold	N	Low shoreline loading 80MB already a PP
Mermaid Reef and Commonwealth Waters surrounding Rowley Shoals KEF	<1% floating oil contact probability above the threshold <1% entrained and dissolved oil contact probability maximum concentration of entrained and dissolved oil <1ppb No accumulated volume along shoreline with concentrations exceeding 100 g/m ² Minimum time to contact for floating oil >10g/m ² , 565 hours	No contact above any threshold	N	Low contact volumes
Clerke Reef	<1% floating oil contact probability above the threshold, <1% entrained and dissolved oil contact probability maximum concentration of entrained and dissolved oil <1ppb No accumulated volume along shoreline with concentrations exceeding 100 g/m ² Minimum time to contact for floating oil >10g/m ² , 629 hours	No contact above any threshold	N	low probability floating oil contact above the threshold, very low shoreline loading from entrained oil only
Imperieuse Reef	<1% floating oil contact probability above the threshold, <1% entrained and dissolved oil contact probability maximum concentration of entrained and dissolved oil <1ppb No accumulated volume along shoreline with concentrations exceeding 100 g/m ² Minimum time to contact for floating oil >10g/m ² , 565 hours	No contact above any threshold	N	Minimal shoreline loading
Ningaloo Coast including World Heritage, State MP	No contact above any threshold	<1% floating oil contact probability above the threshold <1% entrained oil contact probability and maximum concentration 94ppb in the worst replicate <1% dissolved oil contact probability and maximum concentration 4ppb in the worst replicate Maximum local accumulated concentration in worst replicate 0.3g/m ² No contact for floating oil >10g/m ²	N	Minimal shoreline loading

Location in Risk EMBA	Stag Crude spill (Subsea 86.5m ³) all seasons	Diesel spill (surface 250m ³) all seasons	Protection Priority?	Rationale
Muiron Islands MMA	No contact above any threshold	No floating oil contact probability above the threshold <1% entrained oil contact probability and maximum concentration 55ppb in the worst replicate <1% dissolved oil contact probability and maximum concentration 3ppb in the worst replicate No local accumulated concentration No contact for floating oil >10g/m ²	N	Minimal shoreline loading
Gascoyne AMP	No contact above any threshold	No floating oil contact probability above the threshold <1% entrained oil contact probability and maximum concentration 81ppb in the worst replicate <1% dissolved oil contact probability and maximum concentration 9ppb in the worst replicate No local accumulated concentration No contact for floating oil >10g/m ²	N	Minimal shoreline loading

Table 7-15: Impact of a spill response strategy on the environmental values of Protection Priorities

Protection Priority environmental values	No controls	Source control	Dispersant (surface)*	Operational Monitoring	Containment and recovery	Shoreline Protection	Shoreline Cleanup	Oiled Wildlife Response	Scientific Monitoring
Environmental Outcomes	<ul style="list-style-type: none"> - Reduce oil volumes from reaching the shoreline to as low as reasonably practicable - Prioritise sanctuary zones and KPI species and habitats (as per marine park management plan if relevant) - Reduce impacts to marine and coastal fauna through the implementation of the WA Oiled Wildlife Response Plan 								
Eighty Mile Beach									
Migratory birds	Red	Green	Green	Green	Green	Yellow	Yellow	Yellow	Green
Mangroves	Red	Green	Green	Green	Green	Yellow	Yellow	N/A	Green
Tidal creeks	Red	Green	Green	Green	Green	Yellow	Yellow	N/A	Green
Turtle nesting beaches	Red	Green	Green	Green	Green	Yellow	Yellow	Green	Green
Wetlands/ salt marshes	Red	Green	Green	Green	Green	Yellow	Yellow	N/A	Green
Dampier Archipelago									
Mangroves	Red	Green	Green	Green	Green	Yellow	Yellow	N/A	Green
Turtle nesting beaches	Red	Green	Green	Green	Green	Yellow	Yellow	Green	Green
Corals	Red	Green	Yellow	Green	Yellow	N/A	N/A	N/A	Green
Marine habitat	Red	Green	Yellow	Green	Green	N/A	N/A	N/A	Green
Birds	Red	Green	Green	Green	Green	Yellow	Yellow	Yellow	Green
Cultural values	Red	Green	Green	Green	Green	Yellow	Yellow	Green	Green

Protection Priority environmental values	No controls	Source control	Dispersant (surface)*	Operational Monitoring	Containment and recovery	Shoreline Protection	Shoreline Cleanup	Oiled Wildlife Response	Scientific Monitoring
Environmental Outcomes	<ul style="list-style-type: none"> - Reduce oil volumes from reaching the shoreline to as low as reasonably practicable - Prioritise sanctuary zones and KPI species and habitats (as per marine park management plan if relevant) - Reduce impacts to marine and coastal fauna through the implementation of the WA Oiled Wildlife Response Plan 								

Montebello Islands										
Turtle nesting beaches	Red	Green	Green	Green	Green	Green	Yellow	Yellow	Green	Green
Mangroves	Red	Green	Green	Green	Green	Green	Yellow	Yellow	N/A	Green
Corals	Red	Green	Yellow	Green	Green	N/A	N/A	N/A	Green	Green
Seabirds	Red	Green	Green	Green	Green	Yellow	Yellow	Yellow	Green	Green
Barrow Island										
Bird habitat at Bandicoot Bay and Double Island	Red	Green	Green	Green	Green	Green	Yellow	Yellow	N/A	Green
Seabirds	Red	Green	Green	Green	Green	Green	Yellow	Yellow	Yellow	Green
Turtle nesting beaches	Red	Green	Green	Green	Green	Green	Yellow	Yellow	Green	Green
Mangroves	Red	Green	Green	Green	Green	Green	Yellow	Yellow	N/A	Green
Tidal creeks	Red	Green	Green	Green	Green	Green	Yellow	Yellow	N/A	Green
Marine habitat	Red	Green	Yellow	Green	Green	N/A	N/A	N/A	Green	Green
Lowendal Islands										

Protection Priority environmental values	No controls	Source control	Dispersant (surface)*	Operational Monitoring	Containment and recovery	Shoreline Protection	Shoreline Cleanup	Oiled Wildlife Response	Scientific Monitoring
Environmental Outcomes	- Reduce oil volumes from reaching the shoreline to as low as reasonably practicable - Prioritise sanctuary zones and KPI species and habitats (as per marine park management plan if relevant) - Reduce impacts to marine and coastal fauna through the implementation of the WA Oiled Wildlife Response Plan								
Turtle nesting beaches									
Mangroves								N/A	
Corals						N/A	N/A	N/A	
Seabirds									
Marine mammals (dugongs, dolphins)						N/A	N/A		
Marine habitat						N/A	N/A	N/A	
Legend									
*	The potential impact of chemical dispersant addition based on analysis presented in Section 7.9.2								
	Beneficial impact								
	Possible beneficial impact dependent upon the situation (e.g. Timeframes and metocean conditions to dilute entrained oil)								
	Negative impact								
N/A	Not applicable for the environmental value								

7.5.6 Environmental Performance

EPOs and control measures for oil spill response activity implementation are presented in Section 19 of the OPEP.

Environmental Risk		Release of Stag crude (EUH-4)		
Performance Outcome		No spill of hydrocarbon to the marine environment		
ID	Management controls	Performance standards	Measurement criteria	Responsibility
<i>Unplanned release of Stag crude oil from CPF production equipment (including process upset)</i>				
087	Tests and maintenance completed in accordance with Stag Safety Critical Elements Performance Standards Report (GA-70-REP-F-00007) to ensure emergency shutdown can occur and equipment is fit for purpose	The SIS are tested according to the assurance plan which is part of GA-70-REP-F-00001, these are planned and managed using BASSnet CMMS	Inspection and testing records	Stag OIM
088		Emergency Shutdown (ESD) push buttons located in the central control room and throughout the CPF, tested and fit for purpose every six months	Audit records confirm standard.	
089		ESDVs are regularly tested and fit for purpose 6 monthly as per PS-06: ESD and Blowdown – Topsides and Riser Emergency Shutdown Valves (ESDVs)	ESDV testing records	
090		CPF hydrocarbon containing equipment is regularly inspected and maintained and found fit for purpose – Internal inspection of tanks 48 months External inspection of tanks 24 months	Inspection and maintenance records	
091		PSVs undergo external inspection annually and internally inspected every 4 years	Inspection and testing records	
092		Permit to Work Procedure implemented	A Permit to Work (PTW) system is implemented on the CPF to assure competent personnel and implementation of relevant procedures during maintenance.	
093	Wellhead valves maintained and tested as per Stag Safety Critical Elements Performance Standards Report (GA-70-REP-F-00007)	Wellhead Valves are maintained and tested annually and found fit for purpose as per PS-07: ESD and Blowdown: Reservoir Isolation (Including SCSSVs and wellhead valves)	Maintenance and testing records	

Environmental Risk		Release of Stag crude (EUH-4)		
Performance Outcome		No spill of hydrocarbon to the marine environment		
ID	Management controls	Performance standards	Measurement criteria	Responsibility
094	Operational personnel competent and trained in accordance with Competency and Training Management System [JS-60-PR-Q-00015]	Position classification and skills matrix for all personnel involved in operation, maintenance and incident response on the CPF	Skills matrix and annual audit of Competency Management system.	
Unplanned release of Stag crude oil from offtake hose (CALM buoy to third-party tanker)				
095	Monitoring of crude oil offtake hose to third-party tanker during loading in accordance with Stag Marine Tanker Operations Manual (GF-00-MN-H-00037)	Dedicated bow, and dedicated manifold watch, equipped with communications to the Cargo Control Room kept for the whole offtake period	Deck Logbook PMS log	Operations Manager
096				
097	Hose maintenance process in accordance with OCIMF guidelines	Floating hoses maintained and managed in accordance with OCIMF <i>Guidelines for the handling, storage, inspection and testing of hoses in field</i> and includes visual inspections, pressure tests and replacement schedules.		
098	CALM Buoy Hawser Changeout occurs as per PMS	Hawser changed out at intervals of up to 20 months Hawser visual check hourly as part of hourly checks program		
099	Marine breakaway coupling on offtake hose	Maintenance of hose undertaken in accordance with the Preventative Maintenance System and confirms presence of breakaway coupling		
100	Leak Detection	Detection of spill is by means of drop in delivery pressure monitored on the CPF. Delivery pressure monitoring at CPF is done continuously during loading operations by the Panel Operator.		

Environmental Risk		Release of Stag crude (EUH-4)		
Performance Outcome		No spill of hydrocarbon to the marine environment		
ID	Management controls	Performance standards	Measurement criteria	Responsibility
101	Jadestone Stag Marine Tanker Operations Manual (GF-00-H-00037) implemented during offtake activities	Connection and disconnection of the offtake hose will be undertaken in accordance with this manual		
102		Leak test is completed prior to recommencement of slow loading once import hose is connected to incoming tanker		
103		Pilot will review the Stag Marine Facility Operating Procedures with the third party Offtake Tanker Master before proceeding to the Berth, and confirm any special conditions imposed due to prevailing local conditions to ensure safe offtake. The manual outlines requirements for offtake to ensure prevention of spills including: <ul style="list-style-type: none"> - Weather limitations that determine if the terminal is open, restricted or closed for offtake - Personnel competency and induction requirements - Communication test requirements to be conducted prior to load commencement - Leak testing once the offtake hose is in place and connected, and prior to loading commencing - Location of MBC in the hose string to minimize risk of impact with third party tanker 		
104	Tankers vetted in accordance with Stag Offtake Vessel Vetting (GF-90-PR-G-00019) prior to mobilisation	Offtake tankers are vetted prior to acceptance against the following criteria as a minimum to prevent damage or other risks to, or oil pollution from, the facility's offtake equipment, during offtake: <ul style="list-style-type: none"> - Confirm tanker is double hull and vessel dimensions - Confirm the tanker management system complies with the requirements of ISM code - Confirm the manifold and associated equipment complies with the latest edition of OCIMF's: "Standards for Oil Tanker Manifolds and Associated Equipment" - Confirm the forecastle layout/ equipment complies with OCIMF guidelines for single point moorings "Recommendations for Equipment Employed in the Mooring of Ships at a Single Point Mooring" 	Completed questionnaire screened and accepted	Marine Superintendent

Environmental Risk		Release of Stag crude (EUH-4)		
Performance Outcome		No spill of hydrocarbon to the marine environment		
ID	Management controls	Performance standards	Measurement criteria	Responsibility
Subsea release of Stag crude				
105	Subsea equipment inspected in accordance with Subsea Inspection Procedure (GF-16-PR-U-00030)	Subsea equipment shall be inspected in accordance with the schedule, applicable standards, regulatory requirements and procedures described referenced in Safety Critical Elements (SCEs) performance standards reports associated with subsea inspection: Stag Safety Critical Elements Performance Standards Report, GA-70-REP-F-00007	Inspection records in BASSnet	Engineering & Maintenance Manager
106	Inspection of underbuoy hose to ensure hose integrity in accordance with Stag Safety Critical Elements Performance Standards Report (GA-70-REP-F-00007) and Topside Riser & Wellhead conductor Inspection Procedure (GA-02-PR-S-00177)	Inspection of underbuoy hose (PLEM to CALM buoy) is performed in accordance with the maintenance schedule and OCIMF <i>guidelines for the handling, storage, inspection and testing of hoses in the field.</i>		
107	Underbuoy Hose Removal and Replacement Procedure (GF-19-IG-00023) implemented as required	If hoses must be replaced, the procedure includes: <ul style="list-style-type: none"> Flush line from STAG CPF to third-party tanker until clean water being received at third-party tanker Disconnect third-party tanker Air blow underbuoy hose contents back to STAG CPF Divers close PLEM valve 	Close-out Reports in BASSnet	
108	Stag Marine Facility Operating Manual (GF-90-MN-G-00038) details designated anchoring locations	AMSA designated anchoring locations is listed as a 3nM radius around facility and marked on Aus Charts	Annual audit	Stag OIM

33	Personnel aware of roles and responsibilities in the event of a response in accordance with Stag Incident Response Plan (GF-00-PR-F-00041)	Instructs offshore response roles and responsibilities and training requirements, and Spill exercises conducted as part of incident response drills.	Training and induction records	Stag OIM
			Exercise records	Stag OIM Vessel Masters OIM
58	Emergency shutdown system tested and implemented in the event of a loss of pipeline integrity	Emergency Shutdown (ESD) push buttons located in the central control room and throughout the CPF, tested and fit for purpose every six months	Audit records confirm standard.	Stag OIM
59		ESDVs are regularly tested and fit for purpose 6 monthly	ESDV Testing records	Stag OIM
60	Emergency pipeline repair plan in place	Emergency Pipeline Repair Plan (GF-09-PLN-L-00039) is valid and approved prior to commencement of any drilling activity	Controlled document management system records	Stag OIM
61	Post spill scientific monitoring program undertaken	Monitor impacts and recovery of the values and sensitivities identified in this EP in accordance with the OSMP.	Monitoring reports indicate no long-term impacts to the values and sensitivities identified in this EP.	IMT Lead
62	Lifting Procedures	Lifting operations managed in accordance with MODU work instructions or procedures SIMOPS plan and permit to work procedures in place for any starboard outboard lifts (unplanned during the activity).	PTW and SIMPOS procedures in place prior to lifting	MODU OIM Stag OIM
63	MODU Safety Case	MODU Safety case includes controls for dropped objects to manage impacts to in-field infrastructure including: <ul style="list-style-type: none"> • Heavy lift procedures • Lifting equipment is maintained in accordance with manufacturer specifications, certified and inspected 	NOPSEMA approved safety case implemented	Drilling Manager

		<ul style="list-style-type: none"> • All personnel involved in lifts are competently trained • MODU port forward crane is used for outboard lifts as there is no subsea infrastructure to the east of the MODU 		
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*1 The Stag Marine Tanker Operations Manual (GF-00-MN-H-00037) contains the pertinent information required by the nominated Tanker in preparation for arriving at anchoring location to prepare for safe arrival, embarkation of Pilot and Surveyor, and transit to the Stag Marine Facility for offtake duties. Pilot will review the Stag Marine Facility Operating Procedures with the Offtake Tanker Master before proceeding to the Berth

7.5.7 ALARP assessment

All safety options have been considered for the Stag Operations, with no additional safety options possible it is considered that the risk of a loss of containment occurring has been reduced to ALARP. The combination of the standard controls (which reduce the likelihood of the event happening), and the spill response strategies (which reduce the consequence) together aim to reduce potential impacts from a hydrocarbon spill. An oil spill response workshop was undertaken and subsequently, a review of capability by AMOSC. A summary of the spill response measures selected is provided in **Table 7-16**.

Vessel Collision Control

Vessel activities are required to maintain the functioning of the facility and cannot be eliminated. The Stag facilities are marked on Australian Hydrographic Service Nautical Charts which identifies the location of the CPF berthing activities to other sea users. Collision prevention equipment (i.e. navigation and radio equipment) and seagoing qualifications used on vessels/ CPF comply with applicable AMSA Marine Orders which enact the International Convention of the Safety of Life at Sea (SOLAS) 1974 through the Navigation Act 2012. These requirements reduce the risk of errant vessel collisions and the potential for crude oil release from these vessels.

For vessels engaged in operational activities, the procedures outlined in the Stag Marine Facility Operating Manual (GF-90-MN-G-00038) provide controls to reduce the risk of collision. Communication is established between third party vessels and the CPF well before they enter the Operational Area to ensure proposed activities are safe to proceed and to reduce the potential for vessel collision during simultaneous operations.

Controls are in place (refer **Section 7.5.6**) which reduce the likelihood of spill events. There are no further controls that are considered to provide a net benefit in reducing the likelihood or consequence of a release of Stag crude to the marine environment and thus, the controls are considered ALARP.

Topside production system controls

Crude oil processing equipment (e.g. vessels, valves, piping and pumps) is inspected, tested and maintained as per operational performance standards and the CMMS which ensure the correct functioning of equipment and systems that are critical in ensuring hydrocarbon containment and safety of crew. Safety systems are utilised on the hydrocarbon processing equipment which reduce the likelihood of loss of integrity and/or release of crude oil. These include pressure safety valves (PSVs), emergency blowdown systems and emergency shutdown (ESD) systems.

Load alarms on cranes provide warning of excessive crane loads and reduce likelihood of dropped objects. Lifting procedures, lifting equipment testing, equipment protection, competency requirements and the permit to work (PTW) system reduce the risk of dropped/swinging loads impacting process equipment. The competency of personnel working on production equipment is assessed through a competency-based assessment framework and assurance that tasks are scheduled and completed safely is provided through the PTW system. Controls are in place (refer **Section 7.5.6**) which reduce the likelihood of spill events. There are no further controls that are considered to provide a net benefit in reducing the likelihood or consequence of a release of Stag crude to the marine environment and thus the controls are considered ALARP.

Subsea Controls

The integrity of the subsea export pipeline, PLEM and underbuoy hose is monitored through the Subsea Inspection Procedure (GF-16-PR-U-00030). The pipeline inspection and maintenance activities conducted by Jadestone are managed via the CMMS.

The pipeline was subject to a design life extension in 2013, extending the service life by 10 years to 2023. Further integrity reviews will continue to assess remnant life on an ongoing basis.

The identified causes of pipeline, PLEM or underbuoy hose rupture from external factors is through dropped objects, vessel collision and anchor drag. The threat of dropped objects from support/supply vessel

loading/unloading is mitigated by the CPF lift zone being located away from the subsea export pipeline. The rigid riser section of the pipeline is also protected by a frame and runs inside the jacket leg footprint providing additional protection from swinging loads and vessel impacts.

Controls are in place (refer **Section 7.5.6**) which reduce the likelihood of spill events. There are no further controls that are considered to provide a net benefit in reducing the likelihood or consequence of a release of Stag crude to the marine environment and thus the controls are considered ALARP.

Spill Response Controls

For a Level 1 crude oil spill, containment and clean-up is assisted through the bunding system provided around process equipment and the regular inspection program. Spills are responded to as per incident and spill response procedures which are practised through regular spill/ incident response drills on the CPF and vessels. Spill kits are located near high risk areas and maintenance of spill equipment is assured through regular inspections. In the event that diesel or crude oil is not contained through the barriers and procedures, the Stag Facility Operations OPEP (GF-70-PLN-I-00001) which outlines the detailed response and logistical requirements necessary to combat a maximum credible crude oil release, will be implemented to reduce the impacts of a crude oil spill to ALARP.

Where a spill of crude oil reaches the marine environment, spill response activities will be implemented in accordance with the OPEP. A Net Environmental Benefit Analysis (NEBA) will be used to determine which spill response strategies are appropriate for a given spill scenario and is an integral part of the IAP process.

In the case of any spill to the marine environment, source control and operational monitoring activities will be implemented.

The spill response strategies have undergone a robust evaluation and environmental risk assessment process (refer **Figure 5-2** and **Table 8-8**. The applicability of the control to the spill scenario and establishing requirements for each control to ensure its effectiveness in meeting the EPO was also undertaken.

The assumption was that existing controls were ineffective (i.e. 100% probability of vessel collision) and each control would be exposed to the full volume of oil under the maximum credible worst-case scenario with the shortest time to contact. This approach promoted a level of conservatism in the proposed control strategies, and, in particular, the measures for determining the effectiveness of controls and the requirements to achieve the level of effectiveness.

The ALARP assessment for the level of resourcing required for each of the spill response strategies adopted is provided in **Table 7-16** and **Table 7-17**, based on the capability described in the OPEP. This considers the incremental benefit of increasing resourcing levels for each spill response strategy and the associated upfront costs. The effectiveness of each of these response strategies has been increased to a point where further sacrifice made would result in a disproportionately small reduction in environmental risk/impact managed.

It is considered that through the resourcing arrangements outlined within the OPEP (including spill response equipment and personnel from internal and external sources including via the AMOSPlan, AMSA, other operators and other national suppliers) the spill response strategies and control measures reduce spill risk to ALARP. As a member of an industry-wide oil spill response organisation (AMOSC) as a party to a Master Services Contract (MSC) with AMOSC for services for training purposes or in response to a threatened or actual oil spill (MutualAid resources, the AMOSC Core Group) refer OPEP and a party to an MOU with AMSA (refer Appendix J) for support for oil spill preparedness and response Jadestone has access to sufficient response capability to reduce the environmental risk to ALARP.

Table 7-16: Summary of spill response controls

Spill Response Control	Yes/No
Source control	

Spill Response Control	Yes/No
Refuelling watch alert	Y
Secure cargo/trimming	Y
Pipeline isolation and repair	Y
Bunded areas around machinery and engines	Y
Operational Monitoring	
Vessel Surveillance	Y
Aerial Surveillance	Y
Tracking Buoys	Y
Fluorometry	Y
Oil Spill Modelling	Y
Remote Sensing/Satellite Imagery	Y
UAVs	Y
Shoreline and Coastal habitat assessment	Y
Chemical Dispersant	
Existing dispersant stockpiles and transport arrangements	Y
Additional Jadestone dispersant stockpiling	N
Dispersant application aircraft	Y
Dispersant application vessels	Y
Containment and Recovery	
Targeted C&R operations	Y
Pre-deployed at site	N
C&R Planning	Y
Protection and Deflection	
Targeted protection	Y
Pre-deployed at site	N
Protection Planning	Y
Shoreline Clean-up	
Targeted clean-up operations	Y
Pre-deployed at site	N
Shoreline Clean-up Planning	Y
Oiled Wildlife Response (OWR)	
Targeted OWR activities	Y
Pre-set up staging site	N
Waste Management	
Waste Management Planning	Y

Spill Response Control	Yes/No
Emergency Management System	
IMT process (including IAP, NEBA processes)	Y
Scientific Monitoring	
Scientific Monitoring Planning	Y

Table 7-17: ALARP assessment for the level of resourcing available for spill response strategies from those described in the OPEP

Strategy tasks and resources arrangements	Environmental/Social/Economic consequences of additional resources from those described in the OPEP	Practicality of additional resources from those described in the OPEP	ALARP assessment
<p>Source Control Section 8 of OPEP</p>	<p>Reduce volume or speed of spill entering marine environment</p>	<p>Vessel has the response capability as described in the SOPEP and geared towards a Level 1 incident.</p> <p>The SOPEP is to provide shipboard notification and response procedures for stopping or minimizing the unexpected discharge of oil from a ship without compromising the safety of the crew, the vessel or the environment. Unexpected discharge includes the discharge of oil during vessel operations, or vessel casualty.</p> <p>Significant cost would be incurred for Jadestone to alter the contractual arrangements with the third-party tanker operator to increase capability with consideration for equipment, storage, maintenance, crew training and safety of crew when deploying gear.</p>	<p>It is consistent with the National Plan that vessels have a level 1 capability.</p> <p>For Jadestone to increase the vessel response capability to a Level 3 would be a disproportionate benefit for the effort.</p> <p>In addition, the worst-case spill results from a vessel collision and the priority of the vessel master is to safeguard the crew and remove all non-essential personnel.</p> <p>Therefore, there is no value in supplementing the vessel SOPEP capability, and therefore the arrangements described in the OPEP are considered ALARP.</p>
<p>Aerial surveillance Section 9.4 of OPEP</p>	<p>The two passes per day separated by six hours' philosophy allows coverage of oil movement. The spill is a defined volume and not amenable to entrainment. The morning pass will validate the current IAP and the second afternoon pass will inform the development of the next IAP operational period. This will be used along with the other surveillance tactics and validate these (e.g. trajectory modelling and vessel surveillance). Therefore, there is considered no environmental benefit for resourcing an overpass frequency of greater than two passes per day.</p>	<p>Additional charter costs would be incurred by Jadestone to increase from two passes per day.</p> <p>There may be a need for additional resources if determined through the IMT based on the amount of available information and potential data gaps. These can be arranged without need for further upfront costs or planning.</p>	<p>Aerial surveillance is not the only dedicated surveillance tactic. Opportunity for surveillance will also occur from responder movements and opportunistic aerial surveillance through the shared use of aircraft deployed for other purposes e.g. aerial dispersant spraying, C&R and shoreline strategies).</p> <p>The spatial extent of the spill is more dependent on tidal influences than the wind. Tides are twice per day and are best captured by twice daily aerial flights.</p> <p>The two dedicated passes are sufficient to validate and inform the IAP process to ensure overall response is commensurate with nature and scale of incident.</p> <p>Therefore, there is no value in increasing dedicated overpasses and therefore the arrangements described in the OPEP are considered ALARP.</p>

Strategy tasks and resources arrangements	Environmental/Social/Economic consequences of additional resources from those described in the OPEP	Practicality of additional resources from those described in the OPEP	ALARP assessment
<p>Vessel surveillance Section 9.4 of OPEP</p>	<p>One dedicated resource within 48 hours is considered ALARP. There would be no environmental benefit for additional dedicated resources given the need is met through vessel sharing and surveillance will also be conducted through a number of complementary operational monitoring strategies (aerial surveillance, tracker buoys).</p>	<p>In the event that additional dedicated vessels are required due to data gaps, resources are available. The cost of the additional vessels will be added to the cost of the response.</p>	<p>There is no benefit in having additional dedicated surveillance vessels given surveillance can be performed from any vessel and these duties will be shared amongst spill response vessels. Aerial surveillance, tracker buoys and UAVs are more efficient and effective at determining extent of oil movement, vessel surveillance is a secondary tactic.</p> <p>Therefore, there is no value in increasing dedicated vessel numbers and therefore the arrangements described in the OPEP are considered ALARP.</p>
<p>Tracking buoys Section 9.4 of OPEP</p>	<p>The buoys will be deployed within one hour and then 24 hours of spill release. As the spill is instantaneous and of a defined volume, there is no additional benefit to increasing tracker buoys.</p>	<p>Additional buoys are available through AMSA and AMOSC within days. There is no additional upfront cost for accessing these secondary buoys.</p>	<p>Tracking buoys are one tactic in the operational monitoring strategy. The number of buoys immediately available is sufficient to cover tracking of oil given the worst-case spill is a defined volume and timeframe.</p> <p>Placing a tracker buoy on the support vessel would have no additional benefit than from the CPF as the distance between the support vessel (when in field) and CPF is small and subject to same tidal influences. Also, tracker buoys require maintenance which can be scheduled from the CPF as part of the spill response equipment.</p> <p>Therefore, there is no value in increasing tracker buoy numbers and therefore the arrangements in the OPEP are considered ALARP.</p>
<p>Fluorometry Section 9.4 of OPEP This remains the same unless Jadestone changes service providers</p>	<p>The purpose of fluorometry is to: 1) inform the scientific monitoring; 2) provide validation for trajectory modelling predictions.</p> <p>Additional fluorometers may limit missed data opportunities. Fluorometry will target subsea plumes approaching those sites that have the greatest potential for environmental impact (i.e. the most sensitive areas with the highest predicted concentration of entrained oil). Any additional fluorometers would be deployed to other sensitive areas in the EMBA and once those fluorometers have confirmed presence of entrained</p>	<p>Jadestone can access 5 subsea gliders with fluorometers through Blue Ocean Monitoring (via Astron) and additional fluorometers through CSIRO.</p> <p>This is considered sufficient for upfront planning. Additional tow behind fluorometers can be sourced from CSIRO if apparent there are data gaps that can't be filled by existing arrangements. This would not be an upfront cost but the need and costs would be assessed after a spill event.</p>	<p>The existing arrangements are considered sufficient to meet fluorometry purpose. Additional fluorometers can be arranged and deployed should the need arise this is not considered time critical and the additional benefit is considered low.</p> <p>Therefore, there is no value in increasing fluorometer numbers and therefore the arrangements described in the OPEP are considered ALARP.</p>

Strategy tasks and resources arrangements	Environmental/Social/Economic consequences of additional resources from those described in the OPEP	Practicality of additional resources from those described in the OPEP	ALARP assessment
	<p>oil, these units can be moved to other areas. Therefore, it is considered there is little additional environmental benefit in having more fluorometers. Access to vessels for towing (small vessels) will be per the Logistics Management Plan.</p>		
<p>UAVs Section 9 of OPEP</p>	<p>UAVs can monitor in difficult to access areas and prevent unnecessary intrusion by responders. Information is real time and utilised in the IAP for targeted response. UAVs allow more data captured quicker than by deploying responders alone.</p> <p>There is no environmental benefit from additional UAVs as the Protection Priorities are covered by four.</p>	<p>There would be additional cost in obtaining more than the four UAVs outlined in the OPEP, also for additional vessels and personnel to interpret data.</p>	<p>The resourcing provides UAV capability for each Protection Priority (with 4 deemed sufficient to cover Dampier, 80 Mile Beach, Barrow, Montebello’s and Lowendal Islands). Additional UAVs will not provide additional benefit (except for redundancy). The UAVs are considered a secondary aid in locating oil in difficult terrain.</p> <p>Additional UAVs can be sourced as needed after a spill event given their high availability. The number outlined in the OPEP is for pre-deployment planning purposes only. Given the use of UAVs is a secondary strategy and not critical to reducing environmental impact the existing arrangements described in the OPEP are considered ALARP.</p>
<p>Shoreline and coastal habitat assessment using SCAT surveys. Section 9.4 of OPEP</p>	<p>Shoreline Clean up and Assessment Technique (SCAT) is a systematic method for surveying an affected shoreline after an oil spill.</p> <p>SCAT is designed to support decision-making for shoreline clean up. It is flexible in its scale of surveys and in the detail of datasets collected.</p> <p>SCAT continues during the response to verify shoreline oiling, clean up effectiveness, and eventually, to conduct final evaluations of shorelines to ensure they meet clean up endpoints.</p>	<p>The cost of additional resources is not considered the limiting factor; the limiting factor is the availability to use resources at the physical location. Additional people from described in the OPEP could cause unnecessary environmental impacts. If required, additional equipment will be sourced and the additional cost borne by Jadestone.</p>	<p>Jadestone undertook an evaluation to determine the most effective resource capability to reduce the environmental risk from a worst-case spill event (refer OPEP). SCAT numbers are not cumulative as this data represents stochastic modelling outputs. A spill would not contact all receptors modelled and not all at once. Then number required would be based on direction of spill and timeframes to contact.</p> <p>Capability required is 7 teams across the 5 priority receptors with 10 people per team.</p> <p>The existing arrangements are considered sufficient to meet SCAT purpose. Additional personnel can be sourced and deployed should the need arise; this is not considered time critical and the additional benefit is considered low.</p> <p>Therefore, there is no value in increasing SCAT numbers and therefore the arrangements described in the OPEP are considered ALARP.</p>

Strategy tasks and resources arrangements	Environmental/Social/Economic consequences of additional resources from those described in the OPEP	Practicality of additional resources from those described in the OPEP	ALARP assessment
<p>Chemical dispersant application Section 10 of OPEP</p>	<p>Application of additional chemical dispersants within the timeframe planned and implementing a faster application timeframe. These have the potential for further reduction of floating oil and shoreline loading (reducing/eliminating further environmental impacts - clean-up and protection and deflection intrusions, oiled wildlife) and an increased ability of the environment to biodegrade the oil more rapidly to below threshold levels; thus, reducing the severity and duration of the spill and subsequent economic and social impacts such as beach tourism. A negative consequence is the further increase in localised entrained and dissolved oil concentrations with subsequent risk of additional environmental impacts to organisms in the water column (refer Section 8.5.2 and Table 8-7). This could have negative flow-on social and economic consequences e.g. recreational and commercial fishing, diving.</p>	<p>Additional resources include: Dispersant costs of \$10,000 per m³. The maximum volume of dispersant that can be applied within the activity timeframe has been calculated to be 258m³. FWADC aircraft \$15,000 per aircraft per day. Vessels \$15,000 per day plus fuel costs of \$1,600 per day. Additional expert personnel. Chemical dispersant operations are to be conducted in daylight hours only. Indicative costs: Cost of suitable aircraft (e.g. crop duster) USD\$350,000 Standby for Jadestone specialist personnel \$150,000 p.a. Purchasing dispersant stock and maintenance in Karratha \$400,000 p.a. Purchasing dispersant vessel and application equipment \$300,000. OSRL resources: Hercules aircraft (excluding fuel) USD17000 per hour Access to dispersant stocks UK2500 and additional 15% on invoiced stocks. Chemical dispersant stocks charged at replacement purchase price plus all invoiced costs. Dispersant efficacy testing using MacKay Apparatus approx. \$5000 per dispersant tested</p>	<p>The worst-case spill scenario where chemical dispersant is recommended is a subsea spill from the underbuoy hose, with a finite volume of oil and defined timeframe. The estimated Window of Opportunity (WoO) for chemical dispersant application diminishes after 72 hours. Jadestone has evaluated that the earliest chemical dispersant operations can commence is 18 hours after a spill (refer Section 10 of OPEP). This would enable dispersant application to oil within the WoO and does not compromise the effectiveness of other strategies. Jadestone undertook an evaluation to determine the most effective resource requirements to reduce the environmental risk from a worst-case spill event to ALARP. Aspects considered were volume of floating oil, timeframe and spread of spill, best case target area (i.e. thickness of oil), location of sensitive receptors, geographic location of application, location and type of dispersant stocks, volume of dispersant required, number of vessels and aircraft and ancillary resources. The results of the best-case capability evaluation for dispersant application is described in Section 10 of the OPEP and demonstrates that environmental risk will be reduced to ALARP. Due to the small volume of dispersant required, Jadestone has identified the AMOSC Exmouth and AMOSC Karratha dispersant stocks more than sufficient to meet the required volume (<10m³). Laboratory tests for dispersant efficacy are sometimes carried out to rank the effectiveness of one dispersant relative to another for a particular oil. However, caution is advised (ITOPF 2011) when extrapolating these results as accurate replication of the conditions at sea is difficult in a laboratory environment. Effectiveness tests are conducted in closed systems and may not be representative of actual performance expected at sea. SQT testing for dispersants on Stag crude was undertaken and identified that the AMSA National Plan stock and AMOSC stock (namely Slickgone NS and Corexit 9500) is on average 40% effective (refer OPEP Section 10.3). Jadestone considered conducting another dispersant efficacy test on Stag crude using the MacKay Apparatus test; however, this was rejected due to caution advised in expecting laboratory tests to describe what may occur in the real environment, the lack of change in dispersant stock, the availability of the tested dispersants in the market and the lack of change in Stag crude properties since the Quadrant tests. Jadestone considers that it is best practice and ALARP to utilise this information for planning and exercise purposes and conduct real-time field testing in the event of a spill as described in the OPEP (Section 10 of the OPEP). Controls placed on chemical dispersant application (Section 7.9.3 of the EP and Table 16-1 of the OPEP) are in place to ensure environmental risk is reduced to ALARP.</p>

Strategy tasks and resources arrangements	Environmental/Social/Economic consequences of additional resources from those described in the OPEP	Practicality of additional resources from those described in the OPEP	ALARP assessment
			<p>An analysis was undertaken to determine the most effective mix of aircraft and vessels applying dispersant. Comparisons made between 1, 2 and 3 FWADC aircraft and different vessel numbers indicated that 1 FWADC and 1 vessels was the optimum capability within the WoO, beyond which the rate of benefit from application effort diminished (OPEP Section 10).</p> <p>Although Aerotech 1st Response is capable of dispatching up to 3 FWADC aircraft at Karratha airport within 18 hrs of activation and another 3 aircraft at Karratha within 48hrs of activation it would be unnecessary as one aircraft can meet the dispersant demand for the available oil (OPEP Section 10). Additional FWADC will not be an efficient use of resources, and would result in overspray, increasing the concentrations of oil in the water column unnecessarily, which is not an environmental benefit. Vessel dispersant application is a supporting option to FWADC to target breakaway slicks that are not within the application area of the aircraft. Time constraints presented by the WoO, sourcing and steaming time to target location discount the benefit of additional vessel based application. Jadestone Energy has evaluated the options and consider that it has access to what is required for ALARP via existing arrangements. As a member of an industry-wide oil spill response organisation (AMOSC) and a party to an MOU with AMSA for oil spill response. Jadestone has access to sufficient response capability to reduce the environmental risk associated with the worst credible spill to ALARP.</p> <p>Real-time planning for where the spill is going is undertaken as part of the Incident Action Planning process and provides a better operational picture for efficient and effective chemical dispersant application. The arrangements for incident management described in the OPEP reduce the environmental risks associated with chemical dispersant applications and are considered ALARP.</p>
<p>Containment and recovery Section 11 of OPEP</p>	<p>By increasing the recovery of oil off the water, less is able to contact shorelines thereby reducing potential environmental impacts. Additionally, shoreline waste volumes and associated environmental impacts on shorelines is reduced.</p>	<p>Approximate costs: Vessels \$15000 each per day plus \$1,600 per day for fuel Boom hire \$12,000 per day for 6 teams. 6 skimmers \$6000. Additional personnel \$1500 per day</p>	<p>Containment and recovery operations will be focussed on the trajectory of the spill. If this is tracking towards the Montebello's (the highest probability and shortest timeframe determined by the modelling), there are not estimated to be big volumes at Dampier or Eighty Mile Beach (or contact at all).</p> <p>Operations will focus on the Protection Priorities (as the most commonly contacted and environmentally valued locations across all modelled scenarios) and the need is met by the access to resources as described in the OPEP.</p> <p>Jadestone undertook an evaluation to determine the most effective resource capability to reduce the environmental risk from a worst-case spill event (refer Section 11 of OPEP).</p>

Strategy tasks and resources arrangements	Environmental/Social/Economic consequences of additional resources from those described in the OPEP	Practicality of additional resources from those described in the OPEP	ALARP assessment
			<p>It was found that 2 containment and recovery teams (4 vessels, 2 skimmers, 800 m boom) are estimated to contain and recover up to 80 m³ of oil per day. This is more than sufficient to recover the oil available from weathering from the worst-case spill.</p> <p>Jadestone could mobilise additional containment and recovery teams to the spill site, however this is likely to be ineffective, given that containment and recovery is not an efficient strategy (usually limited to between 5% and 20% of the initial spilled volume (IPIECA-IOPG, 2015)).</p> <p>Jadestone could purchase and maintain suitable vessels and equipment to be on standby 24/7/365, however this is cost prohibitive and disproportionate to the risk.</p> <p>In addition, it is not feasible to pre-deploy containment and recovery equipment as modelling identifies different potential shoreline contact locations (depending on the season) which are, largely remote and uninhabited. Even when the Protection Priorities are focussed on (as being the most commonly contacted locations across all modelled scenarios), the intrusion caused by equipment deployment and maintenance (considering the continuing operational aspect of Stag (24/7/365) would result in unnecessary additional impact to these locations and potential safety risks. In addition, the cost of doing this is disproportionate to the benefit.</p> <p>The current level of resources meets for the need as it allows flexibility in response operations as not all locations will be contacted in a single spill event.</p> <p>Containment and recovery arrangements described in the OPEP are considered ALARP.</p>
<p>Protection and Deflection Section 12 of the OPEP</p>	<p>Additional Protection and Deflection resources reduces shoreline contact and accumulation of oil, and subsequent impacts to shorelines.</p> <p>However, additional resources on shorelines will increase potential environmental contact and intrusion opportunities and increase safety risks of responders.</p>	<p>Boom hire costs are variable depending on the configuration and type used however they are estimated to be approximately \$5000 per day.</p> <p>The cost of additional resources is not considered the limiting factor; the limiting factor is considered to be the availability to use resources at the physical location. If required, additional equipment will be sourced and the additional cost borne by Jadestone.</p>	<p>Protection and deflection has limited application for some locations due to tidal influences and lack of anchoring points for booms.</p> <p>Jadestone undertook an evaluation to determine the most effective resource capability to reduce the environmental risk from a worst-case spill event (refer OPEP Section 12).</p> <p>For Jadestone to purchase equipment and store and maintain is cost prohibitive when access via AMOSC will meet the need, and the limiting factor is people (who are accessed from outside Dampier).</p> <p>It is cost prohibitive and disproportional to the risk for Jadestone to purchase and maintain equipment to be on standby 24/7/365 when access to vessels and equipment is possible through contracts and AMSOC. Vessels and people will be utilised as determined through the IAP and NEBA.</p>

Strategy tasks and resources arrangements	Environmental/Social/Economic consequences of additional resources from those described in the OPEP	Practicality of additional resources from those described in the OPEP	ALARP assessment
			<p>Given the remoteness of the locations with shoreline contact modelled and continuing operational aspect of Stag (24/7/365) there is considered limited benefit for pre-deployment of resources as this would create unnecessary long-term environmental disturbance (both for placement of resources and continuing maintenance) and unnecessary safety risks. In addition, the cost of doing this is disproportionate to the benefit.</p> <p>The current level of resources meets for the need as it allows flexibility in response operations as not all locations will be contacted in a single spill event.</p> <p>Therefore, the arrangements described in the OPEP are considered ALARP.</p>
<p>Shoreline Clean-up Section 13 of the OPEP</p>	<p>While oil is arriving there is limited benefit from additional resources that might remove oil more quickly and any additional resources may be counterproductive in that additional impacts may outweigh benefits.</p> <p>After the oil has finished arriving, there may be an additional benefit in having increased resources at particular locations dependent upon environmental considerations. For example a turtle nesting beach during the nesting/hatching season may benefit in having additional resources deployed to clean the beach before nesting/hatching events.</p> <p>There may be benefit in deploying additional machinery in the event of greater opportunities for use, given machinery has the capacity to remove far greater volumes of bulk oil in the right circumstances. The numerous factors and consideration in determining the best approach for shoreline clean-up, the benefit of additional resources</p>	<p>The cost of additional resources is not considered the limiting factor; the limiting factor is considered to be the ability to use resources at the physical location.</p> <p>If required, additional personnel and machinery will be sourced and the additional cost borne by Jadestone.</p>	<p>Jadestone undertook an evaluation to determine the most effective resource capability to reduce the environmental risk from a worst-case spill event (refer OPEP Section 13).</p> <p>Intrusive shoreline clean-up techniques (e.g. mechanical and manual removal) have the potential to damage sensitive shorelines. Given that the majority of protection priorities predicted to be contacted have mangroves and species sensitive to shoreline clean-up activities (e.g. nesting birds) the appropriateness of clean-up will be determined via NEBA (as opposed to natural attenuation). It is therefore the opportunity for use rather than the availability of machinery and personnel which is considered the limiting factor to increase shoreline clean-up capability.</p> <p>In addition, volumes predicted ashore from spill modelling indicate 2-33m³ accumulated oil on shorelines above 100g/m² in the worst replicate.</p> <p>For Jadestone to purchase equipment, store and maintain it is cost prohibitive when access via AMOSC Mutual Aid and mainstream suppliers will meet this need, and the limiting factor is people (who have to be accessed from outside Dampier), health and safety issues for shoreline work and suitable vessels.</p> <p>Given the remoteness of the locations with shoreline contact modelled and continuing operational aspect of Stag (24/7/365) there is considered no benefit for pre-deployment of resources as this would create unnecessary environmental disturbance (both for placement of resources and continuing maintenance) and unnecessary safety risks. In addition, the cost of doing this is grossly disproportionate to the benefit.</p> <p>The current level of resources meets for the need as it allows flexibility in response operations as not all locations will be contacted in a single spill event.</p> <p>The arrangements described in the OPEP are considered ALARP.</p>

Strategy tasks and resources arrangements	Environmental/Social/Economic consequences of additional resources from those described in the OPEP	Practicality of additional resources from those described in the OPEP	ALARP assessment
	<p>will be determined for each Operational Period.</p> <p>However, additional resources on shorelines will increase potential environmental contact and intrusion opportunities, increase safety risks of responders, cause physical damage and could be a negative impact.</p>		
<p>Waste Management OPEP</p>	<p>Additional resources for waste management would have a benefit for reducing secondary contamination.</p> <p>However, additional resources in waste zones will increase potential environmental contact and intrusion opportunities, increase safety risks of responders, cause physical damage and could be a negative impact.</p>	<p>Additional cost would be incurred for additional laydown zones, decontamination areas, receptacles, PPE, people, transport and access to facilities.</p>	<p>Jadestone undertook an evaluation to determine the most effective resource capability to reduce the environmental risk from a worst-case spill event (refer OPEP).</p> <p>Additional resources can be sourced through existing arrangements with NWA if during a response it becomes apparent that additional resources are required.</p> <p>Planned resources are considered to match worst-case modelled waste requirements. Increased resources will have additional stressors and potential negative impact to the environment and operational areas.</p> <p>The arrangements described in the OPEP are considered ALARP.</p>
<p>OWR Section 14 of the OPEP</p>	<p>The OWR level is a Level 3 (refer WAOWRP and POWRP) as Eighty Mile Beach has been identified as a Protection Priority.</p> <p>OWR aims to prevent/reduce the impact to marine fauna (in particular birds and turtles) and any long term effects.</p>	<p>Significant additional cost would be incurred if Level of response increase to Level 4 or above in particular around the people and facility aspect.</p> <p>Significant additional cost would be incurred if Jadestone provided its own oiled wildlife response (personnel, experts, facilities, plans etc).</p>	<p>Jadestone undertook an evaluation to determine the most effective resource capability to reduce the environmental risk from a worst-case spill event (refer OPEP).</p> <p>Additional strategies that have been considered include:</p> <ul style="list-style-type: none"> Additional arrangements to improve mobilisation times of international OWR resources (e.g. additional contracts/arrangements with OWR organisations or pre-mobilisation of international OWR personnel) Additional training of Australian based OWR personnel to increase numbers of competent OWR personnel <p>Given the local (AMOSOC and DBCA) and global (OSRL/Sea Alarm) response capability through existing arrangements could be mobilised within required timeframes, the response arrangements are considered ALARP as these plans are contextualised for the Pilbara.</p> <p>The WAOWRP and the POWRP were developed by the State environmental agency in conjunction with industry, Perth Zoo and academia. Therefore, represents the best-oiled wildlife response plans that WA and Jadestone can utilise.</p>

Strategy tasks and resources arrangements	Environmental/Social/Economic consequences of additional resources from those described in the OPEP	Practicality of additional resources from those described in the OPEP	ALARP assessment
			<p>The level of oiled wildlife response required for a worst-case impact event was considered to be potentially a Level 3 based on worst-case population density and distribution of shorebirds and an examination of applicable case studies of similar characteristics (i.e. Macondo). The arrangements of OWR outlined within the OPEP are considered sufficient for a controlled escalation of response prior to the worst-case minimum contact times for oil at the sites of highest abundance and sensitivity (i.e. Eighty Mile Beach)</p> <p>Stag crude is not toxic and has low adherence properties, but it is persistent. The arrangements described in the OPEP are considered ALARP.</p>

7.5.8 Acceptability Assessment

<p>The potential impacts due to an unplanned release of Stag crude oil are considered d 'Broadly Acceptable' in accordance with the Environment Regulations, based on the acceptability criteria outlined below.</p>	
Policy compliance	Jadestone’s HSE Policy objectives are met.
Management system compliance	Section 9 demonstrates that Jadestone’s HSE Management System is capable of continuously reviewing and updating activities and practices at the Stag facility, including spill response arrangements.
Social acceptability	<p>Stakeholder consultation has been undertaken (see Section 6), including engagement with the State and National response agencies of DoT and AMSA, AMOSC, nearby operators, as well as commercial and recreational fishing industry bodies and fishers. No stakeholder concerns have been raised with regards to impacts of the spill response activities on relevant persons.</p> <p>During any spill response, a close working relationship with key regulatory bodies (e.g. DoT, DBCA, AMSA, DER) will occur and thus there will be ongoing consultation with relevant persons during response operations.</p>
Laws and standards	<p>Jadestone is obligated to respond to a hydrocarbon spill under the following legislative instruments:</p> <ul style="list-style-type: none"> • OPGGS Act Section 572A-F – polluter pays for escape of petroleum) • AMSA Marine Orders Part 91 • Protection of the Sea (Prevention of Pollution from Ships) Act 1983 • Protection of the Sea (Civil Liability for Bunker Oil Pollution Damage) Act 2008
Industry best practice	<p>Response planning and preparedness undertaken in accordance with:</p> <ul style="list-style-type: none"> • NatPlan (AMSA, 2020) • AMOSPlan (AMOSC, 2017) • NOPSEMA Guidance Notes (e.g. Oil Pollution Risk Management Guidance Note July 2021) • DoT Offshore Petroleum Industry Guidance Note, Marine Oil Pollution: Response and Consultation Arrangement July 2020 • DoT OSCP (2015) • State Hazard Plan – Maritime Environmental Emergencies (MEE), 2020) • Fingas, M.F. (2012) The Basics of Oil Spill Clean-up. CRC Press. Florida, United States of America. • ITOPF Technical Information Papers including: <ul style="list-style-type: none"> ITOPF (2014) Technical Information Paper Dispersant Use ITOPF (2020). ITOPF Members Handbook 2020/2021 ITOPF (2014) Technical Information Paper Clean-up of oil from shorelines ITOPF (2013). Technical Information Paper Use of Booms in oil pollution response • IPIECA International Association of Oil and Gas Producers Good Practice Guide Series including: <ul style="list-style-type: none"> IPIECA-IOGP. (2015) A Guide to Oiled Shoreline Clean-up Techniques: Good practice guidelines for incident management and emergency response personnel IPIECA-IOGP (2015) Oil spill preparedness and response: an introduction IPIECA-IOGP (2015) Contingency planning for oil spills on water Good practice guidelines for the development of an effective spill response capability • Oil Spill Response (OSRL) handbooks including: <ul style="list-style-type: none"> Shoreline operations handbook Containment and recovery handbook • Dispersant application field guide

<p>Environmental context</p>	<p>The worst-case credible Stag crude spill scenario for the Stag facility operating activities is as a result of damage to the underbuoy hose at the CALM buoy. The worst case release of oil occurs over 30 minutes and the area of dispersion over which the oil travels is between Eighty Mile beach to the north and Ningaloo in the south. The oil is primarily floating and sensitive receptors at risk include seabirds, shorebirds, marine fauna and coastal habitats.</p> <p>While some response strategies (e.g. application of chemical dispersants and booming operations) pose risk to sensitive receptors, to not implement response activities would likely result in greater negative impact to the receiving environment and a longer recovery period.</p> <p>The mutual interests of responding and protecting sensitive receptors from further impact due to response activities is managed through the use of the net environmental benefit analysis during response strategy planning in preparedness arrangements as well as during a response.</p>
<p>Conservation and management advice</p>	<p>Jadestone will have regard to the representative values of the reserves and other conservation advice published and endeavor to ensure that priority is given to the social and ecological objectives and values, of any AMPs, or state marine parks impacted by unplanned crude release to ensure that the objectives of the management plans are not contravened .</p> <p>Noting ‘Emergency response’ is permitted in all AMPs and state marine parks.</p> <p>Actions required to respond to oil pollution incidents, including environmental monitoring and remediation, in connection with activities authorized under the OPGGS Act may be conducted in all zones. The Director will be notified in the event of an oil pollution incident that occurs within, or may impact upon, an Australian Marine Park and, so far as reasonably practicable, prior to a response action being taken within a marine park.</p> <p>Protected areas within the RISK EMBA predicted to potentially be impacted by crude above threshold levels have been identified as protection priorities (Section 7.5.4).</p> <p>The ‘Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species’ will be applied/used as guidance in the event of an oil spill.</p> <p>A number of conservation advice, threat abatement plans and management plans identify marine pollution and/or habitat degradation or modification as a threat. The plans require appropriate mitigation measures to be implemented to prevent impacts to the fauna. These plans are listed in Table 3-5 and include:</p> <ul style="list-style-type: none"> - - Recovery Plan for the Grey Nurse Shark (<i>Carcharias taurus</i>) (DoE, 2014a) - Recovery plan for the White Shark (<i>Carcharodon carcharias</i>) (DSEWPaC, 2013a) - Approved Conservation Advice on <i>Pristis lavate</i> (dwarf sawfish) (DEWHA, 2009) - Sawfish and River Sharks Multispecies Recovery Plan (DoE, 2015a) - Approved Conservation Advice for <i>Pristis pristis</i> (largetooth sawfish) (DoE, 2014b) - Approved Conservation Advice for <i>Pristis zijsron</i> (green sawfish) (DEWHA, 2008c) - Approved Conservation Advice for <i>Rhincodon typus</i> (whale shark) (TSSC, 2015a) - Approved Conservation Advice for <i>Milyeringa veritas</i> (blind gudgeon) (DEWHA, 2008d) - Approved Conservation Advice for <i>Ophisternon candidum</i> (Blind Cave Eel) (DEWHA, 2008e) - Approved Conservation Advice for <i>Balaenoptera borealis</i> (sei whale) (TSSC, 2015b) - Blue Whale Conservation Management Plan 2015 - 2025 (DoE, 2015b) - Approved Conservation Advice for <i>Balaenoptera physalus</i> (fin whale) (TSSC, 2015c) - Conservation Management Plan for the Southern Right Whale 2011 – 2021 (DSEWPaC, 2012h) - Approved Conservation Advice on <i>Aipysurus apraefrontalis</i> (Short-nosed seasnake) (DSEWPaC, 2011a) - Approved Conservation Advice on <i>Aipysurus foliosquama</i> (Leaf-scaled seasnake) (DSEWPaC, 2011b) - Recovery plan for marine turtles in Australia 2017 – 2027 (DoEE, 2017)

	<ul style="list-style-type: none"> - Approved Conservation Advice on <i>Dermochelys coriacea</i> (DEWHA, 2008f) - Wildlife Conservation Plan for Seabirds (CoA, 2020) - Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015) - Approved Conservation Advice for <i>Calidris canutus</i> (Red knot) (TSSC, 2016a) - Approved Conservation Advice for <i>Anous tenuirostris melanops</i> (Australian lesser noddy) (TSSC, 2015i) - Approved Conservation Advice for <i>Calidris ferruginea</i> (Curlew Sandpiper) (DoE, 2015c) - Approved Conservation Advice for <i>Calidris tenuirostris</i> (Great knot) (TSSC, 2016e) - Approved Conservation Advice for <i>Charadrius leschenaultii</i> (Greater sand - Approved Conservation Advice for <i>Charadrius mongolus</i> (Lesser sand plover) (TSSC, 2016d) - Approved Conservation Advice for <i>Limosa lapponica menzbieri</i> (Bar-tailed godwit (northern Siberian) (TSSC, 2016c) - National recovery plan for threatened albatrosses and giant petrels 2011-2016 (DSEWPaC, 2011c) - Approved Conservation Advice for <i>Numenius madagascariensis</i> (eastern curlew) (DoE, 2015d) - Approved Conservation Advice for the Abbott's booby <i>Papasula abbotti</i> (TSSC, 2020a) - Approved Conservation Advice on <i>Rostratula australis</i> (Australian painted snipe) (DSEWPaC, 2013b) - Approved Conservation Advice on <i>Sternula nereis nereis</i> (fairy tern) (TSSC, 2011) - Conservation Advice <i>Thalassarche cauta</i> Shy Albatross (TSSC, 2020b)
<p>Australian Marine Parks</p>	<p>Australian Marine Parks are established by proclamation under the <i>EPBC Act</i> for the purpose of protecting and maintaining biological diversity in the parks.</p> <p>Environment plan (EP) must be consistent with the Australian Marine Park Management plans. There are 12 AMPs within the RISK EMBA.</p> <p>In all cases where an activity has potential to impact or present risk to AMPs, regardless of whether the activity is inside or outside a park, the EP should evaluate how these impacts and risks will be of an acceptable level and reduced to as low as reasonably practicable (ALARP).</p> <p>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. The requirement is that The Director should be notified in the event of an oil pollution incident that occurs within, or may impact upon, an Australian Marine Park and, so far as reasonably practicable, prior to a response action being taken within a marine park.</p> <p>Consultation to notify the Director of Parks when the proposed response activities is completed as part of the Consultation process (Table 4-4).</p> <p>The Director notification in the event of a spill that would impact one of the AMPs is included in the OPEP and Table 4-4.</p> <p>As such this EP is consistent with the Australian Marine Park Management plans.</p>
<p>ALARP</p>	<p>The residual risk has been demonstrated to be ALARP.</p>

7.6 Unplanned Release of Diesel

7.6.1 Description of Hazard

<p>Aspect</p>	<p>Release of diesel may occur from a support vessel due to platform/vessel collision within the Operational Area or from a dropped object event. Alternatively, diesel may be released to the marine environment due to a leak or rupture of the bunkering hose.</p> <p>The maximum worst-case credible spill volume of diesel has been calculated as 250 m³ based on a typical maintenance support vessel used at Stag.</p>
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Diesel is stored on the CPF and is the main fuel source for support vessels. The CPF uses Stag crude oil as its primary fuel source.

A HAZID was undertaken for the Stag Field activities and the below credible scenarios resulting in a diesel spill were identified (**Table 7-18**).

Table 7-18: Credible diesel releases to the marine environment

Scenario	Maximum Credible Spill	Credibility justification
Release of diesel from support vessel due to CPF/ vessel collision or from dropped object	Based on AMSA (2015) ‘other vessel collision’ – volume of largest fuel tank = 80 m³ (based on a typical operations support vessel); 250 m³ (based on a typical maintenance support vessel)	AMSA (2015) Indicative maximum credible spill volumes table is directly applicable for determining the volume that may be released in a vessel collision scenario. An operations support or supply vessel would typically carry a total fuel capacity of 250 m ³ in a single tank.
Leak or rupture of bunkering hose during support vessel to CPF diesel transfer	Based on AMSA (2015) ‘Production platform refuelling – continuous supervision’ Transfer rate x 15 minutes (continuous supervision) = 20 m ³ /hr for 15 minutes = 5m³	AMSA (2015) Indicative maximum credible spill volumes table is directly applicable for production platform refuelling. Continuous supervision is the appropriate credible level of supervision given that transfers are of short duration and refuelling procedures stipulate continuous supervision.
Dropped object damaging vessel hull and internal tanks	250 m³ (based on a typical maintenance support vessel)	The volumes determined for the collision scenarios have also been used to estimate the volume that may be released due to a dropped object damaging the support vessel hull (and internal tanks).

The HAZID identified scenarios where the event leading to a diesel release would not occur, or, where due to the small volumes or inherent barriers in the facility design did not result in the diesel being released into the marine environment. These include:

Release diesel to the marine environment from a leak or rupture to the bunkering hose during diesel transfer from vessel to vessel – this is considered not credible for vessel to vessel transfers, as no diesel bunkering occurs for support vessels. Note that fuel transfers to the CPF do occur, see above.

Release of diesel to the marine environment from the CPF bulk diesel storage tank from a collision with a vessel (errant vessel) – the CPF bulk storage tank (inventory of 65 m³) is enclosed within the hull structure of the CPF which is raised off the sea surface by ~50 m. The CPF is designed to withstand a 2,000 t vessel impacting at 0.5 m/s (typical support vessel at required low manoeuvring speed) so it is not considered credible that the bulk storage tank would be damaged resulting in a release to the marine environment.

Release of diesel to the marine environment from the CPF bulk diesel storage tank or ancillary pipework/diesel conditioning unit – the CPF bulk storage tank (inventory of 65 m³) is enclosed within the hull structure of the CPF and therefore corrosion or loss of integrity would not lead to diesel released to the marine environment. The diesel is intermittently treated by a conditioning system on the main deck. Loss of diesel from pipework associated with the diesel storage tank and the conditioning system due to loss of integrity/ corrosion would be contained within barriers (e.g. bunding, hull structure).

Release of diesel to the marine environment from day tanks – small quantities of diesel could be spilt when manually filling day tanks or from leaks in day tanks and associated hoses/ pipework (e.g. CPF Hydraulic Workover Unit diesel day tank – 3 m³, CPF firewater pump day tanks – 8 m³, CPF emergency generator day tank – 3 m³). These potential small spill volumes would be restricted to within barriers of

the CPF, third-party tanker or support vessels (e.g. within the hull or within banded areas on the topside deck).

Spill volume

The volume of diesel that could be released to the marine environment from vessel collision and subsequent rupture of fuel tank is largely dependent upon fuel tank position on the vessel, and the degree and location of tank damage. The AMSA (2015) guideline: *Technical guidelines for preparing contingency plans for marine and coastal facilities* has been used in determining the potential release volume of the credible scenarios. These calculations provide a spill volume of 250 m³ for maintenance support vessels, and 5 m³ during transfer of diesel between a support vessel and CPF storage tank. For the purpose of determining potential impacts, the larger volume of 250 m³ has been used as it is considered to be representative of a typical maintenance vessel and subsumes the 5 m³ scenario outlined above.

7.6.2 Diesel characteristics

Characteristics for marine diesel were extracted from the ASA oil database for similar operational temperatures (**Table 7-19**). Diesel fuel oil is a mixture of volatile and persistent hydrocarbons with low proportions of highly volatile and residual components. In general, about 6% of the oil mass should evaporate within the first 12 hours (BP < 180 °C); a further 35% should evaporate within the first 24 hours (180 °C < BP < 265 °C); and a further 54% should evaporate over several days (265 °C < BP < 380 °C). Approximately 5% of the oil is shown to be persistent. The aromatic content of the oil is approximately 3%.

If released in the marine environment and in contact with the atmosphere (i.e. surface spill), approximately 41% by mass of this oil is predicted to evaporate over the first couple of days depending upon the prevailing conditions, with further evaporation slowing over time (RPS APASA, 2020).

Table 7-19: Characteristics of diesel (RPS APASA, 2020)

Initial Density @ 25°C (g/cm ³)	Viscosity @ 25°C (cP)	Component	Volatiles (%)	Semi-volatiles (%)	Low-volatility (%)	Residual (%)	Aromatics (%)
			<180 C4 to C10	180-265 C10 to C15	265-380 C15 to C20		
0.829	4		Non-Persistent			Persistent	
		Boiling Points (°C)	6	34.6	54.4	5	3
		% aromatics	1.8	1	0.2	-	-

In the marine environment diesel will behave as follows:

- Diesel will spread rapidly in the direction of the prevailing wind and waves;
- Evaporation is the dominant process contributing to the fate of spilled diesel from the sea surface and will account for >50% reduction of net hydrocarbon balance;
- Diesel will entrain under the water surface particularly when wind speed and resultant wave action increase;
- The evaporation rate of diesel will increase in warmer air and sea temperatures such as those at the Stag Operations location; and
- 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.

7.6.3 Modelling Results

To determine the spatial extent that may be affected by a 250 m³ diesel spill released instantaneously, modelling was conducted by APASA (2020).

A summary of the modelling methods used to evaluate the weathering and distribution of a 250 m³ diesel spill within the Stag permit area are as per those described in **Section 7.4.2.1**.

The mass balance forecast for the constant-wind case (calm winds at constant 5 knots) for diesel fuel oil shows that approximately 41% of the oil is predicted to evaporate within 24 hours. Under these calm conditions the majority of the remaining oil on the water surface will weather at a slower rate due to being comprised of the longer-chain compounds with higher boiling points. Evaporation of the residual compounds will slow significantly, and they will then be subject to more gradual decay through biological and photochemical processes.

Under the variable-wind case (4-19 knots), where the winds are of greater strength, entrainment of diesel fuel oil into the water column is indicated to be significant. Approximately 24 hours after the spill, around 72% of the oil mass is forecast to have entrained and a further 24% is forecast to have evaporated, leaving only a small proportion of the oil floating on the water surface (<1%). The residual compounds will tend to remain entrained beneath the surface under conditions that generate wind waves (approximately >6 m/s).

7.6.3.1 Results – Surface release of 250m³ diesel

The annualised EMBA is derived from the seasonal stochastic modelling results (i.e. results from all 200 replicates), hence describes a substantially larger area than would be affected during any single spill event. The annualised EMBA is based on Jadestone’s specifications of thresholds for floating oil (1 g/m² and 10 g/m²), shoreline oil (100 g/m²), entrained oil (100 ppb) and dissolved aromatic hydrocarbon (70 ppb) concentrations. The annualised maximum distance from the spill location to the outer edge of the annualised EMBA is calculated as approximately 295 km (**Figure 7-4**).

Floating Oil Results

Results of the worst-case modelling (September to February) indicate that surface sheens of floating oil (>1 g/m² and 10 g/m²) may pass over the following sensitive receptors, with a probability of >1% of reaching these locations, noting that floating oil will not accumulate on submerged features or at open ocean locations (**Table 7-20**).

In the worst case season, floating oil concentrations at or greater than 1 g/m² could travel up to 129 km from the release location (March to August), with the distances reducing to 27 km (March to August) as the contact threshold increases to 10 g/m² (RPS APASA, 2020).

No receptors are predicted to be contacted by shoreline oil concentrations at or greater than 100 g/m² during either season. The worst-case accumulated concentration is predicted as 8.1 g/m² forecast at Lowendal Islands in the March to August period.

Table 7-20: Modelling results for floating oil due to 250 m³ diesel surface release

Receptor Type	Receptor
Australian Marine Parks	Montebello MP
Biologically Important Areas	Marine Turtle BIA
	Seabirds BIA
	Fish and Sharks BIA
	Whales BIA
Islands	Barrow Island

Receptor Type	Receptor
	Lowendal Islands
	Montebello Islands
Key Ecological Features	Ancient Coastline at 125m Depth Contour KEF
	Continental Slope Demersal Fish Communities KEF
	Glomar Shoals KEF
State Marine and National Parks	Barrow Island MMA
	Barrow Islands MP
	Montebello Islands MP

Entrained Oil Results

Entrained oil is most likely to drift to the south-west for spills commencing during summer and winter months. Entrained oil concentrations at or greater than 100 ppb could travel up to 267 km from the release location (March to August).

Highest maximum nearshore concentrations of entrained oil are predicted to occur along shorelines of the Montebello Islands at 5,973 ppb for spills commencing during winter months. And 1,818 ppb in summer months.

For 100 ppb the minimum arrival time is 11 hours to the Montebello Marine Park (in winter months). The maximum entrained hydrocarbon concentration at any depth in the worst replicate is 42,850 ppb at the turtles, seabird and whale BIAs.

Results of the worst-case modelling (March to August) indicate that entrained hydrocarbons >100ppb may pass over the following sensitive receptors, with a probability of >1% of reaching these locations (**Table 7-21**).

Table 7-21: Modelling results for entrained oil due to 250 m³ diesel surface release

Receptor Type	Receptor
Australian Marine Parks	Montebello Marine Park
Biologically Important Areas	Marine Turtle BIA
	Seabirds BIA
	Sharks BIA
	Whales BIA
Islands	Montebello Islands
Key Ecological Features	None
State Marine and National Parks	Montebello Islands MP

Dissolved Aromatic Hydrocarbons

Dissolved aromatic hydrocarbon concentrations at or greater than 70 ppb could travel up to 267 km from the release location (March to August). The maximum dissolved aromatic hydrocarbon concentration at any depth in the worst replicate is 168 ppb at the Montebello marine park.

Results of the worst-case modelling (March to August) indicate that dissolved aromatic hydrocarbons >70 ppb may pass over the following sensitive receptors, with a probability of >1% of reaching these locations (Table 7-22).

Table 7-22: Modelling results for dissolved oil due to 250 m³ diesel surface release

Receptor Type	Receptor
Australian Marine Parks	Montebello Marine Park
Biologically Important Areas	Marine Turtle BIA
	Seabirds BIA
	Sharks BIA
	Whales BIA
Islands	None
Key Ecological Features	None
State Marine and National Parks	None

7.6.4 Impacts and Risks

Marine diesel oil is a highly volatile hydrocarbon with a high proportion of toxic monocyclic aromatic hydrocarbons (MAHs) that are harmful in varying degrees to marine fauna. Diesel contains some heavy components (or low volatility components) that have a strong tendency to physically entrain into the upper water column in the presence of moderate winds (i.e. >12 knots) and breaking waves and can resurface if these energies abate.

In the event of a substantial diesel spill, the heavier components of diesel can remain entrained or at sea surface for an extended period. Given the properties of diesel, it is expected that marine fauna, marine habitats, protected and significant areas and socio-economic receptors, have the potential to be impacted by surface and entrained thresholds.

See **Appendix H** and **Table 7-13** for more detail on the physical and chemical pathways and oil impacts to habitats, marine organisms and socio-economic receptors within the risk EMBA. A summary is also provided in Table 7-23 below.

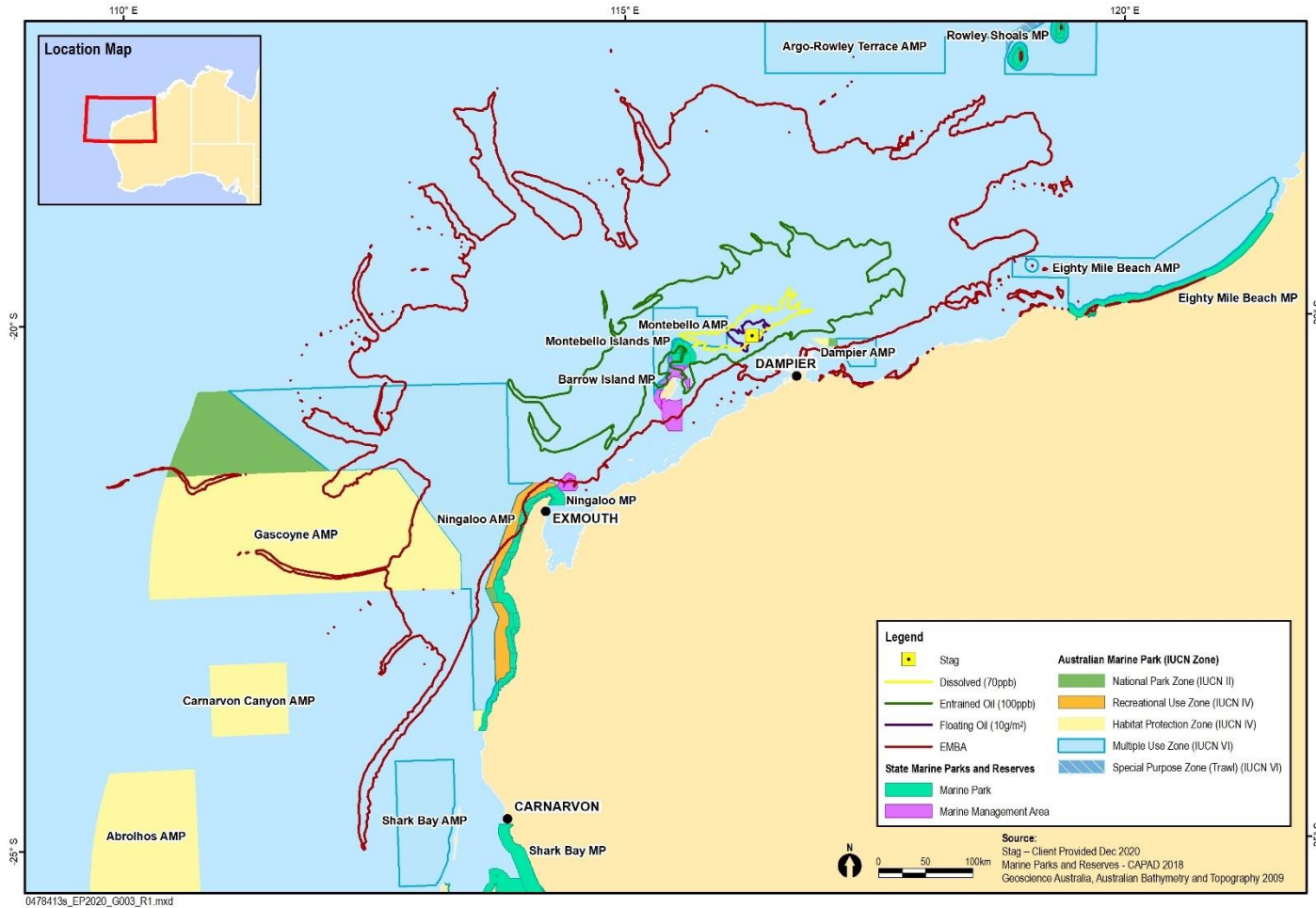


Figure 7-4: Modelled spill trajectories for all seasons for floating and entrained diesel resulting from surface release of 250 m³ diesel at the Stag Facility and the EMBA.

Table 7-23: Potential Impacts to sensitive receptors from diesel spill

Receptors	Potential Impacts from a diesel spill to receptors within the Risk EMBA		
	Floating and/or shoreline	Entrained	Dissolved
Plankton	<p><i>Potential impacts from diesel spill</i></p> <p>There is potential for localised mortality of plankton due to reduced water quality and toxicity. Effects will be greatest in the upper 10 m of the water column and areas close to the spill source where hydrocarbon concentrations are likely to be highest.</p> <p><i>Impact assessment to receptors within the risk EMBA</i></p> <p>High abundance of phytoplankton typically occurs around topographical features that may result in upwelling or a disruption to the current flow which may be present around banks and shoals. The Risk 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 impacted by hydrocarbons entrained in the water column with effects greatest in the upper 10 m of the water column where the majority of plankton concentrate and closest to the spill source. However, following release, the diesel will rapidly evaporate, disperse and degrade in the offshore environment, reducing the concentration and toxicity of the spill. Given duration of fish spawning periods, lack of suitable habitat for aggregating fish populations near the surface, combined with the quick evaporation and dispersion of diesel, impacts to overall fish populations are not expected to be significant.</p>		
Benthic habitat and communities (Including deepwater habitats and shallow shoals)	n/a – benthic habitats are not present at surface	<p><i>Potential impacts from dissolved and entrained oil</i></p> <p>Benthic habitats at shoals may be affected by marine diesel. This may result in toxic effects to both the habitat (in the case where the habitat is biological such as coral reefs) and associated flora and fauna. The degree of impact will depend on several variables, including the duration of exposure to DAHs and other diesel components. Sea grasses and macroalgae may experience a phytotoxic effect caused by absorption of DAHs from the water column. The hydrocarbon molecules can concentrate in membranes of aquatic plants, inhibiting photosynthetic efficiency (Runcie <i>et al.</i>, 2004). Recovery of habitats experiencing chronic effects are expected within weeks to months of return to ambient water quality. Direct contact to shallow hard corals by entrained diesel could lead to impacts such as short or long-term sub-lethal effects including reduced feeding capacity and growth, reduced reproductive output and increased mucous production (IPIECA, 1992). In the worst case instance irreversible tissue necrosis and death could occur.</p>	
	There are a number of shoals that may be present within the risk EMBA for the worst-case diesel spill. Shoals have a diversity of benthic habitats and		

Receptors	Potential Impacts from a diesel spill to receptors within the Risk EMBA		
	Floating and/or shoreline	Entrained	Dissolved
	associated fish and invertebrate assemblages which could be affected by entrained or dissolved oil. The shoals have a number of representative habitats including corals, sponges, seagrass		
Marine mammals	<p><i>Potential impacts from surface oil</i></p> <p>Physical and chemical effects of diesel in sea surface waters have been demonstrated through direct contact with organisms, for example through physical coating, adsorption to body surfaces and ingestion (NRC, 2005).</p> <p>Lethal or sub-lethal physical and toxic effects such as irritation of eyes/mouth and potential illness.</p> <p>Whales and dolphins are smooth skinned, hairless mammals, so hydrocarbons tend not to adhere to their skin and the potential impacts of oiling on them is limited.</p>	<p><i>Potential impacts from dissolved and entrained oil</i></p> <p>The high volatility of the diesel will result in the rapid evaporation and loss of the more toxic aromatic components of the diesel, resulting in a reducing toxicity threat to marine fauna with time. Surface respiration could lead to accidental ingestion of hydrocarbons or result in the coating of sensitive epidermal surfaces. For marine mammals that may be exposed to the more toxic aromatic components of the marine diesel, chemical effects are considered unlikely since these species are mobile and therefore not be constantly exposed for extended durations that would be required to cause any major toxic effects.</p> <p>Clogging of baleen structures and toxicological effects from ingestion, although recorded, is sparse in the literature (Geraci and St. Aubin, 1985).</p> <p>The susceptibility of marine mammal species to physiological effects through ingestion of surface and water column hydrocarbon varies with the feeding mechanism of each species:</p> <ul style="list-style-type: none"> Whales with a baleen mechanism filter nutrient-rich waters containing food such as plankton and small fish over the baleen (a sieve type structure) before subsequently moving the food to the oesophagus using the tongue; Baleen whales that skim surface waters and the water column (e.g. southern right whales) are more likely to be affected by surface hydrocarbons than other whales that ‘gulp’ feed such as the humpback whale; and Toothed whales are also less susceptible to impacts owing to gulp feeding behaviour (Geraci and St. Aubin, 1985). 	
	<p><i>Impact assessment to receptors within the risk EMBA</i></p> <p>Marine mammals present within the diesel risk EMBA include threatened and migratory whales and dolphins, and potentially dugongs, and the risk EMBA overlaps migration BIAs for humpback and blue whales. The activity is being undertaken all year round and may overlap with blue whale migration and humpback whale migration and calving, therefore diesel may contact whales during these life stages. However, given the rapid evaporation of diesel it is unlikely that significant numbers would be impacted. The absence of key feeding, resting or breeding areas for other threatened and migratory species and rapid evaporation and dissipation of diesel means significant numbers are unlikely to be impacted.</p>		

Receptors	Potential Impacts from a diesel spill to receptors within the Risk EMBA		
	Floating and/or shoreline	Entrained	Dissolved
Marine Reptiles	<p><i>Potential impacts from surface oil</i></p> <p>Marine turtles may be impacted by surface hydrocarbons through exposure during surface respiration, particularly where volatiles are being emitted in areas where fresher oil is weathering. Surface respiration could lead to accidental ingestion of hydrocarbons or result in the coating of sensitive epidermal surfaces.</p>	<p><i>Potential impacts from dissolved and entrained oil</i></p> <p>Whilst turtle nesting beaches may be contacted by weathered marine diesel, turtles will always nest above the high tide mark and any diesel moving through the beach profile should not come into contact with nests. Entrained and dissolved oil may result in harm to internal anatomy if ingested, irritation or damage to sensitive external features such as eyes and skin and damage to respiratory processes if significant inhalation of volatile fumes occurs at the surface</p>	
	<p><i>Impact assessment to receptors within the risk EMBA</i></p> <p>Threatened and migratory marine reptile species may occur within the diesel spill area risk EMBA as turtles are widely dispersed at low densities across the NWS and in the unlikely event of a diesel spill occurring, individuals traversing open water may come into contact with water column or surface diesel. The diesel spill EMBA overlaps with the BIAs for some turtle species (green, flatback and hawksbill interesting, foraging, mating) and therefore there is the risk of contact with nesting turtles and hatchlings with surface and dissolved oil.</p>		
Fish, Sharks, Rays	<p><i>Potential impacts from surface oil</i></p> <p>Near the sea surface, fish are able to detect and avoid contact with surface slicks and as a result, fish mortalities rarely occur in open waters from surface spills (Kennish, 1997; Scholz et al., 1992). Pelagic fish species are therefore generally not highly susceptible to impacts from hydrocarbon spills.</p> <p>However, hydrocarbon droplets can physically affect fish and sharks exposed for an extended duration (weeks to months). Smothering through coating of gills can lead to the lethal and sub-lethal effects of reduced oxygen exchange, and coating of</p>	<p><i>Potential impacts from dissolved and entrained oil</i></p> <p>In offshore waters near to the release point, pelagic fish are at risk of exposure to the more toxic aromatic components of the marine diesel. Pelagic fish in offshore waters are highly mobile and comprise species such as tunas, sharks and mackerel. Due to their mobility, it is unlikely that pelagic fish would be exposed to toxic components for long periods in this spill scenario. The more toxic components would also rapidly evaporate and concentrations would significantly diminish with distance from the spill site, limiting the potential area of impact. Rays are typically found on benthic habitats and may be present around shoals in the area and likely below the area of water column affected by a diesel spill.</p>	
	<p><i>Impact assessment to receptors within the Risk EMBA</i></p> <p>Whale sharks could potentially transit through the spill trajectory area; however this is considered unlikely given the small area affected by the diesel spill and its distance from known aggregation areas. Owing to the rapid evaporation expected and dispersion, impacts to the whale shark whose foraging and high density BIA overlaps the EMBA would be expected to be minimal.</p> <p>The NWS supports a diverse assemblage of fish and shark species, particularly in shallower water near islands and shoals. Other shark and pelagic fish species may transit the spill trajectory area but impacts would be anticipated to be negligible as most species will be well below the affected area of the water column.</p>		

Receptors	Potential Impacts from a diesel spill to receptors within the Risk EMBA		
	Floating and/or shoreline	Entrained	Dissolved
Avifauna	<p><i>Potential impacts from surface oil</i></p> <p>Estimates for the minimum thickness of floating oil that will harm seabirds (through ingestion from preening of contaminated feathers or loss of thermal protection of their feathers) range from 10 g/m² (O’Hara and Morandin, 2010) to 25 g/m² (Koops et al. 2004). Seabirds have the potential to become oiled through interactions with surface waters in the spill area or through secondary ingestion of toxins as a result of feeding on affected prey. Potential impacts to seabirds are from contact, ingestion and/ or oiling of feathers. In addition, diesel can erode feathers causing chemical damage to the feather structure that subsequently affects ability to thermo regulate and maintain buoyancy on water.</p> <p>Seabirds may also come into contact with marine diesel around shorelines as it percolates through the beach profile during feeding, breeding and roosting activities. This may result in chemical impacts to feathers and exposed skin from the diesel.</p>	<p><i>Potential impacts from dissolved and entrained oil</i></p> <p>As most fish survive beneath floating slicks, they will continue to attract foraging seabirds, which typically do not exhibit avoidance behaviour.</p> <p>Potential impacts to avifauna due to entrained oil include:</p> <ul style="list-style-type: none"> Harm to internal anatomy if ingested; Irritation or damage to sensitive external features such as eyes and skin; Damage to feathers of marine birds; Damage to respiratory processes of air breathing marine fauna if significant inhalation of volatile fumes occurs at the surface. 	
	<p><i>Impact assessment to receptors within the Risk EMBA</i></p> <p>Threatened and migratory seabirds and shorebirds that may occur within the EMBA may have foraging, feeding, breeding and or nesting habitat in the vicinity of the EMBA.</p> <p>The EMBA intercepts with breeding BIAs for several migratory species and therefore foraging and breeding habitat in the area may be impacted by surface and water column while foraging (dive and skim feeding). The wedge tailed sheaerwater breeding BIA overlaps the Stag drilling operational area and oil pollution is identified as a low threat to the species (SPRAT Wedge-tailed shearwater, DEE 2017a). Higher numbers would be expected during breeding periods. Due to the quick evaporation and dispersion of diesel, significant impacts are not anticipated.</p>		
AMPs	<p><i>Potential impacts from surface oil</i></p> <p>Surface oil may occur at the Montebello Marine Park where mangroves, sandy beaches, rocky shores occur affecting shoreline and intertidal habitats.</p>	<p><i>Potential impacts from dissolved and entrained oil</i></p> <p>Entrained and dissolved hydrocarbons will or may impact the coral and seagrass habitats, as well as other marine park values fauna including dugongs, sea snakes (protected), fish and other marine mammals. Impacts to these receptors are described above.</p>	

Receptors	Potential Impacts from a diesel spill to receptors within the Risk EMBA		
	Floating and/or shoreline	Entrained	Dissolved
	Impacts on the values associated with Protected Areas may result in loss of fauna/ habitat diversity and/ or abundance, reduction in commercial/recreational/ subsistence fishing, loss of livelihood and loss of income from reduced tourism and commercial productivity. The Montebello MP, has conservation values associated with biological attributes including migratory seabirds, nesting turtles, humpback whales, freshwater, green and dwarf sawfish, and dolphins. Tourism may be impacted by real or perceived reduction in health or mortality of habitats that support tourism activities		
State Marine Parks	Values associated with the Montebello Islands MP and Barrow Island MP and MMA include marine fauna and coral reefs, mangroves, saltmarshes and sandy beaches. These values may be contacted by surface, entrained and dissolved oil which would potentially impact the receptors as described in this table.		
World, National and Commonwealth Heritage Places	There are no World, National and Commonwealth Heritage Places within the diesel risk EMBA.		
Threatened Ecological Communities	There are no threatened ecological communities within the diesel risk EMBA.		
Wetlands of International Importance	There are no wetlands of international importance within the diesel risk EMBA.		
KEFs	<i>Potential impacts from surface oil</i> There are no KEFs that would be impacted by surface oil as the KEFs relate to geomorphologic features which are not expected to be impacted by hydrocarbons.	<i>Potential impacts from dissolved and entrained oil</i> Values and sensitivities associated with the KEFs include marine fauna due to the higher diversity of fish species associated with the higher diversity in fish communities or nutrients such as Continental Slope Demersal Fish Communities. Impacts to marine fauna are discussed above.	
	Impact assessment to receptors within the EMBA There are three KEFs which are overlapped by the diesel EMBA, these include: <ul style="list-style-type: none"> • Continental Slope Demersal Fish Communities; • Glomar Shoals; and • Ancient coastline at 125 m depth contour 		

Overall Consequence	Overall Likelihood	Residual Ranking
Minor	Unlikely	Low

7.6.5 Environmental Performance

Environmental Risk		Unplanned release of diesel (EUH-5)		
Performance Outcome		No spill of hydrocarbon to the marine environment.		
ID	Management controls	Performance Standards	Measurement Criteria	Responsibility
109	Compliance with Stag Safety Critical Elements Performance Standards Report (GA-70-REP-F-00007) ensures risks of spills during refuelling are reduced	All hoses are fitted with dry-break couplings and are buoyant or fitted with floats	Bunkering checklist for fuel	Stag OIM
110		Visual inspection of dry break couplings and hoses prior to diesel transfer		
111		Permit-to-work documentation is complete and signed off to ensure refueling is undertaken in accordance with the refueling procedure		
112		Bunding, sumps and drains are inspected monthly	BASSnet shows maintenance has been satisfactorily completed as scheduled	Stag OIM
113		Bunding/ drip trays under all skids and potential leak sources on CPF are inspected monthly as per PS-14: Bunding and Drains	BASSnet shows maintenance has been satisfactorily completed as scheduled	Stag OIM
114	Compliance with Pressure Vessel Inspection Procedure (JS-90-PR-P-00181) to ensure CPF storage tanks are maintained and fit for purpose	CPF bulk diesel storage tank inspected (internal and external) as per procedure and deemed fit for purpose.	BASSnet shows maintenance has been satisfactorily completed as scheduled	Stag OIM

Environmental Risk		Unplanned release of diesel (EUH-5)		
Performance Outcome		No spill of hydrocarbon to the marine environment.		
ID	Management controls	Performance Standards	Measurement Criteria	Responsibility
115	Compliance with Diesel Fuel Bunkering Procedure (GA-19-PR-P-00026) to ensure diesel bunkering equipment is maintained and fit for purpose	Diesel transfer hose is pressure tested at least annually and deemed fit for purpose	BASSnet shows maintenance has been satisfactorily completed as scheduled	Stag OIM
116	Vessel crew are trained in accordance with Competency and Training Management System [JS-60-PR-Q-00015] to ensure competent personnel undertake the activity	Vessel crew qualified in accordance with International Convention of Standards of Training, Certification and Watch-keeping for Seafarers (STCW95)	Records of crew certificates or third-party inspection document	Supply Chain Manager (initial Contract) Contract Owner (Contract Execution)
N/A	Refer Section 7.6.3 for additional controls and performance standards.			

7.6.6 ALARP Assessment

The use of diesel at the Stag Facility is necessary for the operation of various equipment (including emergency equipment) on CPF, and as the main fuel supply on vessels. Vessel presence is implicit in the operation of the facility to transfer supplies/ equipment, offload equipment and waste, perform inspection and maintenance and assist in offtake berthing and crude oil transfer. Therefore, vessels and the risk of a diesel release cannot be completely eliminated from the Operational Area. The use of diesel by support vessels is standard industry practice. Diesel is considered a more environmentally friendly fuel than heavier fuel oils which have a greater persistence in the marine environment should a spill occur.

A number of controls are in place which reduce the likelihood of spill events. No further controls have been identified that could provide a net benefit in reducing the likelihood or consequence of a diesel release to the marine environment and thus the risk and impacts are considered to have been reduced to ALARP.

On the basis of the impact and risk assessment completed, Jadestone considers the control measures described above are appropriate to manage the risk of an unplanned release of diesel to the marine environment. The residual risk ranking for this potential impact is considered Low, and therefore ALARP has been demonstrated. Additional controls considered but rejected are detailed below.				
Rejected control	Hierarchy	Practicable	Cost effective	Justification
N/a	Eliminate	N/a	N/a	The use of diesel for fuel for vessels and machinery cannot be eliminated, vessels and machinery are required for the operations and diesel is therefore required. Other energy sources are not readily available to power all equipment and vessels.
Substitute diesel for another hydrocarbon type	Substitute	No	No	The substitute for diesel is bunker fuel oil or Stag crude, both of which would have a higher environmental impact than diesel. No fuel source has been identified that is more environmentally friendly than diesel
N/a	Engineering	N/a	N/a	Machinery is designed for using diesel as the fuel oil which reduces the potential impact from an unplanned release to as low as possible. As no other hydrocarbon has been identified that is more environmentally friendly that could still fulfil the equipment requirements, no engineering controls have been identified.
N/a	Isolation	N/a	N/a	The Activity is located at distance from sensitive receptors and the coastline.
N/a	Administrative	N/a	N/a	Through the application of specific controls and procedures, and maintenance of machinery, no further administrative controls were identified.

7.6.7 Acceptability Assessment

<p>The potential impacts of an unplanned diesel release to the marine environment are considered 'Broadly Acceptable' in accordance with the Environment Regulations, based on the acceptability criteria outlined below. The control measures proposed are consistent with relevant legislation, standards and codes.</p>	
Policy compliance	Jadestone’s HSE Policy objectives are met.
Management system compliance	Section 9 demonstrates that Jadestone’s HSE Management System is capable of continuously reviewing and updating activities and practices at the Stag facility, including spill response arrangements.
Social acceptability	<p>Stakeholder consultation has been undertaken (see Section 6), including engagement with the State and National response agencies of DoT and AMSA, commercial and recreational fishing industry bodies and fishers. No concerns have been raised with regards to impacts of a diesel spill by relevant persons.</p> <p>During any spill response, a close working relationship with key regulatory bodies (e.g. DoT, DBCA, AMSA, DER) will occur and thus there will be ongoing consultation with relevant persons during response operations.</p>
Laws and standards	<p>Jadestone is obligated to respond to a hydrocarbon spill under the following legislative instruments:</p> <ul style="list-style-type: none"> • OPGGS Act Section 572A-F – polluter pays for escape of petroleum) • AMSA Marine Orders Part 91 • Protection of the Sea (Prevention of Pollution from Ships) Act 1983 • Protection of the Sea (Civil Liability for Bunker Oil Pollution Damage) Act 2008
Industry best practice	<p>Response planning and preparedness undertaken in accordance with:</p> <ul style="list-style-type: none"> • NatPlan (AMSA, 2020) • AMOSPlan (AMOSC, 2017) • NOPSEMA Guidance Notes (e.g. Oil Pollution Risk Management Guidance Note July 2021) • DoT Offshore Petroleum Industry Guidance Note, Marine Oil Pollution: Response and Consultation Arrangement July 2020 • DoT OSCP (2015) • State Hazard Plan – Maritime Environmental Emergencies (MEE), 2020) • Fingas, M.F. (2012) The Basics of Oil Spill Clean-up. CRC Press. Florida, United States of America. • ITOPF Technical Information Papers including: <ul style="list-style-type: none"> ITOPF (2014) Technical Information Paper Dispersant Use ITOPF (2020). ITOPF Members Handbook 2020/2021 ITOPF (2014) Technical Information Paper Clean-up of oil from shorelines ITOPF (2013). Technical Information Paper Use of Booms in oil pollution response · • IPIECA International Association of Oil and Gas Producers Good Practice Guide Series including: <ul style="list-style-type: none"> IPIECA-IOGP. (2015) A Guide to Oiled Shoreline Clean-up Techniques: Good practice guidelines for incident management and emergency response personnel IPIECA-IOGP (2015) Oil spill preparedness and response: an introduction IPIECA-IOGP (2015) Contingency planning for oil spills on water Good practice guidelines for the development of an effective spill response capability • Oil Spill Response (OSRL) handbooks including: <ul style="list-style-type: none"> Shoreline operations handbook Containment and recovery handbook

<p>Environmental context</p>	<ul style="list-style-type: none"> • Dispersant application field guide <p>The worst-case credible diesel spill scenario for the Stag facility operating activities is a result of a vessel collision within the Operational Area, a dropped object or a transfer pipe rupture or leak. The release of oil occurs over five hours and floating oil is not predicted to contact any shorelines. Entrained oil is predicted to contact the Montebellos, Lowendals and Barrow in the worst-case scenarios. The oil is primarily entrained and sensitive receptors at risk include seabirds, shorebirds, marine fauna and habitats including EPBC listed species, or matters protected under Part 3 and KPIs within respective protected area management plans.</p> <p>Jadestone will have regard to the representative values of the reserves and other information published and endeavor to ensure that priority is given to the social and ecological values, of any AMPs, or state marine parks impacted by a release of Stag crude.</p> <p>The 'Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species' will be applied/used as guidance in the event of an oil spill.</p>
<p>Conservation and management advice</p>	<p>Jadestone will have regard to the representative values of the reserves and other conservation advice published and endeavor to ensure that priority is given to the social and ecological objectives and values, of any AMPs, or state marine parks impacted by unplanned crude release to ensure that the objectives of the management plans are not contravened .</p> <p>Noting 'Emergency response' is permitted in all AMPs and state marine parks.</p> <p>Actions required to respond to oil pollution incidents, including environmental monitoring and remediation, in connection with activities authorized under the OPGGS Act may be conducted in all zones. The Director will be notified in the event of an oil pollution incident that occurs within, or may impact upon, an Australian Marine Park and, so far as reasonably practicable, prior to a response action being taken within a marine park.</p> <p>Protected areas within the RISK EMBA predicted to potentially be impacted by crude above threshold levels have been identified as protection priorities (Section 7.5.4).</p> <p>The 'Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species' will be applied/used as guidance in the event of an oil spill.</p> <p>A number of conservation advice, threat abatement plans and management plans identify marine pollution and/or habitat degradation or modification as a threat. The plans require appropriate mitigation measures to be implemented to prevent impacts to the fauna. These plans are listed in Table 3-5and include:</p> <ul style="list-style-type: none"> - Recovery Plan for the Grey Nurse Shark (<i>Carcharias taurus</i>) (DoE, 2014a) - Recovery plan for the White Shark (<i>Carcharodon carcharias</i>) (DSEWPaC, 2013a) - Approved Conservation Advice on <i>Pristis lavate</i> (dwarf sawfish) (DEWHA, 2009) - Sawfish and River Sharks Multispecies Recovery Plan (DoE, 2015a) - Approved Conservation Advice for <i>Pristis pristis</i> (largetooth sawfish) (DoE, 2014b) - Approved Conservation Advice for <i>Pristis zijsron</i> (green sawfish) (DEWHA, 2008c) - Approved Conservation Advice for <i>Rhincodon typus</i> (whale shark) (TSSC, 2015a) - Approved Conservation Advice for <i>Milyeringa veritas</i> (blind gudgeon) (DEWHA, 2008d) - Approved Conservation Advice for <i>Ophisternon candidum</i> (Blind Cave Eel) (DEWHA, 2008e) - Approved Conservation Advice for <i>Balaenoptera borealis</i> (sei whale) (TSSC, 2015b) - Blue Whale Conservation Management Plan 2015 - 2025 (DoE, 2015b) - Approved Conservation Advice for <i>Balaenoptera physalus</i> (fin whale) (TSSC, 2015c) - Conservation Management Plan for the Southern Right Whale 2011 – 2021 (DSEWPaC, 2012h)

	<ul style="list-style-type: none"> - Approved Conservation Advice on <i>Aipysurus apraefrontalis</i> (Short-nosed seasnake) (DSEWPaC, 2011a) - Approved Conservation Advice on <i>Aipysurus foliosquama</i> (Leaf-scaled seasnake) (DSEWPaC, 2011b) - Recovery plan for marine turtles in Australia 2017 – 2027 (DoEE, 2017) - Approved Conservation Advice on <i>Dermochelys coriacea</i> (DEWHA, 2008f) - Draft Wildlife Conservation Plan for Seabirds (CoA, 2019) - Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015) - Approved Conservation Advice for <i>Calidris canutus</i> (Red knot) (TSSC, 2016a) - Approved Conservation Advice for <i>Anous tenuirostris melanops</i> (Australian lesser noddy) (TSSC, 2015i) - Approved Conservation Advice for <i>Calidris ferruginea</i> (Curlew Sandpiper) (DoE, 2015c) - Approved Conservation Advice for <i>Calidris tenuirostris</i> (Great knot) (TSSC, 2016e) - Approved Conservation Advice for <i>Charadrius leschenaultii</i> (Greater sand - Approved Conservation Advice for <i>Charadrius mongolus</i> (Lesser sand plover) (TSSC, 2016d) - Approved Conservation Advice for <i>Limosa lapponica menzbieri</i> (Bar-tailed godwit (northern Siberian) (TSSC, 2016c) - National recovery plan for threatened albatrosses and giant petrels 2011-2016 (DSEWPaC, 2011c) - Approved Conservation Advice for <i>Numenius madagascariensis</i> (eastern curlew) (DoE, 2015d) - Approved Conservation Advice for the Abbott's booby <i>Papasula abbotti</i> (TSSC, 2020a) - Approved Conservation Advice on <i>Rostratula australis</i> (Australian painted snipe) (DSEWPaC, 2013b) - Approved Conservation Advice on <i>Sternula nereis nereis</i> (fairy tern) (TSSC, 2011) - Conservation Advice <i>Thalassarche cauta</i> Shy Albatross (TSSC, 2020b)
<p>Australian Marine Parks</p>	<p>Australian Marine Parks are established by proclamation under the <i>EPBC Act</i> for the purpose of protecting and maintaining biological diversity in the parks.</p> <p>Environment plan (EP) must be consistent with the Australian Marine Park Management plans. There are 7 AMPs within the RISK EMBAs.</p> <p>In all cases where an activity has potential to impact or present risk to AMPs, regardless of whether the activity is inside or outside a park, the EP should evaluate how these impacts and risks will be of an acceptable level and reduced to as low as reasonably practicable (ALARP).</p> <p>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. The requirement is that The Director should be notified in the event of an oil pollution incident that occurs within, or may impact upon, an Australian Marine Park and, so far as reasonably practicable, prior to a response action being taken within a marine park.</p> <p>Consultation to notify the Director of Parks when the proposed response activities is completed as part of the Consultation process (Table 4-4).</p> <p>The Director notification in the event of a spill that would impact one of the AMPs is included in the OPEP and Table 4-4.</p> <p>As such this EP is consistent with the Australian Marine Park Management plans.</p>
<p>ALARP</p>	<p>The residual risk has been demonstrated to be ALARP.</p>

8. IMPLEMENTATION STRATEGY

As required under Regulation 14(1) of the OPGGS 2009 (Environment) Regulations, Jadestone must provide an implementation strategy that will ensure:

- All environmental impacts and risks of the activity will be continually identified and reduced to a level that is ALARP;
- Control measures identified in the EP are effective in reducing the environmental impacts and risks of the activity to ALARP and acceptable levels;
- That environmental performance outcomes and environmental performance standards are met;
- Arrangements are in place to respond to, and monitor impacts of, oil pollution emergencies; and
- Stakeholder consultation is maintained through the activity as appropriate.

To meet these requirements the implementation strategy outlined in this EP includes the following:

- Details on the systems, practices and procedures to be implemented (Section 9.1);
- Key roles and responsibilities (Section 8.2);
- Training, competencies and ongoing awareness (Section 9.3);
- Monitoring, auditing, management of non-conformance and review (Sections 9.4 and 9.5);
- Incident response including Oil Pollution Emergency Plan (Section 8.5 and OPEP);
- Record keeping (Section 8.4.3); and
- Stakeholder consultation (Section 6).

Jadestone is responsible for ensuring that activities within the Operational Area are managed in accordance with the EP, the implementation strategy and the Jadestone Health, Safety and Environment Policy and Business Management System. To ensure Jadestone's environmental management standards and performance outcomes are achieved, all personnel will be required to comply with all relevant requirements of Jadestone's systems and, policies and standards.

8.1 Jadestone Business Management System

Jadestone applies an integrated Business Management System that is aligned with ISO 55001:2014 Asset Management. This covers all activities and includes provision for the systematic management of environment and safety and all other business functions. The Jadestone Business Management System ensures alignment between company objectives and the activities associated with operation of the Stag facility in a structure that is illustrated by **Figure 9-1**.

The management system sets a structured framework that provides governance across company processes for all organisational activities, with defined accountabilities and performance requirements for employees and contractors to deliver activities aligned to the vision and requirements of Jadestone Energy, including those identified in this EP.

At the highest level, environmental performance expectations are communicated by the Value Plan for the asset, and by the Jadestone HSE Policy and HSE Plan.

The structure of the management system is organised to describe the business activities by objective functions (**Figure 8-2**).



Figure 8-1: Business Management System structure

LEAD	Operational Excellence	Value Discipline	People	Stakeholder Management	Risk Management
CORE	Explore	Drill	Develop	Produce	Abandon
HELP	Provide Commercial Guidance	Provide Information	Provide Goods & Services	Provide Customers	Provide Technical Guidance

Figure 8-2: Business activities and objective functions

The objective functions are organised into ‘Lead’, ‘Core’ and ‘Help’, which describe how the intent of the business is delivered. The Lead functions are the activities that provide direction to the Core functions, which represent the life cycle of oil and gas activities. The purpose of the Lead functions is to enact and inform strategy and to guide the Core functions in the delivery of their activities.

Delivery of HSE management and performance is fully integrated (including implementation of the EP) throughout the objective functions relevant to operation of the Stag facility. The relevant functions are:

- Operational excellence;
- Value discipline;

- People;
- Stakeholder management;
- Risk management;
- Develop;
- Produce; and
- Provide goods and services.

Below is a summary of the mechanisms by which these functional areas contribute to HSE management and performance at the Stag facility.

8.1.1 Operational Excellence

‘Operational Excellence’ provides the systems, tools and processes which ensure that all learning experiences that have the potential to improve operational safety, integrity and efficiency, and reduce negative impacts to the environment, to be captured, evaluated and disseminated for future implementation.

The Operational Excellence function is a continuous process and is summarised in **Figure 9-3**.

The Operational Excellence function addresses the key points of:

- Capturing of lessons learnt;
- Review of lessons learnt; and
- Incorporation of knowledge in future work.

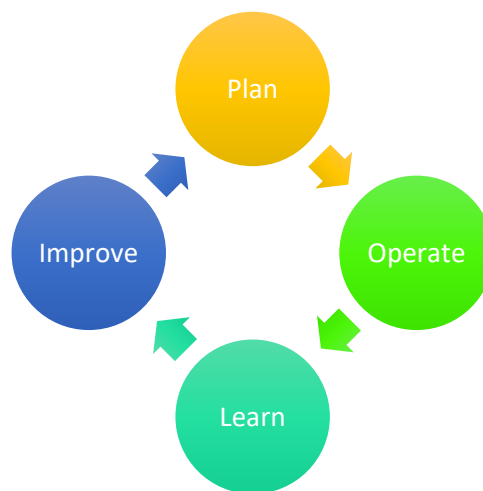


Figure 8-3: Operational excellence business function

Knowledge and best practices can be captured from many sources including internal and external, such as:

- Audits and inspections;
- Emergency response drills;
- Incident reviews;
- Technical papers, legislation and journals; and
- Prior experience.

Processes, procedures and systems are improved based on the historical lessons learnt and applied in subsequent phases. Any actions arising from the assessment of information are incorporated into BASSnet.

8.1.2 Value Discipline

The 'Value discipline' function represents the processes – including annual budgeting, capital funding – that ensure value and capital requirements are met and support the management system functions delivering their business objectives including HSE performance. Commonly HSE performance is a proxy for business performance and therefore HSE management is of interest to the Value discipline function of the management system.

8.1.3 People

The Jadestone Energy Competency Assurance Framework provides the formal systems, tools and processes which ensure that personnel are appropriately trained and competent to complete assigned tasks to an expected standard. Competency assurance is a necessary component of any approach to reduce safety, integrity and environmental risks to a level that is ALARP.

The Competency Assurance Framework addresses the key points of:

- Competency requirements (qualification, experience and training) are maintained for all Jadestone Energy positions where the incumbent is required to undertake, supervise, review or verify critical tasks or where the incumbent has the technical authority to approve critical documents;
- Competent persons are members of the workforce who meet the competency requirements for the respective positions to perform critical tasks without direct supervision;
- Candidates being considered for appointment in a critical position are assessed against the applicable competency requirements before being formally appointed;
- Incumbents must be reassessed against the competency requirements as per the required frequency stipulated in the competency matrix; and
- All contractors with personnel in the field are prequalified in accordance with the Contractor Management Framework.

Jadestone Energy personnel are subject to the provisions of the Jadestone Competency Assurance Framework which outlines the training, development and assessment requirements necessary to ensure that all employees have the relevant knowledge and skills required to conduct their activities in a safe and environmentally responsible manner.

A training and skills matrix has been developed for all positions which identifies responsibilities, training and competency requirements. Personnel will complete relevant training and hold qualifications and certificates for their specific role (e.g. well control certificates, rigging and crane operator certificates etc.). Training records will be retained.

8.1.4 Stakeholder Management

Sub regulation 11A (3) of the Environment Regulations provides that:

The Implementation strategy of the environment plan must provide for appropriate consultation with:

- a) *Relevant authorities of the Commonwealth, a State or Territory; and*
- b) *Other relevant interested persons or organisations*

Ongoing consultation activities build upon Jadestone's consultation for the Stag EP as detailed in Section 4 outlines the processes that will be followed to ensure a standard approach to interacting with relevant persons during the life of the EP, including revision of relevant persons' list and process for dealing with feedback during this period. Risk Management

Jadestone has an integrated approach to risk management to cover all its business activities.

The Risk Management function provides a view of risk that is independent of production delivery. This includes strategic, commercial, and control and compliance risks. In addition, it manages Health Safety and Environment activities, including the preparation and approval of regulatory approvals (including this EP) and the management of change process, which addresses all change activities regardless of type – technical, organisational, software or procedural. Further information on the management of change process is provided in **Section 9.4.2**.

At the activity level, the risk management function includes all the planned activities and accidental events. Risk identification and assessment is a continuous process that identifies all the physical control measures necessary to manage the risks. Control measures are subjected to regular assurance activities. In a similar way, audits of the management system are conducted according to review cycle with timing agreed in the annual planning process. Findings from assurance activities, audits and ongoing review of performance are considered in the Operational Excellence process, which considers opportunities for continuous improvement (refer **Section 8.1.1**).

The Risk Management function is accountable for approval of facility level risk assessments and risk reduction measures; and by so doing, providing a view of risk that is independent from production delivery.

8.1.5 Produce

The Produce function delivers safe and reliable operations as well as environmental performance.

The Produce function works closely with the Operational Excellence and Risk Management functions to evaluate operational performance, including environmental performance, and reduce risk through delivery of continuous improvement activities. Produce is responsible for asset optimisation, reliability, integrity and maintaining compliance. It thus interacts with most functions.

The Produce function delivers environmental management at the activity level via the Computerised Maintenance Management System (CMMS) including detailed work instructions and tasks allowing the activity to meet the environmental performance requirements of this EP. These instructions and tasks are monitored and reviewed to ensure appropriate close out of tasks is achieved as well as ensuring the required outcomes/ performance have been achieved.

8.1.6 Provide Goods and Services

HSE performance in all activities associated with operation of the Stag Facility is achieved either through management of personnel involved, or via management of contracted works.

The Jadestone Competency Management Framework provides personnel with a systematic and uniform approach for managing and improving Health, Safety and Environmental (HSE) performance throughout the life cycle of an individual's appointment, from their selection through to post-completion performance evaluation. The Personnel Management Framework addresses the key points of selection, competency, development requirements and management.

HSE performance is also achieved through Jadestone's Contractor Management Framework. The contract management life-cycle follows four steps: pre-qualification; selection; engagement; and contract completion review process. Through each of these steps Jadestone and service provider/ supplier is evaluated for previous HSE performance and engaged in the mechanisms by which HSE performance will be achieved in the contract to be established.

8.2 Key Roles and Responsibilities

As per Regulations 14(4) and 14(5), a clear chain of command setting out the roles and responsibilities of personnel involved in operation of the Stag Facility, is required as well as detail on what measures are in

place to ensure personnel are aware of their role requirements and how Jadestone evaluates their competency and training needs in these roles. In response to these regulatory requirements, provided in this sub-section is information on:

- Section 8.2.1: Organisational Chart: outlines the key roles involved in operation of the Stag facility;
- Section 8.2.1: Role responsibilities: summarises the responsibilities of each key role involved in operation of Stag facility;
- Section 8.2.2: Communication requirements: outlines how personnel fulfilling key roles are made aware of their responsibilities as described in the EP; and
- Section 8.2.3: Assessment of Competency and Training: outlines how Jadestone assesses and evaluate the competencies and training requirements of personnel responsible for achieving the commitments with this EP.

8.2.1 Organisational Structure and Responsibilities

The Stag Facility is governed by the hierarchy of positions on the CPF. The organisational structure is presented in **Figure 8-4**. Organisation charts showing the reporting relationships including the hierarchy for safety responsibility will be maintained.

Each position has a position description outlining their HSE role and responsibilities, accountabilities and reporting lines (**Table 8-1**). It is the responsibility of all Jadestone personnel to ensure that the requirements of the HSE Policy are applied in their area of responsibility and that personnel are suitably trained and competent in their respective roles. Mandatory training requirements are mapped out in a competency matrix. Further information is provided in the Competency and Training Management System [JS-60-PR-Q-00015].

It is the responsibility of all Jadestone personnel to ensure that they have read and understood the requirements of the HSE Policy. All personnel are suitably trained and competent in their respective roles.

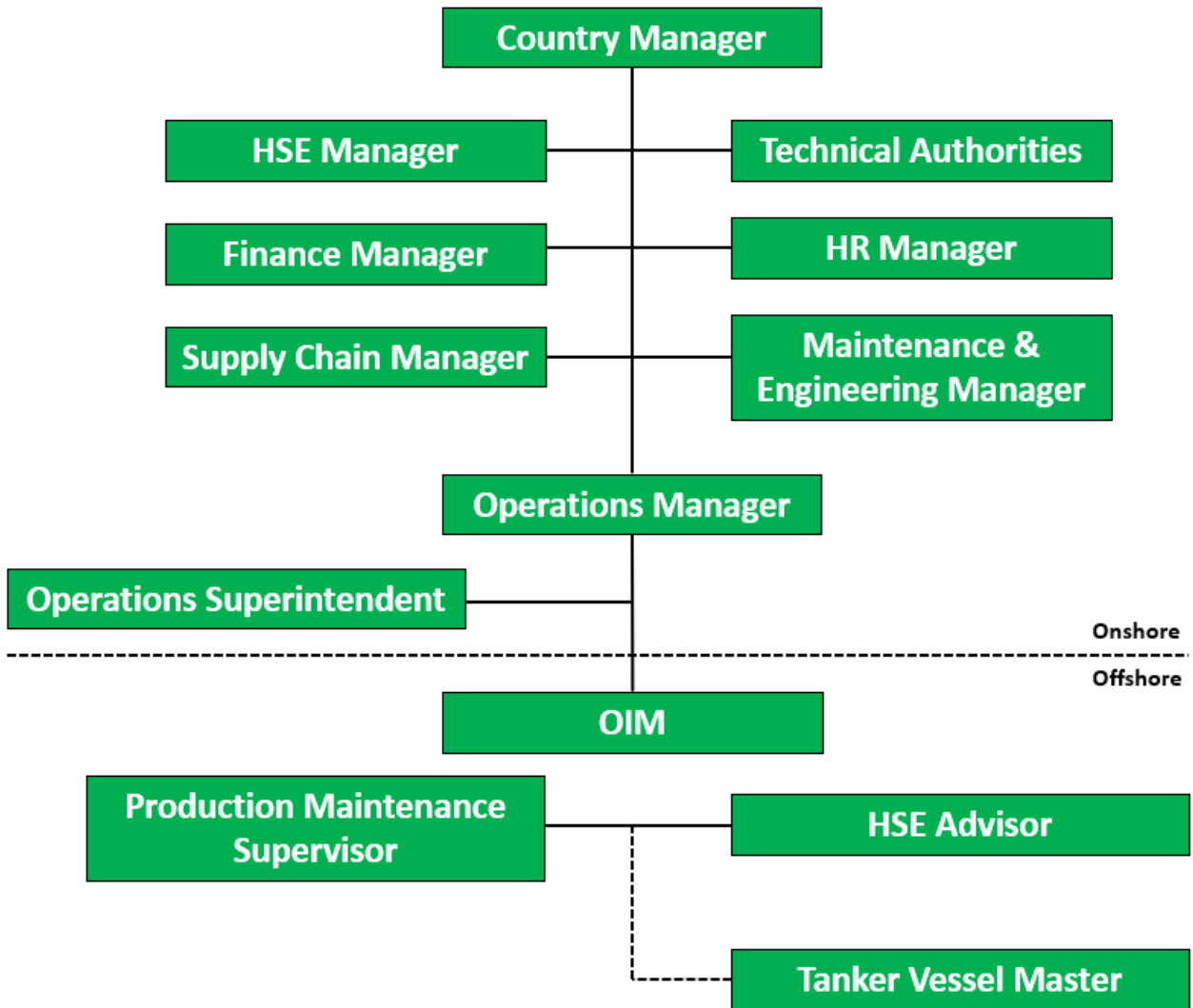


Figure 8-4: Stag Operations Organisation Chart

Table 8-1: Responsibilities of Key Roles

Role	Key Responsibilities
Country Manager	<p>Ensures that activities are conducted in accordance with the Jadestone’s HSE Policy.</p> <p>Primary responsibility for Jadestone Australia operations and for meeting or exceeding corporate targets for all aspects of performance, including conducting activities in accordance with Jadestone’s HSE Policy and this Environment Plan.</p> <p>Responsible for providing adequate resources for environmental management.</p> <p>Accountable for Operational Excellence.</p> <p>Ensures the incident response strategy is implemented in the case of an incident.</p> <p>Responsible for compliance with the BMS.</p> <p>Maintains communication with company personnel, government agencies and the media, where appropriate.</p>
Operations Manager	<p>Primary responsibility for offshore operations and for meeting environmental performance and compliance requirements, including provision of adequate operations resources for delivery of EP commitments.</p> <p>Liaises with regulatory authorities as required.</p> <p>Responsible for ensuring that audits and reviews of the Environment Plan are conducted.</p>
Maintenance & Engineering Manager	<p>Responsible for coordinating all maintenance and integrity works and maintaining the technical integrity of the Stag Facility.</p> <p>Manage HSE hazards and risks related to maintenance activities by ensuring procedures and risk reduction processes have been employed for all activities under their control.</p> <p>Ensure that regular planned maintenance is carried out to meet the requirements embodied within the Computerised Maintenance Management System (CMMS).</p> <p>Ensures maintenance personnel are competent in their respective tasks.</p>
Supply Chain Manager	<p>Overall responsibility for implementation of the contractor management framework, including communication of EP requirements to contractors at the appropriate stages of contract management cycle.</p>
Offshore Installation Manager (OIM)	<p>Responsible for day to day operations on the Stag Facility.</p> <p>Ensures completion of routine performance reporting for the Stag Facility.</p> <p>Responsibility for the implementation and compliance with the requirements of the Environment Plan and the Jadestone's HSE Policy at the facility.</p> <p>Ensures that risk management processes are employed to manage HSE hazards and risks at the facility.</p> <p>Communicates the importance of appropriate levels of training, competency and environmental awareness to all personnel.</p> <p>Ensures the importance of appropriate levels of training, competency and environmental awareness are communicated to facility personnel and that the training matrix is fully implemented.</p> <p>Ensures all personnel undertake appropriate Stag inductions and are aware of their HSE responsibilities.</p> <p>Ensures sufficient resources are made available for offshore environmental management to meet the requirements of the Environment Plan.</p> <p>Ensures all relevant HSE incidents are reported in accordance with internal incident reporting and investigation procedures.</p>

Role	Key Responsibilities
	<p>Conducts regular workplace inspections.</p> <p>Implements corrective and preventative actions arising environmental inspections, audits, incidents and hazard reports.</p> <p>Overall responsibility for HSE and emergency response management at the Facility.</p> <p>Ensure that adequate skills are maintained for effective incident response.</p> <p>Ensure regular drills and exercises are conducted and all personnel actively participate.</p> <p>Ensure Facility HSE meetings are conducted as required by the BMS.</p> <p>Communicates HSE hazards and risks to the workforce and the importance of following good work practices.</p>
Production Maintenance Supervisor (PMS)	<p>Manage HSE hazards and risks related to maintenance activities by ensuring procedures and risk reduction processes have been employed for all activities under their control.</p> <p>Authorises work permits in accordance with BMS and PTW procedures.</p> <p>Ensures persons appointed to roles in PTW have undergone the required training.</p> <p>Identify risks associated with maintenance tasks and ensure control measures are established and implemented.</p> <p>During an incident forms part of the Incident Response Team.</p>
HSE Manager	<p>Ensures review of daily, weekly and monthly reporting, as applicable, from the CPF, third-party tanker and support vessels.</p> <p>Ensures environmental department liaison with the OIM and third-party tanker operator to deliver compliance with all aspects of this EP.</p> <p>Plans and schedules environmental compliance assurance activities (including audits) of the CPF, third-party tanker and support vessels.</p> <p>Ensures regulatory documents are prepared and meet regulatory requirements.</p> <p>Ensures emergency response plans are in place.</p> <p>Develops and participates in oil spill response activities.</p> <p>Ensures reporting of all relevant environmental incidents to NOPSEMA within the required timeframes.</p> <p>Ensure environmental incident reporting meets regulatory requirements (as outlined in the EP) and AEL's internal incident reporting and investigation procedure.</p> <p>Ensures that proposed changes to environmental management activities are subject to Management of Change and approved prior to application.</p>
HSE Advisor	<p>Works with the HSE Manager and OIM to support environmental management and delivery of EP commitments.</p> <p>Contributes to inspections, audits and reviews of the Environment Plan.</p>
Tanker Operator	<p>Ensures completion of daily and monthly reporting from the third-party tanker.</p> <p>Monitors daily activities on the third-party tanker to ensure that the relevant environmental legislative requirements, EP commitments and operational procedures are being followed.</p> <p>Reports all incidents and potential hazards to the OIM to ensure required reporting timeframes are achieved.</p> <p>Ensures the importance of appropriate levels of training, competency and environmental awareness are communicated amongst third-party tanker personnel.</p> <p>Implements corrective and preventative actions arising environmental audits, incidents and hazard reports.</p>

Role	Key Responsibilities
	<p>Communicates hazards and risks to the workforce and the importance of following good work practices.</p> <p>Ensures third-party tanker personnel comply with environmental requirements.</p> <p>Monitors the performance of the third-party tanker maintenance management system.</p> <p>Conducts regular workplace inspections.</p> <p>Maintains their vessel in a state of preparedness for emergency response.</p> <p>Reports environmental incidents to OIM and ensures follow-up actions are carried out.</p>
<p>Facility personnel and contractors</p>	<p>Adhere to work systems and procedures defined for the activities being undertaken.</p> <p>Follow good housekeeping work practices.</p> <p>Report HSE incidents, hazards or non-conformances to supervisors in a timely manner.</p> <p>Identify HSE improvement opportunities wherever possible.</p>

8.2.2 Communication of Responsibilities

The primary mechanism for ensuring personnel involved in the operation of the Stag facility are aware of the environmental commitments as listed in this EP are via: provision of environmental performance commitments lists via the CMMS; management of service providers and suppliers (refer to **Section 9.2.4** below); and online induction prior to attending the Stag facility.

Summary lists of environmental performance commitments as required by this EP are provided directly to key roles (refer **Section 9.2.2**) involved in activities associated with operation of the Stag Facility via the CMMS.

All personnel working at the Stag facility (including the third-party tanker) are required to complete an online induction that contains environmental components prior to arrival at the facility. Inductions are updated to account for site-specific factors or activities, or EP management improvements. Induction attendance records for all personnel are maintained. At a minimum, inductions include:

- The Jadestone HSE Policy;
- Description of the environmental sensitivities within the operational area and surrounding waters;
- Identification of environmental risks and mitigation measures;
- Permit to work;
- Procedures for reporting of any environmental incidents or hazards;
- Waste management requirements;
- Overview of incident response and spill management procedures, including roles and responsibilities;
- Roles and environmental responsibilities of key personnel aboard the survey vessel; and
- Direction on where to find copies of the EP and OPEP.

8.2.3 Competencies and Training

Jadestone Energy’s Contractor Management Framework [JS-90-PR-G-00002] provides a process for ensuring that Contractors and Services Providers have the appropriate level of HSE capability. The assessment of Contractors and Service Providers competency provides a sound level of assurance that all key third-party personnel involved in Stag operations have the necessary skills, knowledge, experience, and ability to perform their work in accordance with their company’s training and competency systems.

Contractors and service personnel are assessed against their company’s criteria and any additional criteria required by Jadestone Energy. Records of competent people are maintained in BASSnet.

Competencies and training arrangements for personnel involved in oil pollution response are detailed in the OPEP and records maintained in BASSnet.

8.3 Monitoring, Auditing, Management of Non-conformance and Review

As required under sub regulation 14(6), Jadestone must provide for sufficient monitoring, recording, audits, management of non-conformance and review of Jadestone's environmental performance and implementation strategy to ensure that environmental performance outcomes and standards in the EP are being met and continue to minimise impacts to the environment.

Environmental performance outcomes and standards as well as management controls as detailed in this EP (**Sections 7 and 8** and the **OPEP**) are monitored and recorded as described. Ongoing monitoring activities to determine if environmental commitments as required in this EP are being met include the CMMS, inspection program, auditing and exercising of response arrangements. In particular, routine commitments in the EP have been loaded into the CMMS that directs work activities for onshore and offshore personnel. Work activities include review of monitoring checklists, audits, inspections, maintenance and continuous improvement reviews, allowing environmental performance of the activity to be monitored. Non-conformances of EP commitments are reported, tracked and closed-out in accordance with **Section 8.3.2**.

The collection of data from environmental performance monitoring activities forms the basis of demonstration that the commitments as listed are being met, that specified mitigation measures are in place to manage environmental risks, and that they remain working, and contribute to continually reducing risks and impacts to ALARP and acceptable levels.

8.3.1 Routine Monitoring

The purpose of monitoring and inspections is to record performance data and routinely check conformance with environmental performance standards and achievement of environmental performance outcomes defined by the EP. Routine inspection activities are scheduled and records kept in a format and for a period that meets the regulatory requirements.

Emissions and discharges to the environment as a result of operations are monitored to assess the environmental performance of the Stag facility on an ongoing basis. **Table 8-2** details the quantitative records that are maintained for all emissions and discharges during routine or emergencies within the Operational Area as per Regulation 14(7) of the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009*.

Table 8-2: Summary of routine monitoring of emissions, discharge and waste

Measurement	Frequency	Monitoring Strategy	Record
CPF produced water [OIW] (in mg/L)	A minimum of 2 samples analysed every 24h for [OIW]	Manual sampling as outlined within <i>Measurement, management and reporting of produced water</i> (GA-19-PR-P-00006)	BASSnet Stag Laboratory Routine Analysis Data Sheet
CPF continuous OIW monitor calibration	Every 3 months	CPF continuous OIW monitor is calibrated every 3 months	Calibration report
CPF spectrophotometer calibration and OIW standards	Biannual	Independent chemist calibrates CPF spectrophotometer OIW measurement annually and checks OIW standards used during manual analysis as outlined in <i>Measurement, management and reporting of produced water</i> (GA-19-PR-P-00006)	Independent laboratory report
Characterisation of CPF PW finds contaminant concentrations (inc. NORM) meet 99% species protection concentration after applying a dilution rate of 1:332	Biannual	Independent chemist samples produced water which is analysed by an independent laboratory for a detailed range of parameters.	Independent laboratory report
Volume of chemical used	Monthly	Volumes used determined from change in inventory	Monthly report
Production chemical concentration within production equipment	Monthly	Routine analysis of chemical concentrations within process equipment determines correct dosage of chemicals	Stag Laboratory Daily Result Sheet
Quantity (kms ³) Gas emissions	Continuous	Metering on the Stag CPF	P2 Greenhouse Gas reporting Stag CPF daily report
GHG and pollutant emissions	Continuous	Calculated from fuel use, flaring	P2 Greenhouse Gas reporting (NGER) Stag CPF daily report

Measurement	Frequency	Monitoring Strategy	Record
Oily water	Intermittently – discharge events recorded as they occur	Discharges determined from oil record book (or equivalent)	Oil record book
Garbage (food scraps)	Intermittently – discharge events recorded as they occur	Discharges determined from garbage record book (or equivalent)	Garbage record book
Sewage	Intermittently – discharge events recorded as they occur	Discharges determined from sewage record book (or equivalent)	Sewage record book
Unplanned discharges of solid objects, hazardous liquids or hydrocarbons	In the event of an incident	Incident only	Incident log
Volumes of the following waste types are recorded: General and putrescible waste Hazardous waste Timber/ wood Recyclables Cardboard/ paper Scrap metal Metal drums & containers Batteries (lead acid) Plastic drums and containers	Logged on Stag Facility when transferred via vessel to shore then to licensed waste facility. This is done approximately every two to four weeks (supply run).	CPF manifests Waste disposal log	Monthly waste reports generated from service provider (tied to invoicing) Waste Record Log Annual EP compliance report

8.3.2 Audits

An audit is a systematic examination and evaluation against defined criteria and performance indicators to determine whether activities/ processes and related results conform to planned arrangements, whether these arrangements are implemented effectively, and if they are suitable to achieve Jadestone’s performance outcomes and requirements.

- Environmental audits provide assurance that the systems and processes in place to deliver the EP (i.e. the implementation strategy) are suitable and effective. The Jadestone Audit Manual (JS-90-PR-G-00003) describes the planning and conduct of audit activities. External parties may be invited to participate as team members on audits.

The annual review process for Jadestone occurs in the third quarter of the calendar year with the outcome being preparation of an Annual Plan (Jadestone Planning Procedure JS-90-PR-G-00205). An important component of the Annual Plan is the audit program. As stated in the Audit Manual (JS-90-PR-G-00003), Jadestone’s Annual Plan and audit program, including frequency and scope of audits, are developed to reflect the risk profile of Jadestone’s activities for the forecasted period. As well as regular, planned audits of the management system including assessment of compliance against Environmental Performance Outcomes and Standards, extraordinary audits undertaken by the Country Manager and reactive audits (e.g. triggered by incidents or non-conformances) may also be added to the audit program in place at the time. Checklist templates (i.e. scopes) for environmental audits that may be undertaken are provided in the Audit Manual (JS-90-PR-G-00003), including for quality (in line with ISO 9001:2015 requirements) and the environmental management system (in line with ISO 14001:2015 requirements) which makes provision for deeper dives on the EP.

Along with monitoring, records, inspections and management of non-conformance, audit results are a key input to the quarterly review of environmental performance which considers the overall effectiveness of the EP implementation strategy / BMS (**Section 9.4.1**).

An outline of Jadestone’s auditing schedule is provided in **Table 9-5**.

Table 8-3: Annual audit schedule

Type	Scope	Minimum per year
Planned	Compliance with EPOs and EPSs	Two
	Drill down on close-out of corrective actions and/or areas of compliance focus (e.g. produced water, oil spill response)	Two
	Contractor management	One
	Independent audit by third-party (Independent Competent Person, ICP)	One
Reactive	As determined by performance / non-compliances identified during internal/ external inspections, reviews, audits and incident investigations	Two

Quarterly reviews of Jadestone’s performance, including environmental performance are undertaken allowing continuous improvement to be achieved (Knowledge Management Guidelines GA-90-PR-G-00006). Part of the quarterly review process will include review of the audit program and the findings generated during the review period.

8.3.3 Non-compliances and Corrective Actions

Non-conformances from audits, inspections, regular monitoring or response testing are communicated immediately to the OIM and tracked and monitored by the Country Manager until closed.

Opportunities for improvement and corrective actions from reviews, audits, inspections, monitoring and testing activities are documented and tracked to closure.

8.3.4 Reporting

Table 8-4 details the approach to routine environmental performance reporting to the Regulator. Reporting activities relating to reportable and recordable incidents will be as per Regulations 26, 26A, 26AA and 26B.

8.4 Continuous Improvement (Operational Excellence)

8.4.1 Review of environmental performance

The owner of the Operational Excellence business function, with input from other business functions with responsibilities relating to the EP (e.g. operations, maintenance, supply chain), conducts an annual review of environmental performance and the effectiveness of the EP implementation strategy (i.e. BMS). This includes a review of the effectiveness of control measures in reducing impacts and risks to ALARP and acceptable levels, and may result in improvements being identified, evaluated and implemented.

The annual review process occurs in the third quarter of the calendar year with the preparation of an Annual Plan, as per Jadestone's Planning Procedure (JS-90-PR-G-00205). Once the Annual Plan has been established, quarterly reviews allowing continuous improvement to be achieved are undertaken as instructed by the Knowledge Management Guidelines (GA-90-PR-G-00006).

Outcomes of the Annual Performance Review are recorded and contribute to the EP Annual Performance Report (**Section 10.1**).

The review of environmental performance includes an assessment of:

- Review of compliance with environmental performance outcomes and performance standards, and adequacy of measurement criteria;
- Function of environmental management controls relevant to reportable and/or recordable incidents;
- Monitoring data and trends;
- Results of audits and incident investigations;
- Inspection and checklist approaches; and
- Adequacy of monitoring, inspections and audits.

The Annual Review is also an opportunity to ensure new information is incorporated into the EP and will consider the following:

- Existing information in relation to any component of the receiving environment described in this EP including, but not limited to, biologically important areas, KEFs, and threatened species;
- Available scientific literature;
- New issues raised by stakeholders;
- Relevance of existing and identification of new stakeholders; and
- Australian Marine Park status (including any changes in status) and relevant IUCN principles.

The results of the review and any identified improvements or recommendations will be incorporated into processes and procedures used to operate the Stag facility, or the EP, to facilitate continuous improvement in environmental performance.

In the event that new information (audits, inspections, reviews etc.) suggests risks and impacts are no longer reduced to acceptable levels, or controls are no longer effective in reducing the risks and impacts to ALARP and acceptable levels, then the process for identification of further controls through a risk assessment will follow that of the risk assessment methodology for this EP (refer **Section 4**).

Any opportunities for improvements identified through the risk assessment (i.e. new controls adopted) will be evaluated via a Management of Change process prior to the EP, procedures or processes being modified (**Section 9.5.6**).

Table 8-4: Summary of reporting requirements

Regulation	Requirement	Required Information	Timing	Type	Recipient
Before the Activity					
Regulation 29(1) & 30 - Notifications	NOPSEMA must be notified that the Activity is to commence.	Complete NOPSEMA’s Regulation 29 Start or End of Activity Notification form for both notifications.	At least 10 days before the Activity commences	Written	NOPSEMA
During the Activity					
Regulation 16(c), 26 & 26A – Reportable Incident	<p>NOPSEMA must be notified of any reportable incidents</p> <p>For the purposes of Regulation 16(c), a reportable incident is defined as:</p> <ul style="list-style-type: none"> An incident relating to the Activity that has caused, or has the potential to cause, moderate to significant environmental damage Types of reportable incidents are described in Table 10-1. 	<p>The oral notification must contain:</p> <ul style="list-style-type: none"> 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 an adverse environmental impact due to the reportable incident; and 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, <u>or</u> if the incident was not detected at the time of the first occurrence, at the time of becoming aware of the reportable incident	Verbal	NOPSEMA
		A written record of the verbal notification must be submitted. The written record is not required to include anything that was not included in the verbal notification	As soon as practicable after the verbal notification	Written	NOPSEMA
		<p>A written report must contain:</p> <ul style="list-style-type: none"> 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 adverse environmental impact due to the reportable incident; The corrective action that has been taken, or is proposed to be taken, to stop, control or remedy the reportable incident; and The action that has been taken, or is proposed to be taken, to prevent a similar incident occurring in the future. 	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.	Written	NOPSEMA

Regulation	Requirement	Required Information	Timing	Type	Recipient
Regulation 26B – Recordable Incidents	NOPSEMA must be notified of a breach of an EPO or EPS, in the environment plan that applies to the Activity that is not a reportable incident	Complete NOPSEMA’s Recordable Environmental Incident Monthly Report form via submissions@nopsema.gov.au	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. If no recordable environmental incidents have occurred during a particular month, a Nil Incident report must be submitted	Written	NOPSEMA
Regulation 14(2) Regulation 26C Environmental Performance	Regulation 14(2) requires that <i>“the titleholder report to the Regulator in relation to the titleholder’s environmental performance for the activity and provide that the interval between reports will not be more than one (1) year”</i> . This is known as the Annual Report. Regulation 26(C) requires <i>“a titleholder undertaking an activity must submit a report to the Regulator in relation to the titleholder’s environmental performance for the activity, at intervals provided for in the environment plan.”</i>	Annual reports will contain sufficient information to determine whether or not environmental performance outcomes and standards in the EP have been met. At a minimum, reports shall include: <ul style="list-style-type: none"> • An overview of the operations and activities undertaken at the Facility; • Summary of environmental incidents (recordable and reportable); • Summary of any Management of Change (MOC), if applicable; • Summary of audits; • An assessment of adherence to requirements of the EP, including the EPO and EPS; • Environmental performance (adequacy of environmental management tools against number of reportable and/or recordable incidents); • Continued relevance of performance objectives and performance standards; • Monitoring data and trends; • Any additional consultation required; 	The annual reporting period for the activity is 12 June to 11 June. Jadestone will submit annual performance reports within 3-months of the end of the reporting period.	Written	NOPSEMA

Regulation	Requirement	Required Information	Timing	Type	Recipient
		<ul style="list-style-type: none"> Lessons learnt. <p>The annual report shall be submitted to satisfy the requirement of Regulation 26 (C).</p>			
End of Activity					
Regulation 29(2) – Notifications	NOPSEMA must be notified that the Activity is completed	Complete NOPSEMA’s Regulation 29 Start or End of Activity Notification form for both notifications	Within 10 days after finishing	Written	NOPSEMA
Regulation 14 (2) & 26C – Environmental Performance	NOPSEMA must be notified of the environmental performance of the Activity	Report must contain sufficient information to determine whether or not environmental performance outcomes and standards in the EP have been met	Annual report submitted within 3 months after the anniversary of the reporting period, with the period commencing on the dated Regulation 29 notification form	Written	NOPSEMA
Regulation 25A Plan ends when titleholder notifies completion	NOPSEMA must be notified that the Activity has ended and all EP obligations have been completed	Notification advising NOPSEMA of end of the Activity	Within six months of the final Regulation 29 (2) notification	Written	NOPSEMA

8.4.2 Management of Change and Revisions of the Environment Plan

Regulation 17 of the *Offshore Petroleum Greenhouse Gas Storage (Environment) Regulations 2009* makes clear the following requirements in respect of a number of circumstances that may lead to the deviation of an activity from the EP, or a new activity requiring an EP.

17 Revision because of a change, or proposed change, of circumstances or operations	
<i>New activity</i>	
17(1)	A titleholder may, with the Regulator’s approval, submit to the Regulator a proposed revision of an environment plan before the commencement of a new activity.
<i>Significant modification or new stage of an activity</i>	
17(5)	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.
<i>New or increased environmental impact or risk</i>	
17(6)	A titleholder must submit a proposed revision of the environment plan for an activity before, or as soon as practicable after:
(a)	The occurrence of any significant new environmental impact or risk, or significant increase in an existing environmental impact or risk, not provided for in the environment plan in force for an activity; or
(b)	The occurrence of a series of new environmental impacts or risks, or a series of increases in existing environmental impacts or risks, which, taken together, amount to the occurrence of:
(i)	A significant new environmental impact or risk; or
(ii)	A significant increase in an existing environmental impact or risk;
	That is not provided for in the environment in force for the activity.

Jadestone’s Management of Change process will determine whether a proposed change to activities triggers the requirements of Regulation 17, which may result in a revision and resubmission of an EP to NOPSEMA. This process is described in the Jadestone’s Management of Change Procedure (MoC) [JS-90-PR-G-00017]. The procedure describes a system for identifying, tracking, responding, progressing and closing out change requests or queries raised by any party involved in Jadestone Energy activities.

The Change Management Procedure also directs and instructs activity owners on external drivers of change including environmental regulatory and stakeholder requirements, including (but not limited to):

- Changes to legislation;
- Provision of new or now relevant technical/ scientific information;
- Changes in the management arrangements/ plans for protected areas or species; or
- Receipt of new information from relevant persons relating to a proposed or existing activity.

The Change Management procedure provides for proper consideration of temporary or permanent changes to activities, including an impact and risk assessment, approved and communicated to all appropriate stakeholders together with providing a record of the change. In particular, the system ensures the following:

- All changes required to critical outputs will be identified, recorded, risk assessed and approved – internally and externally as required – before being implemented;

- Processes and procedures are in place to ensure requirements for change are identified and unauthorised changes are prevented;
- All changes must be assessed to determine if the change introduces a new risk or impact or increases an existing impact or risk, as required by Regulation 17;
- The MoC is prepared internally by Jadestone personnel which includes consultation with relevant parties as necessary such as technical/ subject matter experts and external stakeholders as required;
- Only authorised and competent members of the workforce can approve changes, including relevant Technical Authorities. Technical Authorities are deemed as authorised and competent via the Technical Authority Framework (JS-60-STD-Q-00001);
- Approval of a change internal to Jadestone requires confirmation that impacts and risks have been assessed and appropriate reduction measures implemented (if required) to manage risk to ALARP and impacts to acceptable levels;
- All approved changes that affect the Environment Plan are properly documented and communicated to all relevant internal and external members of the workforce, e.g. via toolbox talk or HSE meetings and JSA; and
- An audit trail is kept of all changes and documents and drawing are updated accordingly.

MOC must be designed to meet the particular requirements of the type of change required and will include:

- Risk assessment to assess potential impacts to the receiving environment as detailed in this EP, including matters of NES and those protected under the EPBC Act;
- Strategies and actions to mitigate any adverse effects; identify opportunities offered by the change; and determine how impacted interfaces shall be managed;
- Timeframes for implementation;
- Documents (e.g. drawing, plan, program, procedure) against which change is monitored;
- Outline drawings or controlled documents affected; and
- Responsibilities for execution, review and approval of the:

Justification for the change,

Assessment of the impact and risk to environment,

Detailed implementation requirements,

Dissemination of the change, training personnel and updating of documentation.

All alterations and updates to controlled documents, including regulatory approvals, procedures or drawings must be in accordance with Document Control requirements. If the change meets any of the criteria detailed above, a revision/resubmission of the EP will occur, and the proposed change to the activity will not commence until the revised EP has been accepted by NOPSEMA.

Maintenance work, which covers the replacement of parts or equipment with identical (or equivalent specification) parts or equipment, and with no change to operating arrangements, is not subject to change control.

8.4.3 Record Keeping

This section of the EP meets Regulation 27(2) by detailing a systematic, auditable record of the results of monitoring and auditing of the environmental performance of the Stag Operations. The records retained are

linked to the performance outcomes, standards and measurement criteria, and monitoring and reporting requirements.

As a minimum, Jadestone will store and maintain the records for five years, where records include:

- Written reports including monitoring, audit and review regarding environmental performance or the business management system;
- Environmental performance reports and associated documentation;
- Documentation generated through stakeholder consultation;
- Records of emissions and discharges;
- Records of calibration and maintenance; and
- Reportable and recordable incident reports.

8.5 Emergency Preparedness and Response

Under the Environment Regulations 14(8) the Implementation Strategy must contain an oil pollution emergency plan and provide for the updating of the plan containing adequate arrangements for responding to and monitoring oil pollution. These details are contained within the OPEP which is part of this EP and details incident response arrangements in the event of an oil spill and should be referred to for all details.

Emergency response procedures and manuals are in place to describe how controls and consequences are mitigated. These documents are available on the Stag facility, vessels and are made accessible to all personnel. The relevant incident response procedures and manuals are detailed in the OPEP.

The Stag Incident Response Plan (GF-00-PR-F-00041), Incident Management Team Response Plan (JS-70-PLN-F-00008) and associated manuals are regularly updated with the revised contact details of relevant organisations and individuals included. They are also frequently tested to determine where they can be improved. The Incident Management Team Response Plan (IMTRP) sets out the structure, organisation and activation, or trigger processes for responding to an incident as well as detailing the schedule for exercising and testing the major hazard incidents and OPEP response and preparedness. The IMTRP also includes as an appendix the Oil Spill Response Arrangements (OSRA). The OSRA sets out the initial actions, notifications and responses once the IMT has triggered an oil spill response.

The Incident Management Exercise & Testing Program (JS-70-PR-F-00001) provides more information on planning and testing cycles. As a minimum, Jadestone conducts quarterly IMT drills, an annual major oil spill exercise, six-monthly oil spill response functional workshops, as well as ad-hoc exercises to coincide with specific project campaigns. The HSE (Emergency Response) Lead maintains an IMT exercise program.

Wherever practical, the IMT exercises, including oil spill responses, may involve support from other agencies, contractors and oil & gas operators as part of resource sharing initiatives. Records of emergency exercises, including OPEP commitments are assessed against measurement criteria and recorded in Jadestone's CMMS BASSnet.

In addition, assurance actions to meet OPEP requirements such as review of Scientific Monitoring capabilities, Waste Contractors compliance and availability of oil spill response vessels and aircraft are scheduled in BASSNet or contractual obligations.

Emergency response, including oil spill arrangements, as part of the implementation strategy are reviewed every 12 months. The scope of the review will be determined by the associated trigger for review. The triggers for the review are:

- document control notification;
- any significant change in the OPEP;

- any change in the risk assessment; and
- significant findings or any requirements from after-action review of drills or incidents.

9. REPORTING

9.1 Routine Reporting

Table 9-1 details the approach to routine environmental performance reporting to the regulator. Reports will be of sufficient detail to demonstrate whether specific environmental performance objectives and standards have been met.

9.2 Incident Reporting

Table 9-1 defines the differences between a reportable and recordable incident. It also defines reporting protocols for initial notification of a reportable incident, written reportable incident reporting and monthly recordable incident reporting. The Incident and Hazard Reporting Procedure (JS-60-PR-F-00016) which incorporates reporting timeframes for incidents depending on their environmental impacts is provided to the Stag Facility and reviewed on an annual basis.

Table 9-1: Routine and incident reporting requirements

Requirements	Timing
Routine Reporting	
<p>Annual Environmental Performance Report</p> <p>The Annual Performance Report for Stag Facility Operations will assess compliance with the EP performance objectives, standards and procedures and performance criteria and will include:</p> <ul style="list-style-type: none"> An overview of the operations and activities undertaken at the Facility; Summary of environmental incidents; Summary of any Management of Change (MOC), if applicable; Summary of audits conducted. 	<p>Annual Performance report is to be submitted to NOPSEMA within 3 months of end of annual reporting period (12 June to 11 June).</p> <p>Therefore, the Annual Performance report is due by 11 September each year.</p>
<p>Annual Review of Environment Plan</p> <p>The review will include an assessment of:</p> <ul style="list-style-type: none"> Environmental performance (adequacy of environmental management tools against number of reportable and/or recordable incidents). Continued relevance of performance objectives and performance standards. Review of existing performance standards and measurement criteria (giving consideration to updated or new standards). Inspection and checklist approaches. Monitoring data and trends; Any additional consultation required; Lesson learnt; Results of audits; and Adequacy of auditing and monitoring 	<p>Annual review of the Environment Plan triggered by the annual environment performance report process.</p> <p>If the Environment Plan requires revision, then in accordance OPGGS Regulations, it will be resubmitted to NOPSEMA.</p>

Requirements	Timing
<p>Recordable Environmental Incident Monthly Report</p> <p>A written report will be provided to NOPSEMA of any breaches of a performance objective or performance standard identified in the EP and is not classed as a reportable incident (refer above).</p> <p>The monthly report will include the following:</p> <ul style="list-style-type: none"> Circumstances and material facts concerning the incident; Actions taken to avoid or mitigate any adverse environmental impacts; Corrective action taken to prevent recurrence. 	<p>Not later than 15 days after the end of each calendar month.</p>
<p>Reportable Incidents: Notifications</p>	
<p>NOPSEMA</p> <p>NOPSEMA will be notified of reportable environmental incidents: i.e. any unplanned event identified as having caused, or having the potential to cause moderate to significant environmental damage.</p> <p>The following is a list of reportable environmental incidents that could occur:</p> <ul style="list-style-type: none"> Uncontrolled release of hazardous chemicals or hydrocarbons more than 80 litres to the marine environment. Gaseous releases of more than 300kg (~255m³ at Standard Ambient Temperature and Pressure) Death or injury to EPBC Act listed marine fauna due to activities in the Operational Area Any unforeseen event that has caused or has the potential to cause an impact with moderate or greater environmental consequence as outlined within this EP which includes: <ul style="list-style-type: none"> Marine pest introduction (moderate consequence) Unplanned release of stag crude (Major consequence) 	<p>Verbal report to NOPSEMA as soon as practicable but not later than two (2) hours of incident having been identified.</p> <p>As soon as practicable a written record of the verbal notification will be provided to NOPSEMA.</p> <p>Notifications to other regulators are described in Oil Spill Response Arrangements (GF-70-PLN-I-00001).</p>
<p>AMSA</p> <p>Oil pollution incidents in Commonwealth waters must be reported to AMSA.</p>	<p>Within 2 hours of incident having been identified:</p> <p>Tel: 1800-641-792</p>
<p>Department of Agriculture, Water and Environment (DAWE)</p> <p>DAWE will be notified of the following incidents:</p> <ul style="list-style-type: none"> • Harm or mortality to Commonwealth EPBC Act Listed Marine Fauna (attributable to the operations activity). • Spills of hydrocarbons or environmentally hazardous chemicals more than 80 litres to the marine environment. • Any unplanned event identified as having caused or having the potential to cause moderate to significant impact to a matter of NES. 	<p>Within 2 hours of incident having been identified:</p> <p>Tel: 1800-110-395</p> <p>Tel: 02-6274-1372</p> <p>compliance@environment.gov.au</p>
<p>Reportable Incidents: Written Reports</p>	
<p>NOPSEMA</p> <p>A written report of a reportable environmental incident will be provided to NOPSEMA and will contain:</p> <ul style="list-style-type: none"> Immediate action taken to prevent further environmental damage and contain the source of the release; Arrangements for internal investigation; 	<p>Written report (Part 1) to NOPSEMA is required within three (3) days.</p> <p>Within 7 days of submitting the written report (Part 1) to NOPSEMA, a copy of the written</p>

<p>All material facts and circumstances concerning the reportable incident that the operator knows or is able, by reasonable search or enquiry, to find out;</p> <p>Immediate cause analysis; and</p> <p>Corrective actions taken or proposed to prevent recurrence of similar incidents with responsible party and completion date.</p>	<p>report will be provided to NOPTA and DMIRS.</p> <p>Written report (Part 2) to NOPSEMA is required within 30 days.</p>
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APPENDIX A – RELEVANT LEGISLATION

Guideline/Legislation	Description
Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2018	These guidelines provide a Water Quality Management Framework which includes limits for common contaminants and water quality parameters in marine and fresh water.
Australian Ballast Water Requirements, 2020	These guidelines state the mandatory ballast water requirements and provide information on ballast pump tests, ballast water reporting and ballast water exchange 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 <i>Biosecurity Act 2015</i> .
Australian Marine Parks (AMP)	<p>Australian Marine Parks (AMP) are established by proclamation under the <i>EPBC Act</i> for the purpose of protecting and maintaining biological diversity in the parks.</p> <p>An environment plan (EP) must be consistent with the Australian Marine Park Management plans. In all cases where an activity has potential to impact or present risk to AMPs, regardless of whether the activity is inside or outside a park, the EP should evaluate how these impacts and risks will be of an acceptable level and reduced to ALARP.</p>
Australian Maritime Safety Authority Act 1990	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 Orders in Commonwealth waters.
Bilateral Agreements on the Protection of Migratory Birds	<p>Australia has negotiated bilateral agreements with Japan (Japan-Australia Migratory Birds Agreement [JAMBA], 1974), China (China-Australia Migratory Birds Agreement [CAMBA], 1986) and the Republic of Korea (Republic of Korea – Australia Migratory Birds Agreement [ROKAMBA], 2007) to protect species of migratory birds with international ranges.</p> <p>In November 2006, the East Asian-Australasian Flyway Partnership (Flyway Partnership) was launched in order to recognise and conserve migratory waterbirds in the East Asian – Australasian Flyway for the benefit of people and biodiversity.</p>

<p>Bonn Agreement for Cooperation in Dealing with Pollution of the North Sea by Oil and other harmful substances (Bonn Agreement)</p>	<p>The Bonn Agreement is the mechanism by which the North Sea states, and the European Union (the Contracting Parties), work together to help each other in combating pollution in the North Sea area from maritime disasters and chronic pollution from ships and offshore installations; and to carry out surveillance as an aid to detecting and combating pollution at sea.</p> <p>The Bonn Agreement Oil Appearance Code (BAOAC) may be used during spill response activities.</p>
<p>Convention on Biological Diversity (1992)</p>	<p>The objectives of the convention are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources.</p>
<p>Convention on the Conservation of Migratory Species of Wild Animals (CMS or Bonn Convention) (1979)</p>	<p>This Convention was concluded in 1979 and came into force on 1 November 1983. The Convention arose from a recommendation of the United Nations Conference on the Human Environment (Stockholm, 1972), and aims to conserve terrestrial, marine and avian species over the whole of their migratory range. It commits “Range States” to take action to conserve migratory species, especially those under threat. It is an umbrella agreement under which subsidiary regional agreements are established.</p>
<p>EPBC Act</p>	<p>Environment Protection and Biodiversity Conservation Act 1999</p> <p>While the Environment Regulations under the OPGGS Act (see below) manage day to day petroleum activities and apply to any activity that may have an impact on the environment, the EPBC Act (Chapter 4) regulates assessment and approval of proposed actions that are likely to have a significant impact on a matter of National Environmental Significance (NES). Actions that are likely to have a significant impact on a matter of NES require approval by the Commonwealth Environment Minister; the assessment process is administered by the Department of the Environment and Energy. The EPBC Act does not replace the need for an Environment Plan to be approved under the OPGGS (Environment) Regulations before an action can proceed.</p> <p>This Act came into force in July 2000 replacing five existing Commonwealth Acts (Environmental Protection (Impact of Proposals) Act 1974, World Heritage Properties Conservation Act 1983, National Parks and Wildlife Conservation Act 1975, Whale Protection Act 1980; and Endangered Species Protection Act 1992).</p> <p>The Environment Protection and Biodiversity Conservation Act (EPBC) provides for the protection of the environment, especially those aspects of the environment that are matters of National Environmental Significance (NES); and promotes ecologically sustainable development through the conservation and ecologically sustainable use of natural resources. Under this legislation all activities that will, or have the potential to, affect matters of NES are prohibited except; when undertaken in accordance with approval by the</p>

	<p>Minister for Environment, or when approved through a Bilateral Agreement with a State or Territory, or when approved through a process accredited by the Minister.</p> <p>Matters of “National Environmental Significance” are: World Heritage Properties; National Heritage Places; Wetlands of International Importance; Listed Threatened Species and Communities; Listed Migratory Species; Nuclear Actions; Commonwealth Marine Areas; and Great Barrier Reef Marine Park</p>
EPBC Act-related guidelines	<p>Relevant guidelines/policies and marine bioregional plans are considered in the management of impacts and risks</p> <p>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.</p> <p>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.</p>
International Convention for the Control and Management of Ships’ Ballast Water and Sediments (Ballast Water Convention) 2004	<p>The International Convention for the Control and Management of Ships Ballast Water and Sediment entered 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.</p>
International Convention for the Protection of Pollution from Ships (1973) and Protocol (1978)	<p>This Convention and Protocol (together known as MARPOL) build on earlier conventions in the same area. MARPOL is concerned with operational discharges of pollutants from ships. It contains five Annexes, dealing respectively with oil, noxious liquid substances, harmful packaged substances, sewage and garbage. Detailed rules are laid out as to the extent to which (if at all) such substances can be released in different sea areas. The legislation giving effect to MARPOL in Australia is the Protection of the Sea (Prevention of Pollution from Ships) Act 1983, the Navigation Act 2012 and several Parts of Marine Orders made under this legislation.</p>
International Convention for the Safety of Life at Sea (SOLAS) 1974	<p>In the event of an offshore emergency event that endangers the life of personnel, the International Convention for the Safety of Life at Sea (SOLAS) 1974 may take precedence over environmental management.</p>

International Convention on Biological Diversity (1992)	The objectives of the convention are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources.
International Convention on Civil Liability for Oil Pollution Damage (1969) and Protocol (1973)	The convention and the associated International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage 1971 set up a system of compulsory insurance and strict liability up to a certain figure for damages suffered as the result of an oil spill accident.
International Convention on Oil Pollution Preparedness, Response and Co-operation (1990) and Protocol (2000)	This convention sets up a system of oil pollution contingency plans and cooperation in fighting oil spills.
International Convention on the Control of Harmful Anti-fouling Systems on Ships 2001	This convention prohibits the use of harmful organotin in anti-fouling paints used on ships and establishes a mechanism to prevent the potential future use of other harmful substances in anti-fouling systems.
International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties (1969) and Protocol (1973)	The convention gives States Parties powers to intervene on ships on the high seas when their coastlines are threatened by an oil spill from that ship.
London (Dumping) Convention (1972)	Dumping at sea is regulated by the convention on the Prevention of Marine Pollution by Dumping of Wastes and other Matter 1972 (the 'London Convention'). Article 4 provides a general prohibition on dumping of wastes except as specified in the Convention. The convention has annexed to it two lists of substances, the 'blacklist' of substances which may not be dumped at all, and the 'grey list' of substances which may only be dumped under a specific permit.
Marine Bioregional Plans	<p>Marine bioregional plans are identified and considered in Section 3.7.</p> <p>Key Ecological Features (KEF) 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. Seven KEFs intersect with the EMBA:</p> <ul style="list-style-type: none"> • Ancient coastline at 125m depth contour; • Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula; • Commonwealth Waters adjacent to Ningaloo Reef; • Continental Slope Demersal Fish Communities; • Exmouth Plateau;

	<ul style="list-style-type: none"> • Glomar Shoals; and • Mermaid Reef and Commonwealth waters surrounding Rowley Shoals.
<p>MOU between AMSA and NOPSEMA</p>	<p>In March 2019, a Memorandum of Understanding was established between AMSA and NOPSEMA to guide cooperation and mutual assistance between AMSA and NOPSEMA in relation to carrying out their respective statutory functions for safety and environmental management in the offshore petroleum sector, including how the parties will respond to the interaction between vessels and offshore petroleum facilities.</p> <p>Section 5.2 of the MOU provides the following:</p> <p><i>In the context of this MOU the above legislation [Navigation Act 2012 and Marine Safety (Domestic Commercial Vessel) National Law Act 2012] will generally apply to the transfer of goods and persons between a vessel and an offshore facility, noting there may be areas of joint interest where some transfers are managed from the offshore facility.</i></p> <p>Jadestone interprets ‘joint interest’ to include an offtake activity in which a tanker is transferred cargo from an offshore facility. The transfer of cargo from the Stag CPF to the offtake tanker is an activity that occurs under legislative instruments for which AMSA is the statutory authority, and this activity is not a petroleum activity as defined by the OPGGS Act nor therefore an activity for which NOPSEMA is considered the statutory authority.</p> <p>The interface therefore of the offtake activity within the context of a petroleum activity and a maritime operation is that the transfer of hydrocarbon through the offtake hose is a petroleum activity to the point in the hose that connects at the offtake tanker (the manifold), and once the hydrocarbon cargo has passed the manifold to the tanker, this is now associated with the maritime operation for which AMSA is the recognised statutory authority.</p>
<p>National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (2018)</p>	<p>A guidance document issued by the Marine Pest Sectoral Committee which provides generic approach to a biofouling risk assessment and practical information on managing biofouling on hulls and niche areas.</p>
<p>National Greenhouse and Energy Reporting Act 2007 National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015</p>	<p>The Act provides a single, national framework for the reporting and distribution of information related to greenhouse gas (GHG) emissions, GHG projects, energy production and energy consumption by corporations in Australia. Several legislative instruments sit under the NGER Act, providing greater detail about corporations' obligations. The Act includes National Greenhouse and Energy Reporting (NGER) requirements and the Safeguard Mechanism requirements. Jadestone has obligations to report their emissions under the NGER scheme.</p>

<p>Navigation Act (2012)</p>	<p>Legislation which covers international ship and seafarer safety, protect the marine environment where it relates to shipping, and the actions of seafarers in Australian waters. Under the Commonwealth Administrative Arrangements Order, the <i>Navigation Act 2012</i> is administered by the Minister for and the Department of Infrastructure, Regional Development and Cities.</p> <p>The Navigation Act gives effect to international conventions for maritime issues where Australia is signatory and provides the legislative power for Australia to implement treaties including the International Convention for the Prevention of Pollution from Ships (MARPOL) developed by the International Maritime Organisation. IMO MARPOL requirements for the discharge of pollution are implemented by the <i>Protection of the Sea (Prevention of Pollution From Ships) Act 1983</i>.</p> <p>The Australian Maritime Safety Authority (AMSA) is a statutory authority established under the <i>Australian Maritime Safety Act 1990</i>. AMSA is Australia’s national agency responsible for maritime safety, protection of the marine environment, and maritime aviation search and rescue.</p> <p>Thus, the legislative requirements of environmental management of the maritime operation, which includes operation of the offtake tanker and its receipt of cargo from the Stag CPF, falls under these Acts and AMSA’s statutory authority.</p> <p>Administrative management of commercial vessels, which includes evidencing compliance with environmental requirements under AMSA’s jurisdiction, is addressed through vessel vetting processes completed by third party independent agents.</p>
<p>NOPSEMA OPGGS Act-related guidelines</p>	<p>NOPSEMA guidelines applicable to the activity include:</p> <ul style="list-style-type: none"> • NOPSEMA Guidance note: Environment plan content requirements (N04750-GN1344, September 2020); • NOPSEMA Guidance: Responding to public comment on environment plans guidance note (N-04750-GN1847, September 2020); • NOPSEMA Guidance note: Notification and Reporting of Environmental Incidents (N-03000-GN0926, June 2020); • NOPSEMA Guidance note: Petroleum activities and Australian Marine Parks (N-04750-GN1785, June 2020); • NOPSEMA Guideline: Environment Plan decision making (N-04750-GL1721, June 2021); • NOPSEMA Guideline: Consultation with Commonwealth agencies with responsibilities in the marine area (N-06800-GL1887, March 2022);

	<ul style="list-style-type: none"> • NOPSEMA Guidance Note: Oil Pollution Risk Management (N-04750-GN1488, July 2021) • NOPSEMA bulletin: Oil Spill modelling (Bulletin #1, April 2019) <p>Relevant guidelines/ policies are considered in the management of impacts and risks.</p>
OPGGGS Act	<p>The OPGGSA 2006 (OPGGSA) entered into force in 2008, superseding and repealing the previous offshore petroleum legislation – the Offshore Petroleum Act 2006 (OPA) and the Petroleum (Submerged Lands) Act 1967 (PSLA).</p> <p>Facilities located entirely in Commonwealth offshore waters are controlled by the Commonwealth OPGGSA and its regulations, including but not limited to the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGGS (E) Regulations).</p> <p>The Act, and its regulations, is currently administered by the Joint Authority, which consists of the commonwealth minister for Resources and Water and the WA State Minister for Mines and Petroleum. The commonwealth minister for Energy and Resources is advised by the Commonwealth Department of Industry, Science, Energy and Resources (DISER).</p>
OPGGSE Regulations	<p>Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGGS (E) Regulations)</p> <p>Under the OPGGGS (E) Regulations an EP is required for proposals under Commonwealth jurisdiction, comprising a description of the environmental effects and risks of the project, and proposed mitigation measures to reduce these risks.</p> <p>The EP must be submitted to and accepted by the Designated Authority (DA). The DA for Commonwealth waters adjacent to WA state waters and out to the Australian Economic Exclusion Zone (EEZ) at 200 nm is NOPSEMA, who administers the regulations.</p>
Ozone Protection and Synthetic Greenhouse Gas Management Act 1989	<p>This Act regulates the import, export and manufacture of ozone depleting substances (ODS) such as firefighting equipment and refrigerants.</p>
Plans of management for: - World Heritage properties, - Commonwealth/National Heritage places	<p>Sites accepted to the World Heritage listing are only inscribed if considered to represent the best examples of the world’s cultural and natural heritage. There are no World Heritage properties that intersect with the operational areas</p>

	<p>The Commonwealth Heritage List is a list of natural, Indigenous and historic heritage places owned or controlled by the Australian Government. There are no Commonwealth Heritage places that intersect with the operational areas;</p> <p>The National Heritage list is Australia’s list of natural, historic and Indigenous places of outstanding significance to the nation. There are no National Heritage properties that intersect with the operational areas</p>
Protection of the Sea (Prevention of Pollution from Ships) Act 1983	This Act gives effect to the International Convention for the Prevention of Pollution from Ships 1973/78 (MARPOL 73/78/97 and Annexes). It provides for penalties for not complying with the MARPOL. Marine Orders are a body of delegated legislation made pursuant to the Navigation Act 2012 and the Protection of the Sea (Prevention of Pollution from Ships) Act 1983
Ramsar wetland ecological character descriptions	A ‘declared Ramsar wetland’ is a wetland area of international importance that has been designated under Article 2 of the Ramsar Convention or declared by the Minister to be a declared Ramsar wetland under Section 16 of the EPBC Act. There is one declared Ramsar site within the EMBA: Eighty-mile Beach.
Species Profile and Threats Database https://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl	This database has been used in Section 3as a source of information on the receptors. Information accessed has included species details such as habitat, movements, feeding, reproduction and taxonomic comments. Noting that profiles are not available for all species and ecological communities. Results of searching this database are found within Appendix B and Appendix C.
The Australian Petroleum Production and Exploration Association (APPEA) Code of Environmental Practice (APPEA 2008)	In Australia, the petroleum exploration and production industry operate within an industry code of practice developed by the Australian Petroleum Production and Exploration Association (APPEA); the APPEA Code of Environmental Practice (2008). This code provides guidelines for activities that are not formally regulated and have evolved from the collective knowledge and experience of the oil and gas industry, both nationally and internationally. The APPEA Code of Practice covers general environmental objectives for the industry, including planning and design, assessment of environmental risks, emergency response planning, training and inductions, auditing and consultation and communication. As an APPEA member, Jadestone Energy adheres to this Code of Environmental Practice when undertaking offshore activities.
The Conservation Values Atlas (DoEE 2021) https://www.environment.gov.au/topics/marine/marine-bioregional-plans/conservation-values-atlas	The Conservation Values Atlas has been developed by the Commonwealth Government. This is used for the identification of Biologically Important Areas (BIA), KEFs etc. which have been presented in Section 3 and considered in the assessment of impacts and risks in Sections 7 and 8.

	<p>BIAs are identified by the Commonwealth government, 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.</p>
Underwater Cultural Heritage Act 2018	<p>The Act gives clarity to the present and ongoing jurisdictional arrangements for protecting and managing Australia’s underwater cultural heritage in line with the 2010 Australian Underwater Cultural Heritage Intergovernmental Agreement.</p> <p>The Act ensures Australia’s underwater cultural inheritance is protected for future generations. It is aligned with the UNESCO 2001 Convention, facilitating Australia to be part of the global community’s response to illegal salvaging, looting and trafficking of underwater cultural heritage.</p>
United Nations Convention on the Law of the Sea (UNCLOS) (1982)	<p>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 of the Convention in 1982, and UNCLOS in 1994.</p>
United Nations Framework Convention on Climate Change (1992)	<p>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.</p>
Vienna Convention on the Protection of the Ozone Layer (1985) and the Montreal Protocol; on Substances that Deplete the Ozone Layer (1987)	<p>The Convention (ratified by Australia in 1987) and the Protocol (ratified in 1989) concern the phasing out of ozone depleting substances.</p>

APPENDIX B – EPBC MATTERS SEARCH REPORTS – OPERATIONAL AREA

- Operational Area
- Operational area with 20km buffer (light and noise; and includes produced 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.

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

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 14/12/21 15:26:12

[Summary](#)

[Details](#)

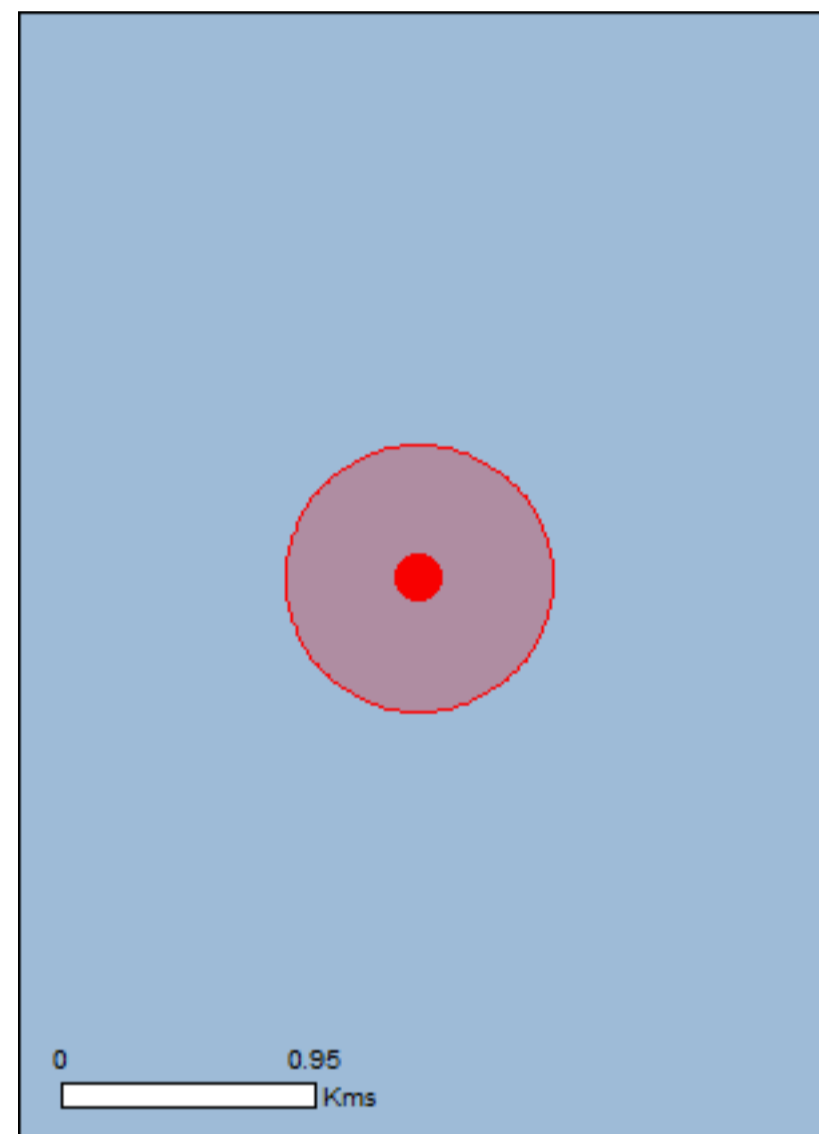
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

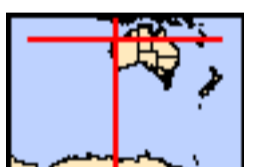
[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

Buffer: 0.5Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	17
Listed Migratory Species:	30

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	62
Whales and Other Cetaceans:	12
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

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

Details

Matters of National Environmental Significance

Commonwealth Marine Area

[\[Resource Information \]](#)

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

Name

EEZ and Territorial Sea

Marine Regions

[\[Resource Information \]](#)

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

Name

[North-west](#)

Listed Threatened Species

[\[Resource Information \]](#)

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	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
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species

Name	Status	Type of Presence
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	habitat known to occur within area Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Sharks		
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 zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
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
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [\[Resource Information \]](#)

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

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	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
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

Name	Threatened	Type of Presence
Pandion haliaetus Osprey [952]		Species or species habitat may 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
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 spinostris 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

Name	Threatened	Type of Presence
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Aipysurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis czeblukovi Fine-spined Seasnake [59233]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis mcdowellii null [25926]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans

[[Resource Information](#)]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area

Name	Status	Type of Presence
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-20.29472 116.28083

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.

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

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 14/12/21 15:29:57

[Summary](#)

[Details](#)

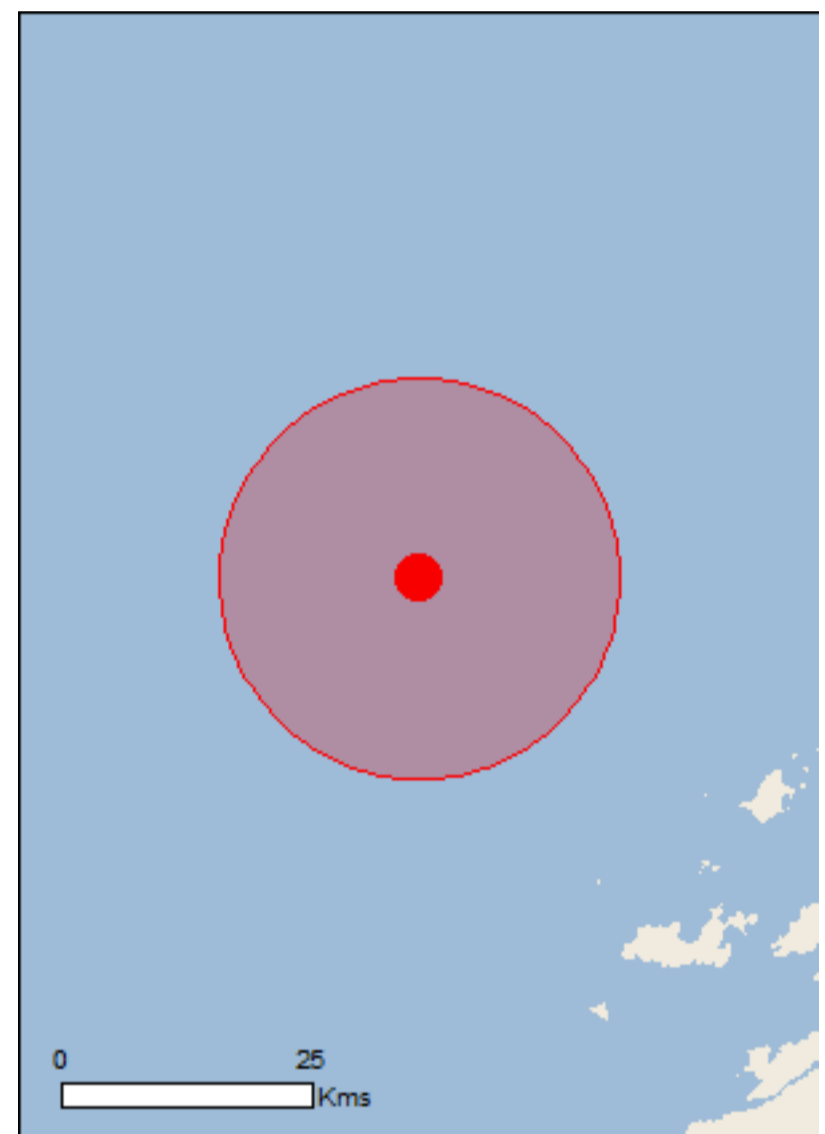
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

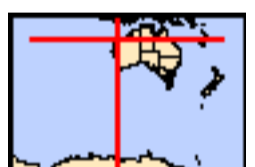
[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

Buffer: 20.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	20
Listed Migratory Species:	36

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	65
Whales and Other Cetaceans:	15
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

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

Details

Matters of National Environmental Significance

Commonwealth Marine Area

[\[Resource Information \]](#)

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

Name

EEZ and Territorial Sea

Marine Regions

[\[Resource Information \]](#)

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

Name

[North-west](#)

Listed Threatened Species

[\[Resource Information \]](#)

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	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
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur

Name	Status	Type of Presence within area
Reptiles		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely 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
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Sharks		
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 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
Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Sterna dougallii Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat may occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area
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
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 likely 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
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area

Name	Threatened	Type of Presence
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis 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 chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area

Migratory Wetlands Species

Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	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
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [\[Resource Information \]](#)

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

Name	Threatened	Type of Presence
Birds		
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

Name	Threatened	Type of Presence
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	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
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
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Sterna dougallii Roseate Tern [817]		Foraging, feeding or related behaviour likely 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

Name	Threatened	Type of Presence
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
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

Name	Threatened	Type of Presence
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Species or species habitat likely to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	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
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within

Name	Threatened	Type of Presence area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Congregation or aggregation known to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis czebukovi Fine-spined Seasnake [59233]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis mcdowellii null [25926]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area
Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat may occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area

Name	Status	Type of Presence
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

Caveat

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

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

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

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

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

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

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

- migratory and
- marine

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

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

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

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

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

Coordinates

-20.29472 116.28083

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 C – EPBC MATTERS SEARCH REPORTS –EMBA



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.

Report created: 14-Nov-2022

[Summary](#)

[Details](#)

[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)

Summary

Matters of National Environment Significance

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

World Heritage Properties:	1
National Heritage Places:	2
Wetlands of International Importance (Ramsar)	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	60
Listed Migratory Species:	88

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:	1
Commonwealth Heritage Places:	2
Listed Marine Species:	143
Whales and Other Cetaceans:	32
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	14
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:	39
Regional Forest Agreements:	None
Nationally Important Wetlands:	3
EPBC Act Referrals:	253
Key Ecological Features (Marine):	7
Biologically Important Areas:	53
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

World Heritage Properties [\[Resource Information \]](#)

Name	State	Legal Status
The Ningaloo Coast	WA	Declared property

National Heritage Places [\[Resource Information \]](#)

Name	State	Legal Status
Indigenous		
Dampier Archipelago (including Burrup Peninsula)	WA	Listed place

Natural

The Ningaloo Coast	WA	Listed place
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Wetlands of International Importance (Ramsar Wetlands) [\[Resource Information \]](#)

Ramsar Site Name	Proximity
Eighty-mile beach	Within Ramsar site

Commonwealth Marine Area [\[Resource Information \]](#)

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name

EEZ and Territorial Sea

Extended Continental Shelf

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	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat may occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically 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	Species or species habitat may occur within area
Malurus leucopterus edouardi White-winged Fairy-wren (Barrow Island), Barrow Island Black-and-white Fairy-wren [26194]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
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	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely 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 may 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	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area
FISH		
Milyeringa veritas Cape Range Cave Gudgeon, Blind Gudgeon [66676]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Ophisternon candidum Blind Cave Eel [66678]	Vulnerable	Species or species habitat known to occur within area
Thunnus maccoyii Southern Bluefin Tuna [69402]	Conservation Dependent	Breeding known to occur within area
MAMMAL		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route 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
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 Central Australian subspecies Mala, Rufous Hare-Wallaby (Central Australia) [88019]	Endangered	Translocated population known to occur within area

Scientific Name	Threatened Category	Presence Text
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat known to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat 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
Petrogale lateralis lateralis Black-flanked Rock-wallaby, Moororong, Black-footed Rock Wallaby [66647]	Endangered	Species or species habitat known to occur within area
Rhinonicteris aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area

REPTILE

Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Ctenotus zasticus Hamelin Ctenotus [25570]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Lerista neviniae Nevin's Slider [85296]	Endangered	Species or species habitat known to occur within area
Liasis olivaceus barroni Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat known to occur within area
Liopholis kintorei Great Desert Skink, Tjakura, Warrarna, Mulyamiji [83160]	Vulnerable	Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
SHARK		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Centrophorus zeehaani Southern Dogfish, Endeavour Dogfish, Little Gulper Shark [82679]	Conservation Dependent	Species or species habitat likely to occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Breeding 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	Breeding known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Scientific Name	Threatened Category	Presence Text
Sphyrna lewini Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat known to occur within area
Listed Migratory Species [Resource Information]		
Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardena carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Ardena pacifica Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Breeding known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Hydroprogne caspia Caspian Tern [808]		Breeding known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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
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
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may 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	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area

Migratory Marine Species

Scientific Name	Threatened Category	Presence Text
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	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
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
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may 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

Scientific Name	Threatened Category	Presence Text
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Breeding 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	Breeding known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa sahalensis 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		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		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 likely to occur within area
Migratory Wetlands Species		

Scientific Name	Threatened Category	Presence Text
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area

Scientific Name	Threatened Category	Presence Text
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Roosting known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area

Scientific Name	Threatened Category	Presence Text
Thalasseus bergii Greater Crested Tern [83000]		Breeding known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Tringa totanus Common Redshank, Redshank [835]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [\[Resource Information \]](#)

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

Commonwealth Land Name	State
Unknown	
Commonwealth Land - [51939]	WA

Commonwealth Heritage Places [\[Resource Information \]](#)

Name	State	Status
Natural		
Mermaid Reef - Rowley Shoals	WA	Listed place
Ningaloo Marine Area - Commonwealth Waters	WA	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

Scientific Name	Threatened Category	Presence Text
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Ardena carneipes as Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Ardena pacifica as Puffinus pacificus Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	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

Scientific Name	Threatened Category	Presence Text
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area overfly marine area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area overfly marine area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area overfly marine area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area overfly marine area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area overfly marine area
Chroicocephalus novaehollandiae as Larus novaehollandiae Silver Gull [82326]		Breeding known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area overfly marine area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area overfly marine area
Glareola maldivarum Oriental Pratincole [840]		Roosting known to occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Breeding known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area overfly marine area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area overfly marine area
Hydroprogne caspia as Sterna caspia Caspian Tern [808]		Breeding known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area overfly marine area
Limnodromus semipalmatus Asian Dowitcher [843]		Species or species habitat known to occur within area overfly marine area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Limosa limosa Black-tailed Godwit [845]		Roosting 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	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area overfly marine area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area overfly marine area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
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

Scientific Name	Threatened Category	Presence Text
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
Phaethon lepturus White-tailed Tropicbird [1014]		Breeding known to occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area overfly marine area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area overfly marine area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting 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
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
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
Stiltia isabella Australian Pratincole [818]		Roosting known to occur within area overfly marine area
Sula dactylatra Masked Booby [1021]		Breeding known to occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may 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	Species or species habitat may 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
Tringa brevipes as Heteroscelus brevipes Grey-tailed Tattler [851]		Roosting known to occur within area

Scientific Name	Threatened Category	Presence Text
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area overfly marine area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area overfly marine area
Tringa totanus Common Redshank, Redshank [835]		Roosting known to occur within area overfly marine area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area overfly marine area
Fish		
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
Choeroichthys latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
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
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
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
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
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
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

Scientific Name	Threatened Category	Presence Text
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammal		
Dugong dugon Dugong [28]		Breeding known to occur within area
Reptile		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Aipysurus pooleorum Shark Bay Seasnake [66061]		Species or species habitat may occur within area
Aipysurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Chitulia ornata as Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [87377]		Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis macdowelli as Hydrophis mcdowelli Small-headed Seasnake [75601]		Species or species habitat may occur within area
Leioselasma czeblukovi as Hydrophis czeblukovi Fine-spined Seasnake, Geometrical Seasnake [87374]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may 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

Current Scientific Name	Status	Type of Presence
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat 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
Grampus griseus Risso's Dolphin, Grampus [64]		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 as Kogia simus 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
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
Mesoplodon ginkgodens Ginkgo-toothed Beaked Whale, Ginkgo-toothed Whale, Ginkgo Beaked Whale [59564]		Species or species habitat may occur within area
Orcaella heinsohni as Orcaella brevirostris 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
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 sahalensis as Sousa chinensis 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

Current Scientific Name	Status	Type of Presence
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

Australian Marine Parks		[Resource Information]
Park Name	Zone & IUCN Categories	
Dampier	Habitat Protection Zone (IUCN IV)	
Gascoyne	Habitat Protection Zone (IUCN IV)	
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)	
Montebello	Multiple Use Zone (IUCN VI)	
Shark Bay	Multiple Use Zone (IUCN VI)	
Dampier	National Park Zone (IUCN II)	

Park Name	Zone & IUCN Categories
Gascoyne	National Park Zone (IUCN II)
Mermaid Reef	National Park Zone (IUCN II)
Ningaloo	Recreational Use Zone (IUCN IV)
Argo-Rowley Terrace	Special Purpose Zone (Trawl) (IUCN VI)

Habitat Critical to the Survival of Marine Turtles

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	
Barrow Island	Nature Reserve	WA	
Barrow Island	Marine Park	WA	
Barrow Island	Marine Management Area	WA	
Bedout Island	Nature Reserve	WA	
Bessieres Island	Nature Reserve	WA	
Boodie, Double Middle Islands	Nature Reserve	WA	
Cape Range	National Park	WA	
Eighty Mile Beach	Marine Park	WA	

Protected Area Name	Reserve Type	State
Great Sandy Island	Nature Reserve	WA
Jarrkunpungu	Nature Reserve	WA
Jurabi Coastal Park	5(1)(h) Reserve	WA
Kujungurru Warrarn	Conservation Park	WA
Kujungurru Warrarn	Nature Reserve	WA
Lowendal Islands	Nature Reserve	WA
Montebello Islands	Conservation Park	WA
Montebello Islands	Marine Park	WA
Montebello Islands	Conservation 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
Nyangumarta Warrarn	Indigenous Protected Area	WA
Nyangumarta Warrarn	Indigenous Protected Area	WA
Round Island	Nature Reserve	WA
Rowley Shoals	Marine Park	WA
Serrurier Island	Nature Reserve	WA
Unnamed WA36909	5(1)(h) Reserve	WA
Unnamed WA36910	5(1)(h) Reserve	WA
Unnamed WA36913	Nature Reserve	WA
Unnamed WA36915	Nature Reserve	WA
Unnamed WA40828	5(1)(h) Reserve	WA

Protected Area Name	Reserve Type	State
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
Unnamed WA52366	Nature Reserve	WA

Nationally Important Wetlands [\[Resource Information \]](#)

Wetland Name	State
Cape Range Subterranean Waterways	WA
Eighty Mile Beach System	WA
Mermaid Reef	EXT

EPBC Act Referrals [\[Resource Information \]](#)

Title of referral	Reference	Referral Outcome	Assessment Status
Balla Balla Export Facilities ? Design Variation	2022/09254		Assessment
Browse to North West Shelf Development, Indian Ocean, WA	2018/8319		Approval
North West Shelf Project Extension, Carnarvon Basin, WA	2018/8335		Approval
Project Highclere Cable Lay and Operation	2022/09203		Completed
Action clearly unacceptable			
Asian Renewable Energy Hub Revised Proposal, WA	2021/8891	Action Clearly Unacceptable	Completed
Highlands 3D Marine Seismic Survey	2012/6680	Action Clearly Unacceptable	Completed
Controlled action			
'Van Gogh' Petroleum Field Development	2007/3213	Controlled Action	Post-Approval
Ammonium Nitrate Project	2010/5423	Controlled Action	Completed
Anketell Point Iron Ore Processing & Export Port	2009/5120	Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Ashburton Infrastructure Project	2021/9064	Controlled Action	Guidelines Issued
Asian Renewable Energy Hub, 220 km east of Port Hedland, Western Australia	2017/8112	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
Cape Lambert Port B Development	2008/4032	Controlled Action	Post-Approval
Construct and operate LNG & domestic gas plant including onshore and offshore facilities - Wheatston	2008/4469	Controlled Action	Post-Approval
Develop Jansz-10 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 an iron ore mine and associated infrastructure	2010/5630	Controlled Action	Assessment Approach
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

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Gorgon Gas Development	2003/1294	Controlled Action	Post-Approval
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
Great Northern Pipeline - 630 km buried gas pipeline	2009/5257	Controlled Action	Completed
Light Crude Oil Production	2001/365	Controlled Action	Post-Approval
Mardie Project, 80 km south west of Karratha, WA	2018/8236	Controlled Action	Post-Approval
Nava-1 Cable System	2001/510	Controlled Action	Completed
North West Shelf Gas Venture Phase VI Expansion	2007/3436	Controlled Action	Referral Decision
Perdaman Urea Project, near Karratha, WA	2018/8383	Controlled Action	Post-Approval
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
Proposed technical ammonium nitrate production facility	2008/4546	Controlled Action	Post-Approval
Proposed West Pilbara Iron Ore Project	2009/4706	Controlled Action	Post-Approval
Pyrenees Oil Fields Development	2005/2034	Controlled Action	Post-Approval
Simpson Development	2000/59	Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Simpson Oil Field Development	2001/227	Controlled Action	Post-Approval
site preparations	2005/2391	Controlled Action	Post-Approval
The Scarborough Project - FLNG & assoc subsea infrastructure, Carnarvon Basin	2013/6811	Controlled Action	Post-Approval
Vincent Appraisal Well	2000/22	Controlled Action	Post-Approval
Widening and resurfacing two principal roads servicing the Dampier Port Authori	2010/5677	Controlled Action	Completed
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
Ammonia Plant	2001/199	Not Controlled Action	Completed
Barrow Island 2D Seismic survey	2006/2667	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
Cape Lambert Port A Marine Structures Refurbishment Project	2018/8370	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
Construction and operation of an unmanned sea platform and connecting pipeline to Varanus Island for	2004/1703	Not Controlled Action	Completed
Construction of Loadout Facility and Laydown Area	2002/598	Not Controlled Action	Completed
Controlled Source Electromagnetic Survey	2007/3262	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Deep Gorge Boardwalk, Murujuga National Park, WA	2018/8283	Not Controlled Action	Completed
Development of Halyard Field off the west coast of WA	2010/5611	Not Controlled Action	Completed
Development of Industrial Land, Port of Dampier	2003/1293	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
Dimethyl ether plant	2001/509	Not Controlled Action	Completed
Drilling of an exploration well Gats-1 in Permit Area WA-261-P	2004/1701	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
Expansion of the Sino Iron Ore Mine and export facilities, Cape Preston, WA	2017/7862	Not Controlled Action	Completed
Expansion Proposal, Mineralogy Cape Preston Iron Ore Project, Cape Preston, WA	2009/5010	Not Controlled Action	Completed
Exploration drilling well WA-155-P(1)	2003/971	Not Controlled Action	Completed
Exploration of appraisal wells	2006/3065	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
HCA05X Macedon Experimental Survey	2004/1926	Not Controlled Action	Completed
Hess Exploration Drilling Programme	2007/3566	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
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
King Bay East Rock Quarry & Industrial Estate Development	2003/1150	Not Controlled Action	Completed
Klammer 2D Seismic Survey	2002/868	Not Controlled Action	Completed
Maia-Gaea Exploration wells	2000/17	Not Controlled Action	Completed
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
Methanol manufacturing	2001/528	Not Controlled Action	Completed
Methanol plant	2001/521	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
Pipeline System Modifications Project	2000/3	Not Controlled Action	Completed
Pluto-North West Shelf Interconnector, Burrup Peninsula, WA	2018/8353	Not Controlled Action	Completed
Port Expansion and Dredging	2003/1265	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Port Hedland Channel Risk and Optimisation Project, WA	2017/7915	Not Controlled Action	Completed
Project Highclere Geophysical Survey	2021/9023	Not Controlled Action	Completed
Searipple gas and condensate field development	2000/89	Not Controlled Action	Completed
Stages 1 & 2 Port of Dampier Security Upgrade & Associated Works	2004/1751	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
Widening of MOF Road	2005/2305	Not Controlled Action	Completed
Woodside Project Facilities Increase	2006/3191	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

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
"Leanne" offshore 3D seismic exploration, WA-356-P	2005/1938	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 seismic survey	2008/4493	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey	2005/2146	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey Permit Area WA-352-P	2008/4628	Not Controlled Action (Particular Manner)	Post-Approval
2D seismic survey within permit WA-291	2007/3265	Not Controlled Action (Particular Manner)	Post-Approval
3D marine seismic survey	2008/4281	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 over petroleum title WA-268-P	2007/3458	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
3D Marine Seismic Surveys - Contos CT-13 & Supertubes CT-13, offshore WA	2013/6901	Not Controlled Action (Particular Manner)	Post-Approval
3D seismic survey	2006/2715	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 Basin on the North West Shelf	2002/778	Not Controlled Action (Particular Manner)	Post-Approval
3D seismic survey	2006/2781	Not Controlled Action (Particular Manner)	Post-Approval
Acheron Non-Exclusive 2D Seismic Survey	2009/4968	Not Controlled Action (Particular Manner)	Post-Approval
Acheron Non-Exclusive 2D Seismic Survey	2008/4565	Not Controlled Action (Particular Manner)	Post-Approval
Agrippina 3D Seismic Marine Survey	2009/5212	Not Controlled Action (Particular Manner)	Post-Approval
Ammonia Plant, Murujuga Burrup Peninsula - Renewable Hydrogen Project	2020/8739	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
Aperio 3D Marine Seismic Survey, WA	2012/6648	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Artemis-1 Drilling Program (WA-360-P)	2010/5432	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
Bonaventure 3D seismic survey	2006/2514	Not Controlled Action (Particular Manner)	Post-Approval
Cable Seismic Exploration Permit areas WA-323-P and WA-330-P	2008/4227	Not Controlled Action (Particular Manner)	Post-Approval
Cape Preston East - Iron Ore Export Facilities, Pilbara, WA	2013/6844	Not Controlled Action (Particular Manner)	Post-Approval
Cerberus exploration drilling campaign, Carnarvon Basin, WA	2016/7645	Not Controlled Action (Particular Manner)	Post-Approval
CGGVERITAS 2010 2D Seismic Survey	2010/5714	Not Controlled Action (Particular Manner)	Post-Approval
Charon 3D Marine Seismic Survey	2007/3477	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	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Cue Seismic Survey within WA-359-P, WA-361-P and WA-360-P	2007/3647	Not Controlled Action (Particular Manner)	Post-Approval
CVG 3D Marine Seismic Survey	2012/6654	Not Controlled Action (Particular Manner)	Post-Approval
Dampier Marine Services Facility including 300m Wharf and Dredging Works	2009/5108	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

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
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 Manner)	Post-Approval
Effect of marine seismic sounds to demersal fish and pearl oysters, north-west WA	2018/8169	Not Controlled Action (Particular Manner)	Post-Approval
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 of Zeus-1 well	2008/4351	Not Controlled Action (Particular Manner)	Post-Approval
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

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Geco Eagle 3D Marine Seismic Survey	2008/3958	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 Manner)	Post-Approval
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
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
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
Klimt 2D Marine Seismic Survey	2007/3856	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	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Millstream 20GL Pipeline, Bungaroo, Borefield Integration	2012/6379	Not Controlled Action (Particular Manner)	Post-Approval
MOF Road Widening and Resurfacing Works	2011/5843	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
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
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
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

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
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
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 Manner)	Post-Approval
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 reservoir 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	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
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
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
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
The Dampier Heavy Load Out Facility Berth and Swing Basin Expansion	2012/6271	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Tidepole Maz 3D Seismic Survey Campaign	2007/3706	Not Controlled Action (Particular Manner)	Post-Approval
Tortilla 2D Seismic Survey, WA	2011/6110	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
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

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Wheatstone Iago Appraisal Well Drilling	2007/3941	Not Controlled Action (Particular Manner)	Post-Approval
Wheatstone Iago Appraisal Well Drilling	2008/4134	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
3D Seismic Survey	2008/4219	Referral Decision	Completed
Bianchi 3D Marine Seismic Survey, Carnavon Basin, WA	2013/7078	Referral Decision	Completed
construction of a new loadout facility and associated laydown area south of the	2002/579	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
Outer Harbour Development and associated marine and terrestrial infrastructure	2008/4148	Referral Decision	Completed
Rose 3D Seismic acquisition survey	2008/4220	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

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
Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	North-west

Name	Region
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

Biologically Important Areas

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 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

Scientific Name	Behaviour	Presence
Chelonia mydas Green Turtle [1765]	Foraging	Likely to occur
Chelonia mydas Green Turtle [1765]	Foraging	Known to occur
Chelonia mydas Green Turtle [1765]	Internesting	Known to occur
Chelonia mydas Green Turtle [1765]	Internesting buffer	Known to occur
Chelonia mydas Green Turtle [1765]	Mating	Known to occur
Chelonia mydas Green Turtle [1765]	Migration corridor	Known to occur
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Foraging	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	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
River shark		
Pristis clavata Dwarf Sawfish [68447]	Foraging	Known to occur
Pristis clavata Dwarf Sawfish [68447]	Nursing	Known to occur
Pristis clavata Dwarf Sawfish [68447]	Pupping	Known to occur
Pristis pristis Freshwater Sawfish [60756]	Foraging	Known to occur
Pristis pristis Freshwater Sawfish [60756]	Pupping	Likely to occur
Pristis zijsron Green Sawfish [68442]	Foraging	Known to occur
Pristis zijsron Green Sawfish [68442]	Nursing	Known to occur
Pristis zijsron Green Sawfish [68442]	Pupping	Known to occur

Seabirds

Scientific Name	Behaviour	Presence
Ardena pacifica Wedge-tailed Shearwater [84292]	Breeding	Known to occur
Fregata ariel Lesser Frigatebird [1012]	Breeding	Known to occur
Phaethon lepturus White-tailed Tropicbird [1014]	Breeding	Known to occur
Sterna dougallii Roseate Tern [817]	Breeding	Known to occur
Sternula albifrons sinensis Little Tern [82850]	Breeding	Known to occur
Sternula albifrons sinensis Little Tern [82850]	Resting	Known to occur
Sternula nereis Fairy Tern [82949]	Breeding	Known to occur
Sula leucogaster Brown Booby [1022]	Breeding	Known to occur
Thalasseus bengalensis Lesser Crested Tern [66546]	Breeding	Known to occur
Sharks		
Rhincodon typus Whale Shark [66680]	Foraging	Known to occur
Rhincodon typus Whale Shark [66680]	Foraging (high density prey)	Known to occur
Whales		
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Distribution	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Foraging	Known to occur

Scientific Name	Behaviour	Presence
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 are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

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

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

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

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

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

Please feel free to provide feedback via the [Contact us](#) page.

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APPENDIX D – SUBSEA INTEGRITY AND MAINTENANCE ACTIVITIES

- Air Diving Operations
- Tasks in accordance with the Subsea Inspection Procedure (GF-16-PR-U-00030)
 - Platform inspection, maintenance and repair
 - Platform marine growth cleaning
 - Platform debris removal
 - Platform splash zone corrosion protection installation
 - Pipeline and platform anode replacements
 - Riser/ Conductor inspection, maintenance and repair
 - Riser/ Conductor clamp repairs or replacement
 - Riser/ Conductor splash zone corrosion protection installation
 - Pipeline inspections, maintenance and repairs
 - Pipeline debris removal
 - Pipeline stabilisation and freespan reduction
 - Spool installation
 - Underbuoy hose change-outs
 - CALM Buoy and Mooring inspections, repair and maintenance
 - Valve operations
- **Frequency**
 - Platform and diving frequencies are set ‘as required’ as per the Subsea Inspection Procedure (GF-16-PR-U-00030) and are based on findings during ROV Surveys and planned maintenance requirements.
 - The Underbuoy Hose Change Out is changed out at a minimum of every three (3) years as per the Oil Companies International Marine Forum (OCIMF) *Guidelines for the handling, storage, inspection and testing of hoses in field*. The OCIMF Guidelines state the service life can be extended based on an appropriate inspection, testing and maintenance program and historical evidence of hose performance.
- **Vessels**
 - Air Diving Operations are to be supported by a suitable Diving Support Vessel (DSV) operating in DP mode or anchored in the field. DSV’s will be in the range of 30 to 90m in size depending on the activity.
 - DSV’s anchored will be supported by an Anchor Handling Vessel (AHV) or Supply Vessel
- **Support**
 - In some instances, Rope Access will support diving operations

-
- **Saturation Diving**
 - Tasks in accordance with the Subsea Inspection Procedure (GF-16-PR-U-00030)
 - Platform inspection, maintenance and repair
 - Platform marine growth cleaning
 - Platform debris removal
 - Pipeline and platform anode replacements
 - Riser/ Conductor inspection, maintenance and repair
 - Riser/ Conductor clamp repairs or replacement
 - Pipeline inspections, maintenance and repairs
 - Pipeline debris removal
 - Pipeline stabilisation and free span reduction
 - Spool installation
 - Underbuoy hose change-outs
 - CALM Buoy Mooring inspections, repair and maintenance
 - Valve operations
 - **Frequency**
 - Platform and diving frequencies are set 'as required' as per the Subsea Inspection Procedure (GF-16-PR-U-00030) and are based on findings during ROV Surveys and planned maintenance requirements.
 - The Underbuoy Hose Change Out is changed out at a minimum of every three (3) years as per the Oil Companies International Marine Forum (OCIMF) *Guidelines for the handling, storage, inspection and testing of hoses in field*. The OCIMF Guidelines state the service life can be extended based on an appropriate inspection, testing and maintenance program and historical evidence of hose performance.
 - **Vessels**
 - Saturation Diving Operations are to be supported by a suitable Diving Support Vessel (DSV) operating in DP mode or moored in a four-point mooring pattern. DSV's will be in the range of 50 to 90m in size depending on the activity.
 - **ROV Operations**
 - Tasks in accordance with the Subsea Inspection Procedure (GF-16-PR-U-00030)
 - Platform inspection, maintenance and repair
 - Platform marine growth cleaning
 - Platform debris removal
 - Riser/ Conductor inspection, maintenance and repair
 - Pipeline surveys
 - Pipeline debris removal

-
- Pipeline stabilisation and freespan reduction
 - Platform site and pipeline route surveys
 - Pipeline and platform anode replacements
 - CALM Buoy and Mooring inspections, repair and maintenance
 - Platform and Pipeline post cyclone surveys
 - **Frequency**
 - ROV survey frequency is set at every three (3) years as per the Subsea Inspection Procedure (GF-16-PR-U-00030) and annually in the event of a cyclone passing in the near vicinity.
 - **Vessels**
 - ROV Operations will be conducted from a suitable vessel operating in DP mode or other. ROV support vessels will be in the range of 25 to 90m in size depending on the activity.
 - **Rope Access Operations**
 - **Tasks**
 - Platform inspection, maintenance and repair
 - Platform marine growth cleaning
 - Riser/ Conductor inspection, maintenance and repair
 - Riser/ Conductor clamp repairs or replacement
 - Riser/ Conductor splash zone corrosion protection installation
 - **Vessels**
 - Standby vessel for rope access and overside operations.
 - **Side Scan Sonar (SSS) and Autonomous Underwater Vehicle (AUV) Survey**
 - **Tasks**
 - Pipeline Surveys
 - Platform seabed surveys
 - Seabed Surveys
 - **Frequency**
 - SSS and AUV survey frequency is set at every three (3) years as per the Subsea Inspection Procedure (GF-16-PR-U-00030)
 - **Vessels**
 - SSS and AUV Operations will be conducted from a suitable vessel and generally are in the range of 25 to 50 m in size.

APPENDIX E – STAG FIELD STAKEHOLDER CONSULTATION INFORMATION

Appendix E

Table 1: Relevant persons' engagement log - Stag 50H and 51H Drilling EP

Relevant Stakeholders	Date	To/From	Engagement Logistics	Reference Number	Summary of content	Action undertaken/Status
Commonwealth government department or agency						
Australian Fisheries Management Authority (AFMA)	2 Dec 21	SENT	How: Email Supplementary: Fishery information sheet	F1	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	N/A
	7 Dec 21	RECEIVED	How: Email	AFMA1	Acknowledgement. Noted to consult directly through relevant fishing organisations.	Refer to Assessment of Merit table – this has been undertaken as part of standard consultation approach
Australian Hydrographic Office (AHO)	2 Dec 21	SENT	How: Email Supplementary: General information sheet	G1	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	Reminder sent
	6 Jan 22	SENT	How: Email Supplementary: General information sheet	G2	Reminder - Given no response to previous correspondence, will assume no comment unless JSE hear from you in next week.	N/A
	7 Jan 22	RECEIVED	How: Email	AHO1	Acknowledgement. Data will be registered and charts updated	Noted. No further action
Australian Maritime Safety Authority (AMSA)	2 Dec 21	SENT	How: Email Supplementary: General information sheet	G1	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	N/A
	2 Dec 21	RECEIVED	How: Email	AMSA1	Notification requirements - refer to assessment of merit table for detail	Response assessed and EP updated

Department of Agriculture, Water and the Environment (Fisheries section)	2 Dec 21	SENT	How:Email Supplementary: Fisheries information sheet	F1	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	Reminder sent
	6 Jan 22	SENT	How: Email Supplementary: General information sheet	F2	Reminder - Given no response to previous correspondence, will assume no comment unless JSE hear from you in next week.	No further action
Department of Agriculture, Water and the Environment (Marine Pests)	2 Dec 21	SENT	How:Email Supplementary: Fisheries information sheet	F1	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	Reminder sent
	6 Jan 22	SENT	How: Email Supplementary: General information sheet	F2	Reminder - Given no response to previous correspondence, will assume no comment unless JSE hear from you in next week.	No further action
Department of Agriculture, Water and the Environment (Biosecurity)	2 Dec 21	SENT	How: Email Supplementary: Fisheries information sheet	F1	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	Reminder sent
	6 Jan 22	SENT	How: Email Supplementary: General information sheet	F2	Reminder - Given no response to previous correspondence, will assume no comment unless JSE hear from you in next week.	No further action
Director of National Parks	2 Dec 21	SENT	How: Email Supplementary: General information sheet	G1	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	N/A

	22 Dec 21	RECEIVED	How: Email	DNP1	Response noting outside AMPs and no authorisation required. Referred to guidance note for development of EP and emergency notification requirements	Refer to Assessment of Merit table. No further correspondence required
Department of Industry, Science, Energy and Resources	2 Dec 21	SENT	How: Email Supplementary: General information sheet	G1	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	Reminder sent
	6 Jan 22	SENT	How: Email Supplementary: General information sheet	G2	Reminder - Given no response to previous correspondence, will assume no comment unless JSE hear from you in next week.	No further action
Hon Keith Pitt MP – Minister for Resources and Water	2 Dec 21	SENT	How: Email Supplementary: General information sheet	G1a	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	N/A
	2 Dec 21	RECEIVED	How: Email	Pitt	Acknowledgement of receipt	Noted. No further action
Hon Angus Taylor MP – Minister for Industry, Energy and Emissions Reduction	2 Dec 21	SENT	How: Email Supplementary: General information sheet	G1a	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	Reminder sent
	6 Jan 22	SENT	How: Email Supplementary: General information sheet	G2	Reminder - Given no response to previous correspondence, will assume no comment unless JSE hear from you in next week.	No further action
WA State government department or agency						
Department of Mines, Industry Regulation and Safety	2 Dec 21	SENT	How: Email Supplementary: General information sheet	G1	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and	N/A

					associated management controls). Feedback requested	
	20 Dec 21	RECEIVED	How: Email	DMIRS1	Acknowledgement of receipt. Need to provide pre-start and cessation of activity notification and ensure that notifications reporting environmental incidents are received.	Refer to Assessment of Merit table. No further correspondence required
Department of Primary Industry and Regional Development (Fisheries Branch)	2 Dec 21	SENT	How: Email Supplementary: Fisheries information sheet	F1	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	Reminder sent
	6 Jan 22	SENT	How: Email Supplementary: General information sheet	F2	Reminder - Given no response to previous correspondence, will assume no comment unless JSE hear from you in next week.	N/A
	14 Jan 22	RECEIVED	How: Email	DPIRD1	Suggested changes/ additions to current mitigation and management measures for IMS: <ul style="list-style-type: none"> changing the wording from “if required” to “as required” notification of potential detection of IMS in WA waters is made to DPIRD within 24 via FishWatch (ph 1800 81 5 507) or by email to Aquatic.Biosecurity@dpird.wa.gov.au and will follow subsequent advice provided by Aquatic Biosecurity Use the online tool Vessel Check to manage the biosecurity risk for vessels entering WA waters https://www.vessel-check.com 	Response assessed and EP updated
	19 Jan 22	SENT	How: Email	DPIRD1	Response provided on mitigation and management measures for IMS addressing DPIRD questions.	Refer to Assessment of Merit table and email correspondence

						(Attachment 1) for further detail. No further action
Department of Transport (Marine Pollution)	2 Dec 21	SENT	How: Email Supplementary: General information sheet	DoT1	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	N/A
	2 Dec 21	RECEIVED	How: Email	DoT2	Acknowledgement of receipt	Noted
	8 Dec 21	RECEIVED	How: Email	DoT3	Acknowledgement of receipt and asked for OPEP to be sent to DoT for review.	Noted and OPEP to be sent when finalised at same time as submission to NOPSEMA
	25 Jan 22	SENT	How: Email	DoT4	OPEP issued to DoT for comment	N/A
	09 Mar 22	RECEIVED	How: Email		Receipt of comments	OPEP updated
	13 Apr 22	SENT	How: Email		Response to DoT comments issued as a table	Any further comments will be responded to and OPEP updated as required
Hon William (Bill) Johnston MLA - Minister for Mines and Petroleum; Energy; Corrective Services	2 Dec 21	SENT	How: Email Supplementary: General information sheet	G1a	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	Reminder sent
	6 Jan 22	SENT	How: Email Supplementary: General information sheet	G2	Reminder - Given no response to previous correspondence, will assume no comment unless JSE hear from you in next week.	N/A
	21 Jan 22	RECEIVED	How: Email	Johnston	Acknowledgement of receipt. No comments given DMIRS have provided response.	No further action
	2 Dec 21	SENT	How: Email	G1a	Email sent to stakeholder. Attached was a factsheet with information on the potential	N/A

Hon Amber-Jade Sanderson – Minster for Environment; Climate Action; Commerce			Supplementary: General information sheet		environmental impacts and risks (and associated management controls). Feedback requested	
	2 Dec 21	RECEIVED	How: Email	Sanderson	Acknowledgement of receipt	Noted. No further action
Commercial fishers and fishing associations: Commonwealth						
Australian Fisheries Trade Association	2 Dec 21	SENT	How: Email Supplementary: Fisheries information sheet	F1	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	Reminder sent
	6 Jan 22	SENT	How: Email Supplementary: General information sheet	F2	Reminder - Given no response to previous correspondence, will assume no comment unless JSE hear from you in next week.	No further action
Australian Southern Bluefin Tuna Industry Association	2 Dec 21	SENT	How: Email Supplementary: Fisheries information sheet	F1	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	Reminder sent
	6 Jan 22	SENT	How: Email Supplementary: General information sheet	F2	Reminder - Given no response to previous correspondence, will assume no comment unless JSE hear from you in next week.	No further action
Commonwealth Fisheries Association (CFA)	2 Dec 21	SENT	How: Email Supplementary: Fisheries information sheet	F1	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	Reminder sent
	6 Jan 22	SENT	How: Email Supplementary: General information sheet	F2	Reminder - Given no response to previous correspondence, will assume no comment unless JSE hear from you in next week.	No further action
Commercial fishers and fishing associations: WA state						

Pearl Producers Association	2 Dec 21	SENT	How: Email Supplementary: Fisheries information sheet	F1	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	Reminder sent
	6 Jan 22	SENT	How: Email Supplementary: Fisheries information sheet	F2	Reminder - Given no response to previous correspondence, will assume no comment unless JSE hear from you in next week.	Email bounced
	7 Jan 22	RECEIVED	How: Email	PPA bounce 1	Email bounced	Find alternative email address
	10 Jan 22	CALL	How: Phone call	N/A	Called number for Pearl Producers Association to try and find another email address to send fact sheet to.	Called to leave message, mailbox full
	17 Jan 22	SENT	How: Email Supplementary: Fisheries information sheet	F2	Reminder - Given no response to previous correspondence, will assume no comment unless JSE hear from you in next week.	Resent Email bounced.
	18 Jan 22	RECEIVED	How: Email	PPA bounce 2	Email bounced	No response expected based on previous consultation activities at Stag. If a response is received it will be included in the next revision of EP
Western Australian Fishing Industry Council (WAFIC)	2 Dec 21	SENT	How: Email Supplementary: Fisheries information sheet	F1	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	N/A
	16 Dec 21	RECEIVED	How: Email	WAFIC1	Acknowledgement of receipt. Asked for information on the following: <ul style="list-style-type: none"> Baseline scientific data on aquatic organisms and the aquatic environment 	Noted and following up with OPEP team to provide a response

					<ul style="list-style-type: none"> Detailed post spill scientific monitoring of aquatic organism and aquatic environment Communication strategy that considers the commercial fishing industry in the event of a spill event Support to the commercial fishing industry with regards to traceability of fish products to manage tainting risks, if required. Financial assistance to the commercial fishing industry in the event of a spill event. 	
	11 Jan 22	SENT	How: Email	WAFIC1	<p>Thanked for feedback and advised that a response to WAFIC questions was being worked on and would be sent through shortly.</p> <p>Asked if WAFIC as peak body have contacted individual licence holders for each fishery in relation to this EP.</p>	Response sent 11 Jan 22
	14 Jan 22	RECEIVED	How: Email	WAFIC1	WAFIC only contact fishers for some Environment Plans, in most cases wouldn't consult again if already undertaken by titleholder to avoid stakeholder fatigue	Responded to on 17 Jan 22
	17 Jan 22	SENT	How: Email	WAFIC1	Following previous discussions with WAFIC on stakeholder fatigue asked WAFIC if a second mail out to individual stakeholders was appropriate or if the contact WAFIC have with individual licence holders as the peak body is sufficient and the preferred approach to reduce stakeholder fatigue.	Response sent 17 Jan 22
	18 Jan 22	SENT	How: Email	WAFIC1	Response provided on incident preparedness at Stag Facility addressing WAFIC questions.	Refer to Assessment of Merit table and email correspondence (Attachment 1) for further detail

	19 Jan 22	RECEIVED	How: Email	WAFIC1	Email thanking Jadestone for response regarding incident preparedness. WAFIC have no further comment at this stage.	Responded to 19 Jan 22
	19 Jan 22	SENT	How: Email	WAFIC1	Emailed WAFIC to follow up on request re response in relation to stakeholder fatigue and requirement for a second mail out to individual licence holders	Response sent 19 Jan 22
	19 Jan 22	RECEIVED	How: Email	WAFIC2	WAFIC advised they have not as they only do it for some EP's and are working through this issue with DPIRD and APPEA to try and find a solution	Responded to 20 Jan 22
	20 Jan 22	SENT	How: Email	WAFIC2	Thanked WAFIC for their feedback and asked to be updated on guidance on stakeholder fatigue in the future	No further action
Onslow Prawn Managed Fishery (individual license holder details in Table 2)	3 Dec 21	SENT	How: Postal mail Supplementary: Fisheries information sheet	F1	Letters posted to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	No responses. Reminders not sent as only postal addresses available.
Mackerel Managed Fishery (Area 2) (individual license holder details in Table 2)	3 Dec 21	SENT	How: Postal mail Supplementary: Fisheries information sheet	F1	Letters posted to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	No responses. Reminders not sent as only postal addresses available.
Pilbara Trap Managed Fishery (individual license holder details in Table 2)	3 Dec 21	SENT	How: Postal mail Supplementary: Fisheries information sheet	F1	Letters posted to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	No responses. Reminders not sent as only postal addresses available.
Pilbara Line Managed Fishery (individual license holder details in Table 2)	3 Dec 21	SENT	How: Postal mail Supplementary: Fisheries information sheet	F1	Letters posted to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	No responses. Reminders not sent as only postal addresses available.

Octopus Development Fishery (individual license holder details in Table 2)	3 Dec 21	SENT	How: Postal mail Supplementary: Fisheries information sheet	F1	Letters posted to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	No responses. Reminders not sent as only postal addresses available.
Marine Tourism WA	2 Dec 21	SENT	How: Email Supplementary: General information sheet	MTWA1	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	Reminder sent
	6 Jan 22	SENT	How: Email Supplementary: General information sheet	F2	Reminder - Given no response to previous correspondence, will assume no comment unless JSE hear from you in next week.	No further action
Fishing Tour Operators (individual license holder details in Table 3)	31 Dec 21	SENT	How: Postal mail Supplementary: Fisheries information sheet	F1	Letters posted to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	No responses. Reminders not sent as only postal addresses available.
Recreational fishing						
Recfishwest	2 Dec 21	SENT	How: Email Supplementary: Fisheries information sheet	F1	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	N/A
	4 Jan 22	RECEIVED	How: Email	Recfish1	Suggested contact two main fishing clubs in Karratha to notify them of project. Asked to be provided with project updates.	Two main fishing clubs contacted and added to list of relevant persons. Refer to Assessment of Merit table.
	6 Jan 22	SENT	How: Email	Recfish2	Response sent noting feedback and notifying Recfishwest that Jadestone have contacted two fishing clubs as suggested and will keep	No further action

					Recfishwest updated on project through notifications	
King Bay Game Fishing Club	5 Jan 22	SENT	How: Email Supplementary: Fisheries information sheet	Fishclub1	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	Reminder sent
	19 Jan 22	SENT	How: Email Supplementary: Fisheries information sheet	F2	Reminder - Given no response to previous correspondence, will assume no comment unless JSE hear from you in next week.	Response pending
Nickol Bay Sportsfishing Club	5 Jan 22	SENT	How: Email Supplementary: Fisheries information sheet	Fishclub1	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	Reminder sent
	19 Jan 22	SENT	How: Email Supplementary: Fisheries information sheet	F2	Reminder - Given no response to previous correspondence, will assume no comment unless JSE hear from you in next week.	Response pending
Oil and Gas						
Australian Petroleum Production and Exploration Association (APPEA)	2 Dec 21	SENT	How: Email Supplementary: General information sheet	G1	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	Reminder sent
	6 Jan 22	SENT	How: Email Supplementary: General information sheet	G2	Reminder - Given no response to previous correspondence, will assume no comment unless JSE hear from you in next week.	No further action
Response Partners						
Australian Marine Oil Spill Centre (AMOSC)	2 Dec 21	SENT	How: Email Supplementary: General information sheet	G1	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and	Reminder sent

					associated management controls). Feedback requested	
	6 Jan 22	SENT	How: Email Supplementary: General information sheet	G2	Reminder - Given no response to previous correspondence, will assume no comment unless JSE hear from you in next week.	No further action
Research						
Australian Institute of Marine Science	2 Dec 21	SENT	How: Email Supplementary: General information sheet	G1	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	Reminder sent
	6 Jan 22	SENT	How: Email Supplementary: General information sheet	G2	Reminder - Given no response to previous correspondence, will assume no comment unless JSE hear from you in next week.	No further action
CSIRO	2 Dec 21	SENT	How: Email Supplementary: General information sheet	G1	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	Email bounced. Find alternative email or phone number for relevant person
	2 Dec 21	RECEIVED	How: Email	CSIRO bounce	Email bounce notification	Follow up with a phone call
	6 Dec 21	CALL	How: Call	N/A	Called CSIRO switchboard to find appropriate contact details. Given number for Communications Manager for Energy (Claire Ginn). Left a message	Follow up with phone call in a week
	13 Dec 21	CALL	How: Call	N/A	Left another message for Communications Manager	Follow up with another phone call after Christmas
	5 Jan 22	CALL	How: Call	N/A	Spoke to CSIRO switchboard who advised if we hadn't received a return phone call by now project not considered relevant	No further action. No response expected based on previous consultation activities at Stag. If a response is

						received it will be included in the next revision of EP
Western Australian Marine Science Institute	2 Dec 21	SENT	How: Email Supplementary: General information sheet	G1	Email sent to stakeholder. Attached was a factsheet with information on the potential environmental impacts and risks (and associated management controls). Feedback requested	Reminder sent
	6 Jan 22	SENT	How: Email Supplementary: General information sheet	G2	Reminder - Given no response to previous correspondence, will assume no comment unless JSE hear from you in next week.	No further action



Stag Facility Invitation for Consultation

Invitation for Consultation

Jadestone Energy (Australia) Pty Ltd (Jadestone) is the operator and titleholder of the existing Stag Field Production and Export Facility (Stag Facility). Jadestone is preparing for assessment by the National Offshore Petroleum Regulatory Authority (NOPSEMA) two Environment Plans for the following activities:

- **Ongoing production and maintenance at the Stag Facility for the next five years; and**
- **Plugging and abandonment of two production wells and then drilling two new production wells at the Stag Facility.**

We invite you to provide comment for consideration in this process.



Who is Jadestone Energy?

Jadestone Energy (Jadestone) is a leading upstream oil and gas company in the Asia Pacific region, with a focus on production and near-term development assets. The company is listed on the Alternative Investment Market of the London Stock Exchange (JSE). Contact details for the Perth office are provided at the end of this document

What is an Environment Plan?

The purpose of an Environment Plan (EP) is to identify impacts on and risks to the environment related to an activity. The EP also sets measures to reduce environmental impacts and risks and describes how and to what standard those measures will be implemented; this includes emergency situations. There will be two EPs covering:

- Stag operations: covering activities associated with production, oil loading to a third-party tanker, inspection maintenance and repair of the facility, subsea export pipeline, wells and associated subsea infrastructure and non-routine/ unplanned activities and incidents as they arise. This EP is in place and needs to be refreshed after its five-year timeline is now almost due; and,

- Stag drilling: two new production wells to be drilled from the facility, with activities including firstly abandoning two existing wells before drilling the new production wells using a mobile offshore drilling unit or drilling rig.

Length and timing of activities

The Stag Operations EP is being prepared to cover a further five years of operation. The new EP will be consistent with the activities currently undertaken with the facility's operation. Oil is currently produced from the Stag Reservoir by production wells. Seawater is injected into the reservoir to help production and produced water is discharged overboard from the platform. Ongoing drilling and completion activities are necessary to maintain oil production at the facility.

Approximately 90 days is required to plug and abandon two existing wells and then drill two new wells. While timing of the activities will be driven by rig availability, the preferred timing will be between June and October 2022. Activities may occur outside this window and into 2023, and for this reason, it is intended that the drilling EP will remain valid for a two-year period from the time of acceptance.

Location

The Stag Facility is located on the North-west Shelf, approximately 60 km north-west of Dampier. The permit area (WA-15-L) is in Commonwealth waters. The water depth at the Stag Facility is 49 m LAT. Indicative location details are listed here and shown in Figure 1:

- Lat: 20° 16.5" S: Long:116° 15.433" E (GDA 94, Zone 51)

The Stag platform has been present and operating for 20 years, with the required restricted zone in place. This restricted zone of 500 m radius around the platform,

catenary anchor leg mooring (CALM) buoy and pipeline will remain in place along with the cautionary area as designated by AMSA of 3 Nm radius charted around the Stag Field facilities.

The Operational Area for the Stag Operations EP is the area within the 500 m radius Restricted Zone that extends around the CPF, subsea export pipeline, and CALM buoy. The Operational Area for the Drilling EP is defined as the area within the 3 Nm radius Restricted Zone that extends around the Stag CPF.

All planned activities will be contained within the Operational Areas.

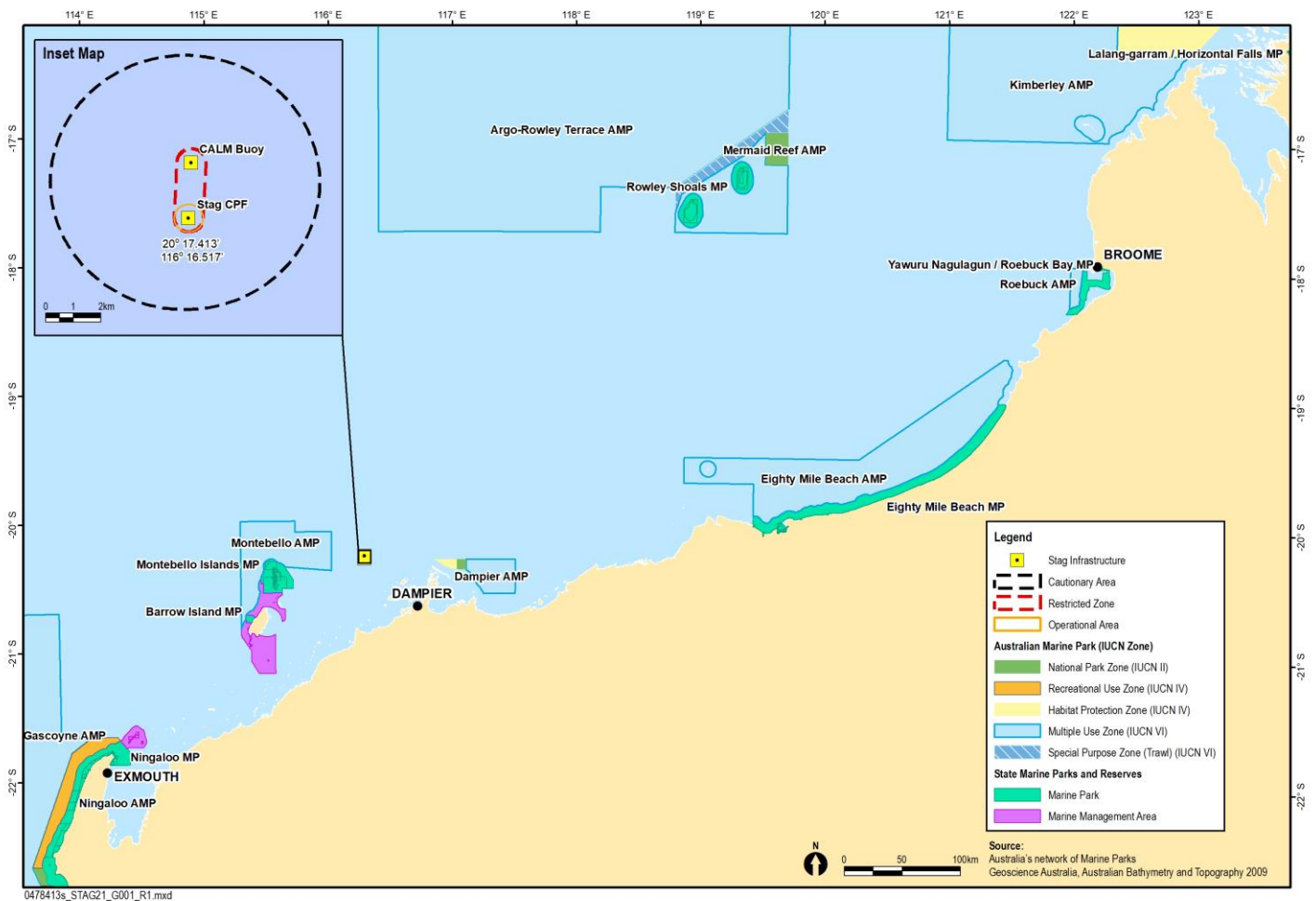


Figure 1 –Stag facility – Location

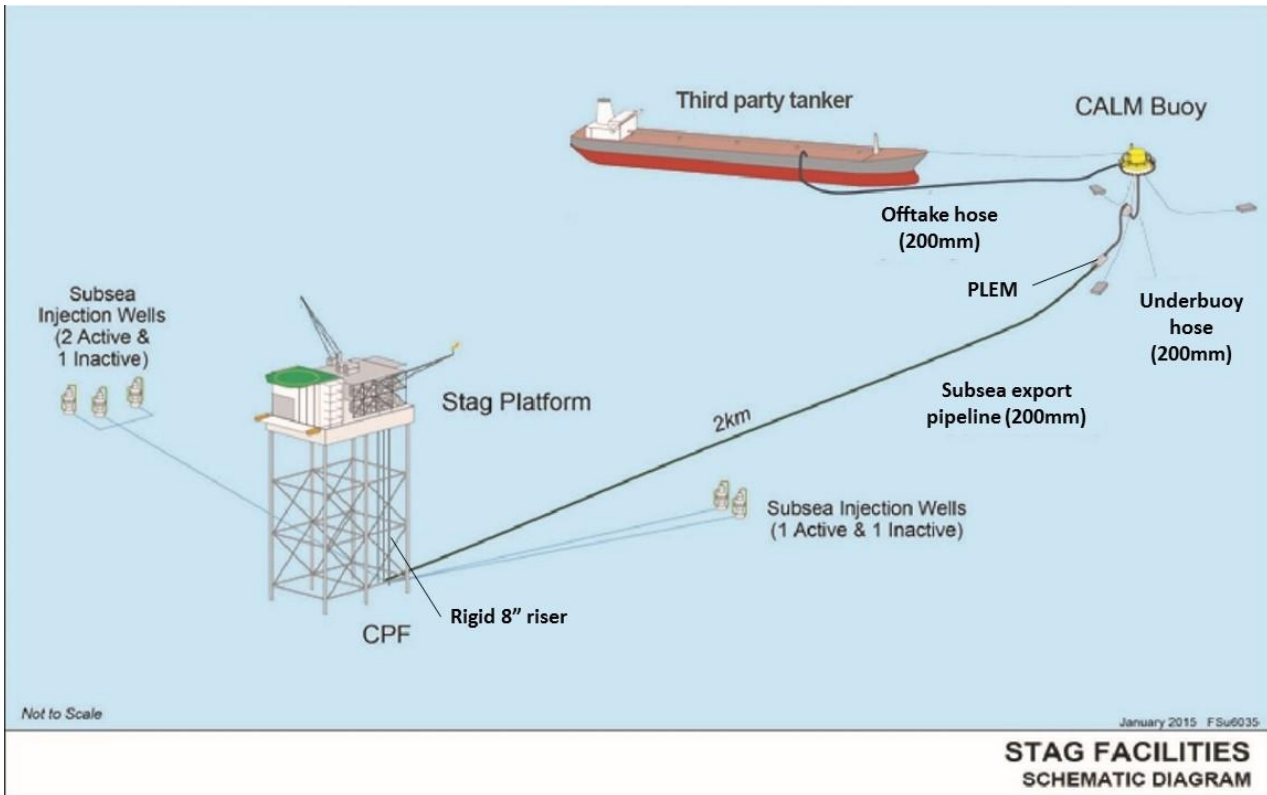


Figure 2 –Stag facility – Existing infrastructure

Operational Area Environmental Values

There are no Matters of National Environmental Significance in the Operational Area.

The distance to Australian Marine Parks (AMP) and other key features in the area is summarised in the table below.

Regional Feature	Distance from Stag CPF
Montebello AMP	30 km
Dampier Archipelago	32 km
Dampier AMP	60 km
Closest Montebello Island	75 km

The benthic habitat in the Operational area is generally sandy seabed with occasional shell or gravel patches that is well represented in the region.

In the event of a hydrocarbon spill the values in a broader Environment that May be Affected (EMBA) have been identified to enable key habitats or locations of particular value in the region to be responded to as protection priorities.

Potential risks and management

A summary of potential risks to the fishery sector that are common to both Environmental Plan activities is provided below. For each risk the associated management measures are summarised in Table 1.

TABLE 1: POTENTIAL RISKS AND MITIGATION/MANAGEMENT MEASURES COMMON TO BOTH ENVIRONMENT PLANS

Potential Risks	Mitigation and /or Management Measures
Light Emissions	<ul style="list-style-type: none"> • Potential impacts from lighting are assessed as occurring within 20 km of a vessel or facility based on the National Light Pollution Guidelines for Wildlife (Commonwealth of Australia 2019) • Facility and vessel navigation lights are compliant with the Navigation Act 2012
Noise Emissions	<ul style="list-style-type: none"> • Vessels and helicopters comply with relevant parts of EPBC Regulation (2000) Part 8 • Vessel and machinery are maintained in accordance with Flag State certification requirements • All engines, compressors and machinery on the CPF and MODU are maintained via a maintenance management system
Atmospheric Emissions	<ul style="list-style-type: none"> • Flag State Certificate and/or IAPP certifies measures are in place to manage air emissions • All engines, compressors and machinery on the CPF and MODU are maintained via a maintenance management system
Operational discharges	<ul style="list-style-type: none"> • Emissions and discharges of liquid waste to sea are in accordance with legislative requirements, the impact and risk assessment process indicates that discharges will not result in significant effects to marine fauna • Waste Management Plan
Interaction with other users	<ul style="list-style-type: none"> • A pre-existing 500 m restricted zone is in place around the facility and will remain in place for the duration of operations under the proposed EPs, including during the drilling activity as the MODU will be within the 500m restricted zone of the CPF. No fishing vessels are to enter this zone • Commercial fishers are permitted to enter the wider 3Nm cautionary zone and fish, transit or anchor for the duration of operations under the proposed EPs, as long as it is safe to do so • Notice to Mariners and charts will show zones
Interaction with fauna	<ul style="list-style-type: none"> • Vessels operating within the restricted zone must not exceed a speed of five (5) knots • Induction includes information on speed limits and requirements for interacting with marine fauna
Physical Presence	<ul style="list-style-type: none"> • Seabed disturbance limited to planned activities and defined locations

In addition to the risks outlined in Table 1, the risk of produced water discharge is specific to the Stag Operations EP activities (Table 2).

TABLE 2: POTENTIAL RISKS AND MITIGATION/MANAGEMENT MEASURES ASSOCIATED ONLY WITH STAG 5 YEAR OPERATIONS EP

Potential Risks	Mitigation and /or Management Measures
Produced water discharges	<ul style="list-style-type: none"> • Beyond temporary perturbation to water quality, no environmental impacts due to the discharge of produced water are expected • Produced water discharges are monitored and recorded with adaptive management processes in place if significant changes are identified

In addition to the risks outlined in Table 1, the risk of drilling discharges is specific to the Stag Drilling EP activities (Table 3).

TABLE 3: POTENTIAL RISKS AND MITIGATION/MANAGEMENT MEASURES ASSOCIATED ONLY WITH STAG DRILLING EP

Potential Risks	Mitigation and /or Management Measures
Drilling discharges	<ul style="list-style-type: none"> • Selection process for materials as part of NOPSEMA approval • Process for inventory control to minimise leftovers • Cuttings management system in place to manage muds (no synthetic based muds planned for use)

Additional risks that are associated with events that are not expected to occur during normal activities are outlined in Table 4.

Potential Risks	Mitigation and /or Management Measures
Introduced Marine Species (IMS)	<ul style="list-style-type: none"> • IMS Management will meet legal requirements and reduce risks to ALARP and acceptable levels • Vessels will be required to adhere to ballast water management, quarantine and biofouling requirements if required
Unplanned discharges	<ul style="list-style-type: none"> • No release of non-hazardous / hazardous solid wastes or non-hydrocarbon hazardous liquids to the marine environment • Dropped object prevention • Waste management plan implemented, and details included in induction materials • Spill kits available and incident response plans in place
Vessel/MODU collision	<ul style="list-style-type: none"> • Marine notifications will be made to relevant stakeholders, describing the location of the activity and a 500 m petroleum safety zone is present to prevent the risk of collisions • Vessels operating within the restricted zone must not exceed a speed of five (5) knots • Simultaneous Operations (SIMOPS) plan in place to interface between the Stag facility and MODU during drilling • Navigation lights installed and checked
Hydrocarbon release	<ul style="list-style-type: none"> • Oil Pollution Emergency Plan • Procedures in place on CPF to prevent hydrocarbon release to sea during operations • Procedures in place on MODU to prevent hydrocarbon release to sea during drilling • Appropriate vessel spill response plans, equipment and materials will be in place and maintained • Appropriate refuelling procedures and equipment will be used to prevent spills to the marine environment

Providing Feedback

If you would like to comment on the proposed activity outlined in this fact sheet or would like additional information, please contact Jadestone before Monday 20th December 2021.

Feedback can be provided at any time before/during or after the activity.

Phone: 08 9486 6600

Email: consult@jadestone-energy.com

Our Perth office is located at: The Atrium, Level 2, 168 St Georges Terrace, Perth WA 6000



Any person providing feedback is asked to advise if this information is to remain confidential and they do not wish it to be published within the Environment Plan.



Stag Facility Invitation for Consultation

Fishing sector

Invitation for Consultation

Jadestone Energy (Australia) Pty Ltd (Jadestone) is the operator and titleholder of the existing Stag Field Production and Export Facility (Stag Facility). Jadestone is preparing for assessment by the National Offshore Petroleum Regulatory Authority (NOPSEMA) two Environment Plans for the following activities:

- **Ongoing production and maintenance at the Stag Facility for the next five years; and**
- **Plugging and abandonment of two production wells and then drilling two new production wells at the Stag Facility.**

We invite you to provide comment for consideration in this process.



Who is Jadestone Energy?

Jadestone Energy (Jadestone) is a leading upstream oil and gas company in the Asia Pacific region, with a focus on production and near-term development assets. The company is listed on the Alternative Investment Market of the London Stock Exchange (JSE). Contact details for the Perth office are provided at the end of this document.

What is an Environment Plan?

The purpose of an Environment Plan (EP) is to identify impacts on and risks to the environment related to an activity. The EP also sets measures to reduce environmental impacts and risks and describe how and to what standard those measures will be implemented; this includes emergency situations. There will be two EPs covering:

- Stag operations: covering activities associated with production, oil loading to a third-party tanker, inspection maintenance and repair of the facility, subsea export pipeline, wells and associated subsea infrastructure and non-routine/ unplanned activities and incidents as they arise. This EP is in place and needs to be refreshed after its five-year timeline is now coming due.

- Stag drilling: two new production wells to be drilled from the facility, including firstly abandoning two existing wells before drilling the new production wells using a mobile offshore drilling unit or drilling rig.

Length and timing of activities

The Stag Operations EP is being prepared to cover a further five years of operation. The new EP will be consistent with the activities currently undertaken with the facility's operation.

Oil is currently produced from the Stag Reservoir by production wells. Seawater is injected into the reservoir to help production and produced water is discharged overboard from the platform. Ongoing drilling and completions activities are necessary to maintain oil production at the facility.

Approximately 90 days is required to plug and abandon two existing wells and then drill two new wells. While timing of the activities will be driven by rig availability, the preferred timing will be between June and October 2022. Activities may occur outside this window and into 2023, and for this reason, it is intended that the drilling EP will remain valid for a two-year period from the time of acceptance.

Location

The Stag Facility is located on the North-west Shelf, approximately 60 km north-west of Dampier. The permit area (WA-15-L) is in Commonwealth waters. The water depth at the Stag Facility is 49 m LAT. Indicative location details are listed here and shown in Figure 1:

- Lat: 20° 16.5" S: Long:116° 15.433" E (GDA 94, Zone 51)

The Stag platform has been present and operating for 20 years, with the required restricted zone in place. This restricted zone of 500 m radius around the platform,

catenary anchor leg mooring (CALM) buoy and pipeline will remain in place along with the cautionary area as designated by AMSA of 3 Nm radius charted around the Stag Field facilities.

The Operational Area for the Stag Operations EP is the area within the 500 m radius Restricted Zone that extends around the CPF, subsea export pipeline, and CALM buoy. The Operational Area for the Drilling EP is defined as the area within the 3 Nm radius Restricted Zone that extends around the Stag CPF.

All planned activities will be contained within the Operational Areas.

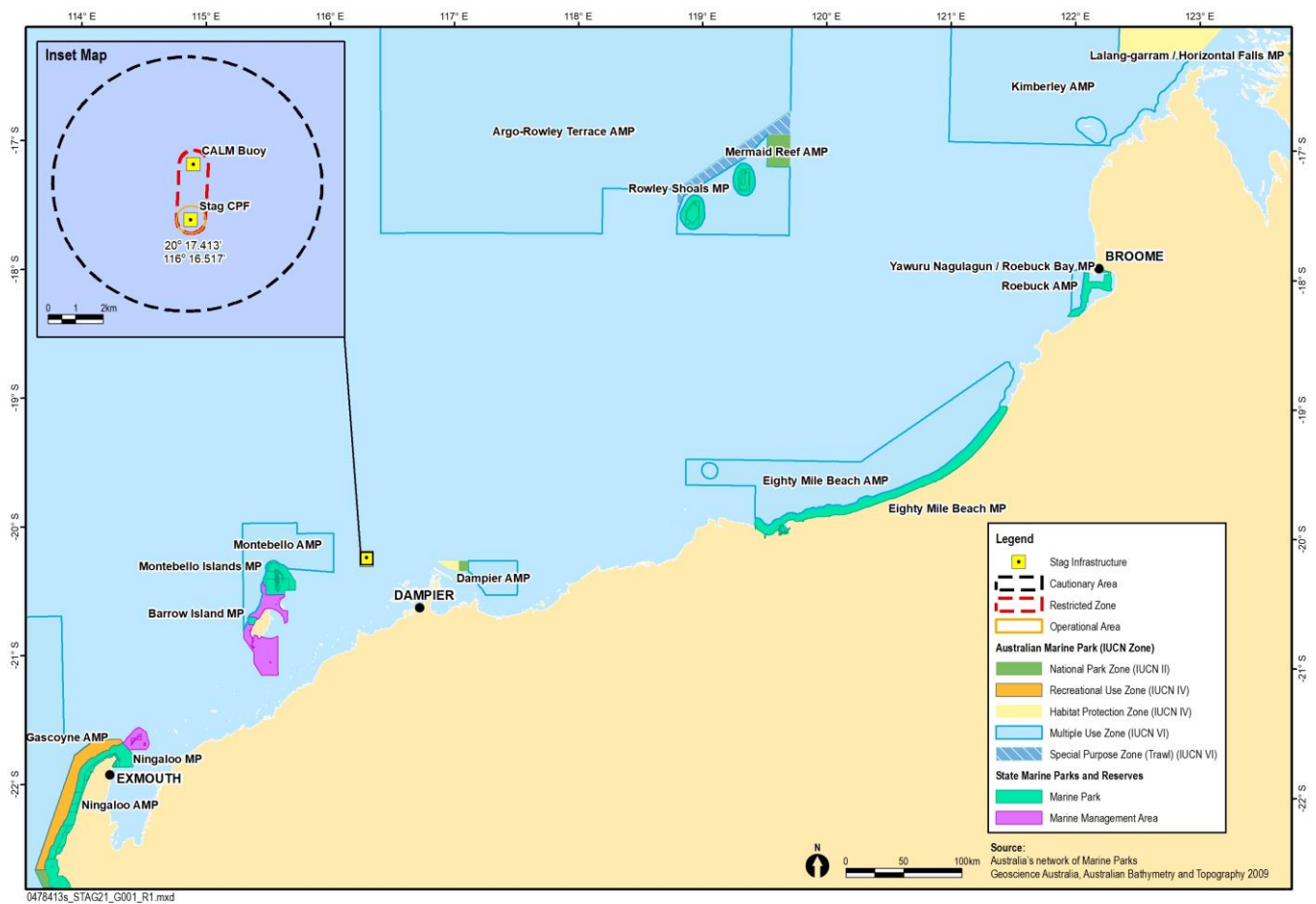


Figure 1 –Stag facility – Location

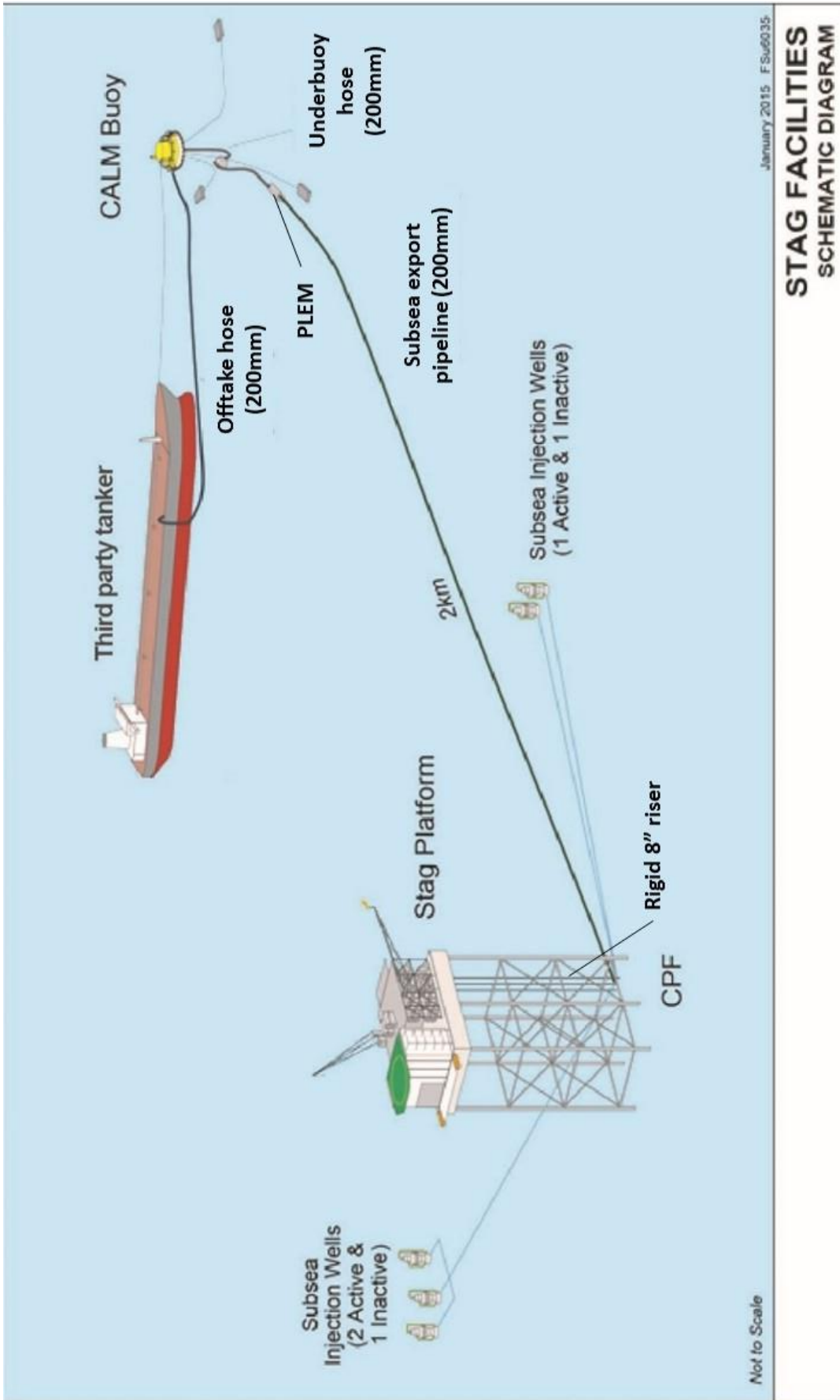


Figure 2 –Stag facility – Existing infrastructure

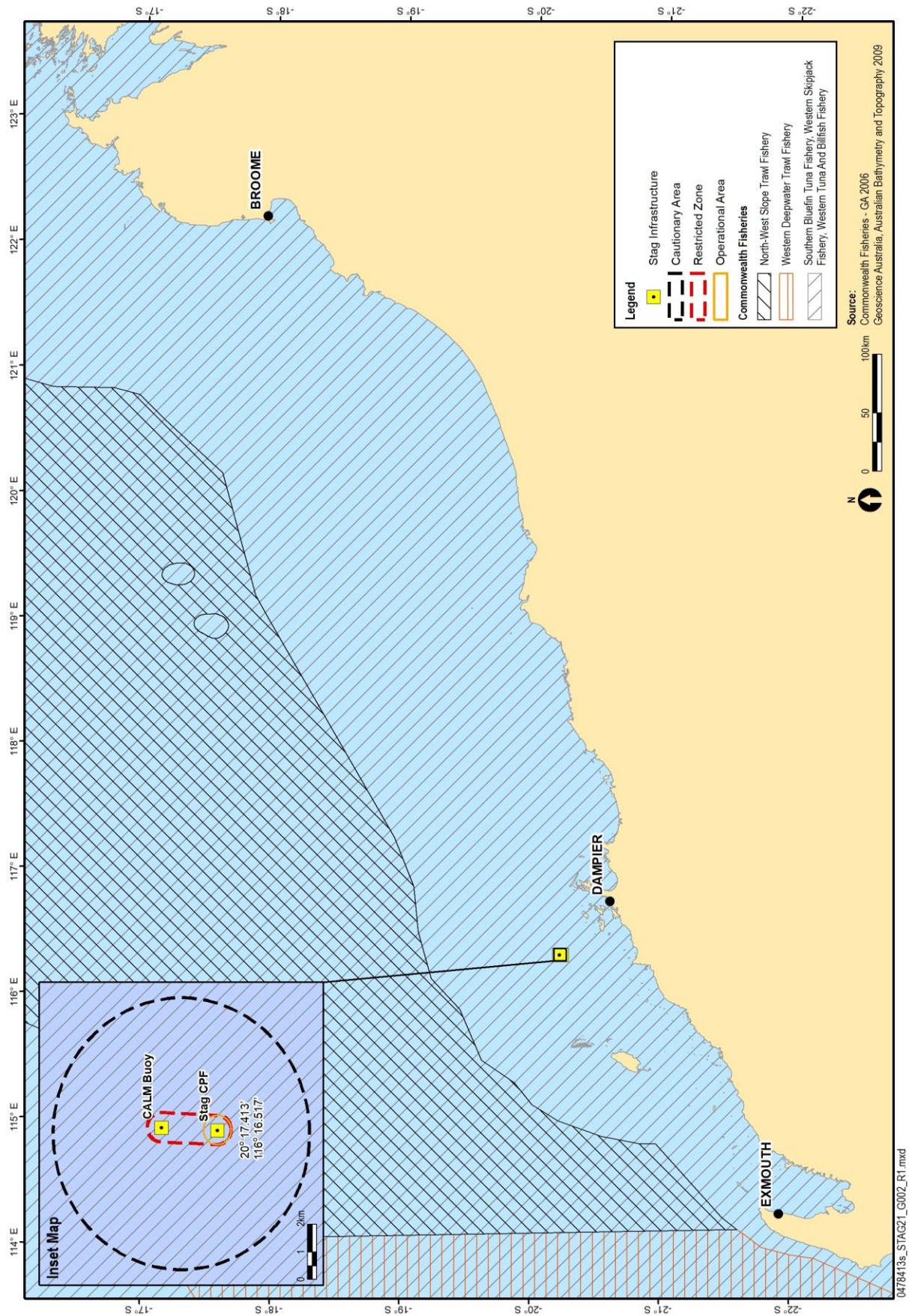


Figure 3 – Commonwealth Commercial Fishing Zones in the vicinity of the Stag Facility

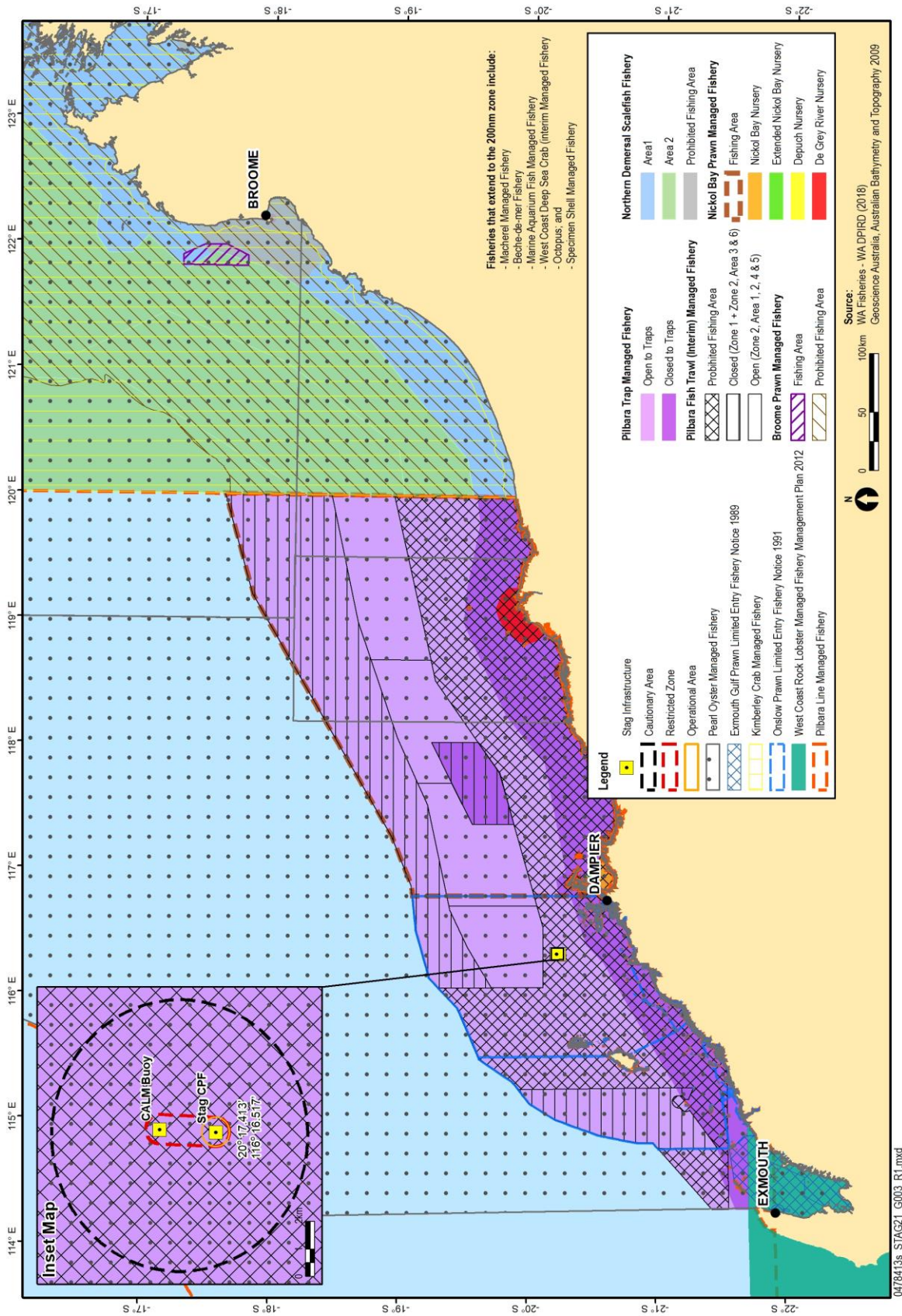


Figure 4 – State Commercial Fishing Zones in the vicinity of the Stag Facility

What fisheries may be affected?

As Figures 3 and 4 indicate, there are a number of fisheries permitted to operate in the operations area. Fisheries that are licensed to operate and were assessed as having potential to utilise this area in the future (based on catch history over the last 5 years) include:

- **Mackerel Managed Fishery - Area 2 (WA)**
- **Onslow Prawn Managed Fishery (WA)**
- **Pilbara Trap Managed Fishery (WA)**
- **Pilbara Line Fishery (WA)**
- **Octopus Developmental Fishery (WA)**

These fisheries will be Jadestone’s focus for consultation. Consultation for other fisheries will take place through notification of State and Commonwealth representative bodies or directly if requested by representative bodies.

In the unlikely event of a hydrocarbon spill, Jadestone Energy will conduct extensive and immediate consultation with other fisheries licensed to operate within the broader Environment that May be Affected (EMBA) by such a spill.

Potential risks to fishing sector

A summary of potential risks to the fishery sector that are common to both Environmental Plan activities is provided below. For each risk the associated management measures are summarised in Table 1.

TABLE 1: POTENTIAL RISKS AND MITIGATION/MANAGEMENT MEASURES COMMON TO BOTH ENVIRONMENT PLANS

Potential Risks	Mitigation and /or Management Measures
Light Emissions	<ul style="list-style-type: none"> • Potential impacts from lighting are assessed as occurring within 20 km of a vessel or facility based on the National Light Pollution Guidelines for Wildlife (Commonwealth of Australia 2019) • Facility and vessel navigation lights are compliant with the Navigation Act 2012
Noise Emissions	<ul style="list-style-type: none"> • Vessels and helicopters comply with relevant parts of EPBC Regulation (2000) Part 8 • Vessel and machinery are maintained in accordance with Flag State certification requirements • All engines, compressors and machinery on the CPF and MODU are maintained via a maintenance management system
Atmospheric Emissions	<ul style="list-style-type: none"> • Flag State Certificate and/or IAPP certifies measures are in place to manage air emissions • All engines, compressors and machinery on the CPF and MODU are maintained via a maintenance management system
Operational discharges	<ul style="list-style-type: none"> • Emissions and discharges of liquid waste to sea are in accordance with legislative requirements, the impact and risk assessment process indicates that discharges will not result in significant effects to marine fauna • Waste Management Plan
Interaction with other users	<ul style="list-style-type: none"> • A pre-existing 500 m restricted zone is in place around the facility and will remain in place for the duration of operations under the proposed EPs, including during the drilling activity as the MODU will be within the 500m restricted zone of the CPF. No fishing vessels are to enter this zone • Commercial fishers are permitted to enter the wider 3Nm cautionary zone and fish, transit or anchor for the duration of operations under the proposed EPs, as long as it is safe to do so • Notice to Mariners and charts will show zones
Interaction with fauna	<ul style="list-style-type: none"> • Vessels operating within the restricted zone must not exceed a speed of five (5) knots • Induction includes information on speed limits and requirements for interacting with marine fauna
Physical Presence	<ul style="list-style-type: none"> • Seabed disturbance limited to planned activities and defined locations

In addition to the risks outlined in Table 1, the risk of produced water discharge is specific to the Stag Operations EP activities (Table 2).

TABLE 2: POTENTIAL RISKS AND MITIGATION/MANAGEMENT MEASURES ASSOCIATED ONLY WITH STAG 5 YEAR OPERATIONS EP

Potential Risks	Mitigation and /or Management Measures
Produced water discharges	<ul style="list-style-type: none"> • Beyond temporary perturbation to water quality, no environmental impacts due to the discharge of produced water are expected • Produced water discharges are monitored and recorded with adaptive management processes in place if significant changes are identified

In addition to the risks outlined in Table 1, the risk of drilling discharges is specific to the Stag Drilling EP activities (Table 3).

TABLE 3: POTENTIAL RISKS AND MITIGATION/MANAGEMENT MEASURES ASSOCIATED ONLY WITH STAG DRILLING EP

Potential Risks	Mitigation and /or Management Measures
Drilling discharges	<ul style="list-style-type: none"> • Selection process for materials as part of NOPSEMA approval • Process for inventory control to minimise leftovers • Cuttings management system in place to manage muds (no synthetic based muds planned for use)

Additional risks that are associated with events that are not expected to occur during normal activities are outlined in Table 4.

TABLE 4: POTENTIAL RISKS AND MITIGATION/MANAGEMENT MEASURES ASSOCIATED ONLY WITH UNPLANNED EVENTS

Potential Risks	Mitigation and /or Management Measures
Introduced Marine Species (IMS)	<ul style="list-style-type: none"> • IMS Management will meet legal requirements and reduce risks to ALARP and Acceptable levels. • Vessels will be required to adhere to ballast water management, quarantine and biofouling requirements if required
Unplanned discharges	<ul style="list-style-type: none"> • No release of non-hazardous / hazardous solid wastes or non-hydrocarbon hazardous liquids to the marine environment • Dropped object prevention • Waste management plan implemented, and details included in induction materials • Spill kits available and incident response plans in place
Vessel/MODU collision	<ul style="list-style-type: none"> • Marine notifications will be made to relevant stakeholders, describing the location of the activity and a 500 m petroleum safety zone is present to prevent the risk of collisions • Vessels operating within the restricted zone must not exceed a speed of five (5) knots • Simultaneous Operations (SIMOPS) plan in place to interface between the Stag facility and MODU during drilling • Navigation lights installed and checked
Hydrocarbon release	<ul style="list-style-type: none"> • Oil Pollution Emergency Plan • Procedures in place on CPF to prevent hydrocarbon release to sea during operations • Procedures in place on MODU to prevent hydrocarbon release to sea during drilling • Appropriate vessel spill response plans, equipment and materials will be in place and maintained • Appropriate refuelling procedures and equipment will be used to prevent spills to the marine environment

Providing Feedback

If you would like to comment on the proposed activity outlined in this fact sheet or would like additional information, please contact Jadestone before Monday 20th December 2021. Feedback can be provided at any time before/during or after the activity.

Phone: 08 9486 6600 Email: consult@jadestone-energy.com

Our Perth office is located at: The Atrium, Level 2, 168 St Georges Terrace, Perth WA 6000



Any person providing feedback is asked to advise if this information is to remain confidential and they do not wish it to be published within the Environment Plan.



Table 2: Relevant persons' engagement log - current

Relevant person	Date	To/from	Engagement logistics	Reference Number	Summary of content	Action undertaken/Status
Commonwealth government department or agency						
Australian Fisheries Management Authority (AFMA)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	30-Jan-23	RECEIVED	How: Email	AFMA	Acknowledgement of receipt, no specific comment at this stage. Noted to consult directly through relevant fishing organisations.	Refer to Assessment of Merit table – this has been undertaken as part of standard consultation approach
	6-Mar-23	SENT	How: Email	AFMA	Acknowledgement of guidance	No further action
Australian Hydrographic Office (AHO)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	23-Dec-22	RECEIVED	How: Email	AHO	Acknowledgement. Data will be registered and charts updated	Noted
	6-Mar-23	SENT	How: Email	AHO	Acknowledgement of email	No further action
Australian Maritime Safety Authority (AMSA)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	23-Dec-22	RECEIVED	How: Email	AMSA	Notification requirements - refer to assessment of merit table for detail	Response assessed and EP updated to include notifications
	6-Mar-23	SENT	How: Email	AMSA	Acknowledgement of email	No further action
Clean Energy Regulator	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	17-Feb-23	SENT	How: Email	G2	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Awaiting response
	3-Mar-23	RECEIVED	How: Email	CER	Email advising no comment from CER	Noted
	22-Mar-23	SENT	How: Email	CER	Acknowledgement of email	No further action

Relevant person	Date	To/from	Engagement logistics	Reference Number	Summary of content	Action undertaken/Status
Department of Agriculture, Fisheries & Forestry (DAFF)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	22-Dec-22	RECEIVED	How: Email	DAFF_AutoResponse	Auto Response email received	N/A
	17-Feb-23	SENT	How: Email	G3	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Awaiting response. Read receipt received
	17-Feb-23	RECEIVED	How: Email	DAFF_AutoResponse_2	Auto Response email received	Awaiting response
	26-Apr-23	PLACED	How: Call	N/A	Called to follow up email	No response. Call again
Department of Defence (DOD)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	14-Feb-23	RECEIVED	How: Email	DOD	Acknowledgement of receipt and confirmation that activity area is outside of any Defence Training Areas and restricted airspace. Advised of risk of UXOs. Please provide continued liaison with AHO for Notice to Mariners	Noted. EP updated to include notifications
	6-Mar-23	SENT	How: Email	DOD	Acknowledgement of email	No further action
Department of Industry, Science & Resources (DISR)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	17-Feb-23	SENT	How: Email	G2	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Awaiting response. Read receipt received
	20-Apr-23	PLACED	How: Call	N/A	Called DISR to confirm receipt of information package. More appropriate email address provided	Relevant contact details recorded and emailed information package
	20-Apr-23	SENT	How: Email	DISR	Email sent to updated email address with information package	Awaiting response

Relevant person	Date	To/from	Engagement logistics	Reference Number	Summary of content	Action undertaken/Status
Director of National Parks (DNP), Parks Australia, part of the Department of Climate Change, Energy, the Environment and Water (DCCEEW)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	4-Jan-23	RECEIVED	How: Email	DNP	Acknowledgement of receipt and confirmation that no objections or claims at this time. Provision of relevant guidance note details and notification requirements	Refer to Assessment of Merit table. EP updated to include notifications.
	6-Mar-23	SENT	How: Email	DNP	Acknowledgement of email	No further action
Maritime Border Command (MBC), part of Australian Border Force (ABF), part of the Department of Home Affairs (DHA)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	17-Feb-23	SENT	How: Email	G2	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Awaiting response
National Offshore Petroleum Titles Administrator (NOPTA)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	17-Feb-23	SENT	How: Email	G2	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Awaiting response. Read receipt received
	17-Feb-23	RECEIVED	How: Email	NOPTA	Email advising NIL response from NOPTA as they do not provide comment on EPs	Noted
	6-Mar-23	SENT	How: Email	NOPTA	Acknowledgement of email	No further action
WA State government department or agency						
Department of Biodiversity, Conservation and Attractions (DBCA)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	22-Dec-22	RECEIVED	How: Email	DBCA_AutoResponse	Auto Response email received	N/A
	9-Feb-23	RECEIVED	How: Email	DBCA	Email around baseline survey data for the current area and notification requirements	Baseline data summary for SMPs sent to DBCA and notification requirements amended in A6 of OPEP and EPS added.

Relevant person	Date	To/from	Engagement logistics	Reference Number	Summary of content	Action undertaken/Status
	4-May-23	SENT	How: Email	DBCA	Email sent providing summary of baseline data and incident and emergency response amendment	No further action
Department of Mines, Industry Regulation and Safety (DMIRS)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	17-Feb-23	SENT	How: Email	G2	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Awaiting response
	19-Apr-23	PLACED	How: Call	N/A	Called DMIRS to confirm receipt of information package. Unable to confirm if package received. Asked to resend to different email	Information package sent to updated email
	19-Apr-23	SENT	How: Email	DMIRS	Email sent to DMIRS with information package	Awaiting response
Department of Planning, Lands & Heritage (DPLH)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	22-Dec-22	RECEIVED	How: Email	DPLH_AutoResponse	Auto Response email received	N/A
	17-Feb-23	SENT	How: Email	G2	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Awaiting response
	27-Apr-23	PLACED	How: Call	N/A	Left a message asking DPHL to call Jadestone to confirm if consultation package was received and provide any feedback	Awaiting return call
Department of Primary Industries and Regional Development (DPIRD)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	17-Feb-23	SENT	How: Email	G2	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Awaiting response

Relevant person	Date	To/from	Engagement logistics	Reference Number	Summary of content	Action undertaken/Status
	26-Apr-23	PLACED	How: Call	N/A	Left a message asking DPIRD to call Jadestone to confirm if consultation package was received and provide any feedback	Awaiting return call
Department of Transport (DOT)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	5-Jan-23	RECEIVED	How: Email	WA DOT	Acknowledgement of receipt. Provision of relevant guidance <u>note details</u> .	Noted
Department of Water & Environmental Regulation (DWER)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	22-Dec-22	RECEIVED	How: Email	DWER_AutoResponse	Auto Response email received	N/A
	17-Feb-23	SENT	How: Email	G3	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the <u>regulations</u>	Awaiting response
	17-Feb-23	RECEIVED	How: Email	DWER_AutoResponse_2	Auto Response email received	Awaiting response
	20-Feb-23	RECEIVED	How: Email	DWER	Email advising no comment from DWER as does not relate to any <u>active projects</u>	Noted
	6-Mar-23	SENT	How: Email	DWER	Acknowledgement of email	No further action
Local Government Authorities						
Shire of Ashburton	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	4-Jan-23	RECEIVED	How: Email	SOA_AutoResponse	Acknowledgement of receipt. Email has been forwarded to <u>relevant shire officer</u>	Awaiting response
	17-Feb-23	SENT	How: Email	G3	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the <u>regulations</u>	Awaiting response
	20-Feb-23	RECEIVED	How: Email	SOA_AutoResponse_2	Acknowledgement of receipt. Email has been forwarded to <u>relevant shire officer</u>	Awaiting response

Relevant person	Date	To/from	Engagement logistics	Reference Number	Summary of content	Action undertaken/Status
	20-Feb-23	RECEIVED	How: Email	SOA	SOA highlighted the possible risk of impact to the Montebello islands, Barrow Island and further afield should any hydrocarbon spill occur. All appropriate measures should be undertaken to mitigate any environmental impacts	Response assessed. Refer to Assessment of Merit Table
	23-Mar-23	SENT	How: Email	SOA	Confirmation that EP includes appropriate measures to mitigate environmental impacts should a spill occur. The Montebello Islands and Barrow Island are listed as protection priorities for spill response in the Stag OP and OPEP	No further action
City of Karratha	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	5-Jan-23	RECEIVED	How: Email	COK	Acknowledgement of receipt and that some facilities and reserves are within the EMBA however no significant concerns at this stage	Noted
	6-Mar-23	SENT	How: Email	COK	Acknowledgement of email	No further action
Shire of Exmouth	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	17-Feb-23	SENT	How: Email	G2	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Awaiting response. Read receipt received
	19-Apr-23	PLACED	How: Call	N/A	Called Shire of Exmouth to confirm receipt of information package. Asked for package to be resent	Package resent
	19-Apr-23	SENT	How: Email	SOE	Information package resent	Awaiting response
Oil and Gas Industry						

Relevant person	Date	To/from	Engagement logistics	Reference Number	Summary of content	Action undertaken/Status
Australian Maritime Oil Spill Centre (AMOSC)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response Read receipt received
	17-Feb-23	SENT	How: Email	G2	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Awaiting response
	20-Feb-23	RECEIVED	How:Email	AMOSC	Acknowledgement of receipt. Require a copy of the EP and OPEP prior to submission to NOPSEMA. Requests 2 weeks to review the plans	Email sent with requested documents
	12-Apr-23	SENT	How: Email	AMOSC	Email sent with Stag OPEP and relevant risk scenarios from Stag EP as requested	No further action
Oil Spill Response Limited (OSRL)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	17-Feb-23	SENT	How: Email	G2	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Awaiting response
	27-Apr-23	PLACED	How: Call	N/A	Left a message asking OSRL to call Jadestone to confirm if consultation package was received and provide any feedback	Awaiting return call
WA Commercial fishers and fishing associations						
Western Australian Fishing Industry Council (WAFIC)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	8-Feb-23	PLACED	How: Call	WAFIC	Initial discussion seeking assistance of WAFIC to identify licence holders undertaking fishing effort in EMBA	N/A

Relevant person	Date	To/from	Engagement logistics	Reference Number	Summary of content	Action undertaken/Status
	9-Feb-23	SENT	How: Email	WAFIC_1	Email sent asking if WAFIC can undertake review of commercial fishing licence holders as part of their fee for service to help determine which licence holders may undertake fishing effort within the EMBA and require further consultation	Awaiting response
	13-Feb-23	RECEIVED	How: Email	WAFIC_1	WAFIC are unable to review or comment on list and do not support consultation with all licence holders who intersect a project EMBA, rather will only consult with those directly impacted by planned activities within a projects Operational	Noted.
	15-Feb-23	PLACED	How: Call	WAFIC_2	WAFIC can only provide advice on fishing licence holders within Operational Area	Noted.
	17-Feb-23	PLACED	How: Call	WAFIC_3	WAFIC reiterated that they will only provide information based on Operational Area	Noted.
Commonwealth Commercial fishers and fishing associations						
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	17-Feb-23	SENT	How: Email	G2	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Awaiting response
	17-Feb-23	SENT	How: Email	ASBTIA	Email seeking advice regarding presumption that no fishing effort taking place for Southern Bluefin Tuna Fishery off NW WA	Awaiting reponse
	21-Feb-23	PLACED	How: Call	N/A	Called to follow up email	No response. Call again
	23-Feb-23	PLACED	How: Call	N/A	Called to follow up email	No response.
	22-Mar-23	PLACED	How: Call	ASBTIA_1	Indirectly indicated that there is no commercial Southern Bluefin Tuna fishing effort undertaken within or adjacent to EMBA	Noted.
Commonwealth Fisheries Association (CFA)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response

Relevant person	Date	To/from	Engagement logistics	Reference Number	Summary of content	Action undertaken/Status
	9-Feb-23	RECEIVED	How: Email	CFA	CFA is not resourced to provide feedback, Suggested directing enquiries to associations that represent the directly affected fisheries/fishers	Noted. The suggested fisheries/fishers have already been consulted. No further action
Seafood Industry Australia (SIA)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	N/A
	22-Dec-22	RECEIVED	How:Email	SIA_AutoResponse	Automatic email response	Awaiting response
	9-Feb-23	SENT	How: Email	G2	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Awaiting response
	26-Apr-23	PLACED	How: Call	N/A	Left a message asking SIA to call Jadestone to confirm if consultation package was received and provide any feedback	Awaiting return call
Recreational fishing associations						
Recfishwest (WA)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response. Read receipt received
	17-Feb-23	SENT	How: Email	G2	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Response assessed and EP updated to include notifications.
	22-Feb-23	RECEIVED	How:Email	Recfishwest	Email advising it is not expected there will be any new impacts based on the information provided. Asked to be added to incident notifications - refer to assessment of merit table for detail	No further action
	6-Mar-23	SENT	How: Email	Recfishwest	Acknowledgement of email	Awaiting response
First Nations peoples						
Buurabalayji Thalanyji Aboriginal Corporation	20-Apr-23	SENT	How: Email	Buurabalayji	Email seeking opportunity to meet with Directors to introduce Stag project and seek advice on the most appropriate means of undertaking consultation	Awaiting response
	3-May-23	SENT	How: Email	Buurabalayji	Reminder email sent	N/A

Relevant person	Date	To/from	Engagement logistics	Reference Number	Summary of content	Action undertaken/Status
	3-May-23	RECEIVED	How: Email	Buurabalayji	Acknowledgement of email, will respond shortly	Response sent
	3-May-23	SENT	How: Email	Buurabalayji	Acknowledgement email	Awaiting response
Kariyarri Aboriginal Corporation	20-Apr-23	SENT	How: Email	Kariyarri	Email seeking opportunity to meet with Directors to introduce Stag project and seek advice on the most appropriate means of undertaking consultation	Awaiting response
	3-May-23	SENT	How: Email	Kariyarri	Reminder email sent	Awaiting response
Malgana Aboriginal Corporation	20-Apr-23	SENT	How: Email	Malgana	Email seeking opportunity to meet with Directors to introduce Stag project and seek advice on the most appropriate means of undertaking consultation	Awaiting response
	3-May-23	SENT	How: Email	Malgana	Reminder email sent	Awaiting response
Nanda Aboriginal Corporation	3-May-23	SENT	How: Email	Nanda	Email seeking opportunity to meet with Directors to introduce Stag project and seek advice on the most appropriate means of undertaking consultation	Awaiting response
Nganhurra Thanardi Garrbu Aboriginal Corporation	20-Apr-23	SENT	How: Email	Nganhurra Thanardi Garrbu	Email seeking opportunity to meet with Directors to introduce Stag project and seek advice on the most appropriate means of undertaking consultation	Awaiting response
	21-Apr-23	RECEIVED	How: Email	Nganhurra Thanardi Garrbu	Email detailing next available board meeting 5 September	Response sent
	3-May-23	SENT	How: Email	Nganhurra Thanardi Garrbu	Email confirming Jadestone will present to directors at next board meeting	Jadestone to attend board meeting 5 September 2023
Ngarluma Aboriginal Corporation	20-Apr-23	SENT	How: Email	Ngarluma	Email seeking opportunity to meet with Directors to introduce Stag project and seek advice on the most appropriate means of undertaking consultation	Awaiting response
	3-May-23	SENT	How: Email	Ngarluma	Reminder email sent	Awaiting response
Nyangumarta Karajarri Aboriginal Corporation	3-May-23	SENT	How: Email	Nyangumarta Karajarri	Email trying to find contact details for the Corporation	Awaiting response
Nyangumarta Warrarn Aboriginal Corporation	3-May-23	SENT	How: Email	Nyangumarta Warrarn	Email seeking opportunity to meet with Directors to introduce Stag project and seek advice on the most appropriate means of undertaking consultation	Awaiting response
Wanparta Aboriginal Corporation	20-Apr-23	SENT	How: Email	Wanparta	Email seeking opportunity to meet with Directors to introduce Stag project and seek advice on the most appropriate means of undertaking consultation	Awaiting response

Relevant person	Date	To/from	Engagement logistics	Reference Number	Summary of content	Action undertaken/Status
	27-Apr-23	RECEIVED	How: Email	Wanparta	Acknowledgment of receipt, will liaise with Directors and revert in due course	N/A
	27-Apr-23	SENT	How: Email	Wanparta	Asked where directors meet	N/A
		RECEIVED	How: Email	Wanparta	Board meetings held in Port Hedland	Awaiting response from Directors
Wirrawandi Aboriginal Corporation	20-Apr-23	SENT	How: Email	Wirrawandi	Email seeking opportunity to meet with Directors to introduce Stag project and seek advice on the most appropriate means of undertaking consultation	Awaiting response
	3-May-23	SENT	How: Email	Wirrawandi	Reminder email sent	Awaiting response
	3-May-23	RECEIVED	How: Email	Wirrawandi	Email received, would like opportunity to meet	Jadestone organising meeting
Yamatji Marlpa Aboriginal Corporation (YMAC)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response. Read receipt received
	1-Mar-23	RECEIVED	How: Email	YMAC_1	Email with attachment asking for response	Note: original email sent by YMAC on 6th February not received due to incorrect email
	3-Mar-23	SENT	How: Email	YMAC_1	Responded to February 6 email and Jadestone requested face to face meeting with YMAC	Response sent
	4-Apr-23	MEETING	How: In person meeting in Perth	YMAC_2	Meeting to seek YMAC assistance in identifying and engaging with individual TO groups	Response sent
	19-Apr-23	RECEIVED	How: Email	YMAC_2	Acknowledgment of email, will review and respond	Awaiting response
Yinggarda Aboriginal Corporation	3-May-23	SENT	How: Email	Yinggarda	Email seeking opportunity to meet with Directors to introduce Stag project and seek advice on the most appropriate means of undertaking consultation	Awaiting response
Port Authorities						
Pilbara Ports Authority	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	17-Feb-23	SENT	How: Email	G2	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Noted

Relevant person	Date	To/from	Engagement logistics	Reference Number	Summary of content	Action undertaken/Status
	17-Feb-23	RECEIVED	How:Email	PilbaraPorts	Acknowledgement of receipt. Pilbara Ports has no comment. Confirmation that email address is correct for future engagement	No further action
	6-Mar-23	SENT	How: Email	PilbaraPorts	Acknowledgement of email	Awaiting response
eNGOs						
Conservation Council of Western Australia (CCWA)	4-May-23	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Montara EP and details on why they have been engaged and what is required	Awaiting response
Greenpeace	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	N/A
	22-Dec-22	RECEIVED	How:Email	GP_AutoResponse	Automatic email response	Awaiting response
	17-Feb-23	SENT	How: Email	G2	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Awaiting response
	17-Feb-23	RECEIVED	How: Email	GP_AutoResponse_2	Auto Response email received	Awaiting response
	24-Feb-23	RECEIVED	How: Email	Greenpeace	Correspondence received in relation to Stag and Montara EPs. Requesting information on emissions, spill modelling and spill response plan as well as information on how Jadestone have identified relevant persons	Response email sent
	31-Mar-23	SENT	How: Email	Greenpeace_1	Response sent to queries raised in email	No further action
The Wilderness Society	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	17-Feb-23	SENT	How: Email	G2	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Awaiting response
	13-Feb-23	RECEIVED	How: Email	TWS	Acknowledgement of receipt. Will make comment by 21.02.2023	Awaiting response by 21 February

Relevant person	Date	To/from	Engagement logistics	Reference Number	Summary of content	Action undertaken/Status
World Wildlife Fund (WWF)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	17-Feb-23	SENT	How: Email	G2	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Awaiting response
Other Associations						
Australian Council of Prawn Fisheries	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	17-Feb-23	SENT	How: Email	G2	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Awaiting response
King Bay Game Fishing Club (KBGFC)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	17-Feb-23	SENT	How: Email	G2	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Noted
	18-Feb-23	RECEIVED	How: Email	KBGFC	Acknowledgement of receipt. KBGFC have no questions and appreciate the information. Confirmed contact details for future engagement	No further action
	6-Mar-23	SENT	How: Email	KBGFC	Acknowledgement of email	Awaiting response
Exmouth Game Fishing Club	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	17-Feb-23	SENT	How: Email	G2	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Awaiting response

Relevant person	Date	To/from	Engagement logistics	Reference Number	Summary of content	Action undertaken/Status
	19-Apr-23	PLACED	How: Call	N/A	Left a message asking Exmouth GFC to call Jadestone to confirm if consultation package was received and provide any feedback	Awaiting return call
Karratha and Districts Chamber of Commerce and Industry	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	17-Feb-23	SENT	How: Email	G2	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Awaiting response
	19-Apr-23	PLACED	How: Call	N/A	Left a message asking KDCCI to call Jadestone to confirm if consultation package was received and provide any feedback	Awaiting return call
Nickol Bay Sport Fishing Club	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	17-Feb-23	SENT	How: Email	G2	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Awaiting response
	19-Apr-23	PLACED	How: Call	N/A	Called Nickol Bay SFC to confirm receipt of information package. Asked for package to be resent.	Package resent
	19-Apr-23	SENT	How: Email	NBSFC	Information package resent	Awaiting response
Marine Tourism Association of Western Australia (MTWA)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	17-Feb-23	SENT	How: Email	G2	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Awaiting response

Relevant person	Date	To/from	Engagement logistics	Reference Number	Summary of content	Action undertaken/Status
	23-Feb-23	PLACED	How: Call	N/A	Called MTWA to confirm receipt of information package. Package received. Will review and respond.	Awaiting response
Academic and Research Organisations						
Australian Institute of Marine Science (AIMS)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	17-Feb-23	SENT	How: Email	G2	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Awaiting response
Australian Marine Conservation Society (AMCS)	22-Dec-22	SENT	How: Email	G1	Email sent to stakeholder with attached information package providing an update on 5 year revision of Stag EP and details on why they have been engaged and what is required	Awaiting response
	17-Feb-23	SENT	How: Email	G2	Reminder- Given no correspondence, email sent to stakeholder to try and elicit a response as required by the regulations	Awaiting response

Jadestone
Energy



Invitation for Consultation
Stag Field Operations
and Future Activities

Invitation for Consultation

Jadestone Energy (Jadestone) is the operator of the existing Stag Field off the Pilbara coast. Jadestone is preparing two Environment Plans (EPs) for assessment by the Commonwealth regulatory authority, the National Offshore Petroleum Regulatory Authority (NOPSEMA).

The Environment Plans are for:

- **Ongoing production and maintenance at the Stag Facility (Stag Operations); and**
- **Plugging and abandonment of production wells and drilling new production wells at the Stag Facility as needed (Stag Drilling).**

Jadestone invites comments for its consideration during the period of the preparation of each EP.



Who is Jadestone Energy?

Jadestone is a leading upstream oil and gas company in the Asia Pacific region, with a focus on production and near-term development assets. The company is listed on the Alternative Investment Market of the London Stock Exchange (JSE).

Contact details for Jadestone's Australian Operations are provided at the end of this document.

What is an Environment Plan?

The purpose of an EP is to identify the proposed petroleum activity's impacts on and risks to the environment. The EP also sets measures to reduce identified environmental impacts, potential risks due to the activity, and describe how and to what level of performance those measures will be implemented throughout the activity, including in the unlikely event of an unplanned event, e.g., hydrocarbon spill.

NOPSEMA requires that the existing EP, in place for Stag operations, must be revised and resubmitted every five years, or sooner if required.

There will be two EPs.

One for the existing Stag Operations which is now due its five-year revision, and one for Stag Drilling, for the abandonment of production wells and for drilling new production wells.

- The Stag Operations revision EP is currently in preparation, covering activities associated with production; oil loading to a third-party tanker; the inspection, maintenance and repair of the calm buoy; central processing facility; subsea export pipeline; wells; associated subsea infrastructure; and non-routine / unplanned activities and events should they arise.
- The Stag Drilling EP is for the abandonment of existing wells before drilling new production wells from the facility, using a mobile offshore drilling unit (MODU) or drilling rig. The abandonment of existing wells and the drilling of new wells is required to maintain production. These activities occur approximately every two years (last drilled November 2022) and a five-year term drilling EP will be prepared in 2023.

Why are you being engaged?

Jadestone has identified that you or your organisation is a 'relevant person' under the Offshore Petroleum and Greenhouse Gas (Environment) Regulations 2009 because of your functions, activities, or interests within the operational area and Environment that Might Be Affected (EMBA) for Stag.

This is defined as the area that might be affected by planned events that will occur within a defined operational area or unplanned events which could extend beyond the defined operational area e.g., in the low likelihood of an unplanned hydrocarbon spill.

What do we do with information provided?

In line with Regulation 9(8) of the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009, correspondence between Jadestone and you or your organisation must be provided to NOPSEMA. All comments are compiled into a report and are published in the publicly available EP, with names and contact details redacted.

There is, however, the opportunity for you to request that your correspondence not be published. That is, whilst the correspondence is still required to be provided to NOPSEMA, it will be provided in a separate report that is for NOPSEMA only and is not published.

Please notify Jadestone of any correspondence that we receive from you or your organisation that you wish to be confidential.

All comments received by Jadestone will be carefully assessed to understand the potential impacts of the activity upon you or your organisation as a relevant person, that is your functions, activities, or interests. Jadestone's assessment will be provided to you and documented in the EP.

How do I find out more?

Further information on Jadestone's Stag facility is available on our website: <https://www.jadestone-energy.com/assets/australia-portfolio/stag/>

Following NOPSEMA's completion of its pre-assessment checks of the EP it will be published, minus any confidential material, on the NOPSEMA's website.

https://info.nopsema.gov.au/offshore_projects/19/show_public

What do Jadestone want to know?

Jadestone is committed to ongoing dialogue with all its stakeholders and welcomes your or your organisation's comments at any time.

Please let us know if you:

- have any comments on the activity and the potential impacts on you or your organisation's interests
- require any further information
- have any preference on how we contact you in the future
- need anything further from us to assist you with comments you might wish to make.

Could you also help us make an informed decision about your requirement for ongoing consultation by letting us know if you do not wish to receive further updates for activities associated with the Stag field operations or drilling activities.

What Happens next?

Jadestone will make reasonable efforts to consult with all parties that have been identified as potentially relevant persons.

Please be aware that it is a requirement of NOPSEMA that Jadestone documents no responses to this Invitation for Consultation, and consequently, if no response is received, Jadestone may make follow-up contact with you or your organisation several times to seek a response.

Location

The Stag Field is located on the Northwest Shelf, approximately 60 km north-west of Dampier. The permit area (WA-15-L) is in Commonwealth waters. The water depth at the Stag Field is 49 m LAT. Location details are on Figure 1, including key features in the area.

The distance to Australian Marine Parks (AMP) and other key features in the area is indicated in table 1.

Table 1: Distance to Regional Features

Regional Feature	Distance from Stag CPF
Montebello AMP	30 km
Dampier Archipelago	32 km
Dampier AMP	60 km
Closest Montebello Island	75 km

The Stag facility has been producing since 1998 with the required restricted zone in place. Petroleum Safety Zone (PSZ) extends 500 m around the following Stag infrastructure:

- central processing facility
- catenary anchor leg mooring (CALM) buoy
- 2 km long carbon steel export oil pipeline

Pursuant to Section 616 of the Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGGS Act) all vessels, other than those under the control of Jadestone or authorised by Jadestone, are prohibited from entering or being present in the PSZ.

A cautionary zone of 2.5nm radius is maintained around the facilities, with the centre located 1.4 km due north of the CPF. Although vessels are requested to avoid navigating, anchoring and fishing within the cautionary zone, it is not an exclusion zone.

All current activities are contained within the PSZ, although vessel activities and offtakes may occur outside of the defined PSZ, but within the cautionary zone.

Future activities such as drilling, including MODU activity, will be contained within the defined Operational Areas in permit area WA-15-L.

In the unlikely event of a significant unplanned event, e.g., hydrocarbon spill, the values in the EMBA (habitats and locations), having been identified in the EP, will be prioritised for prompt protection activities.

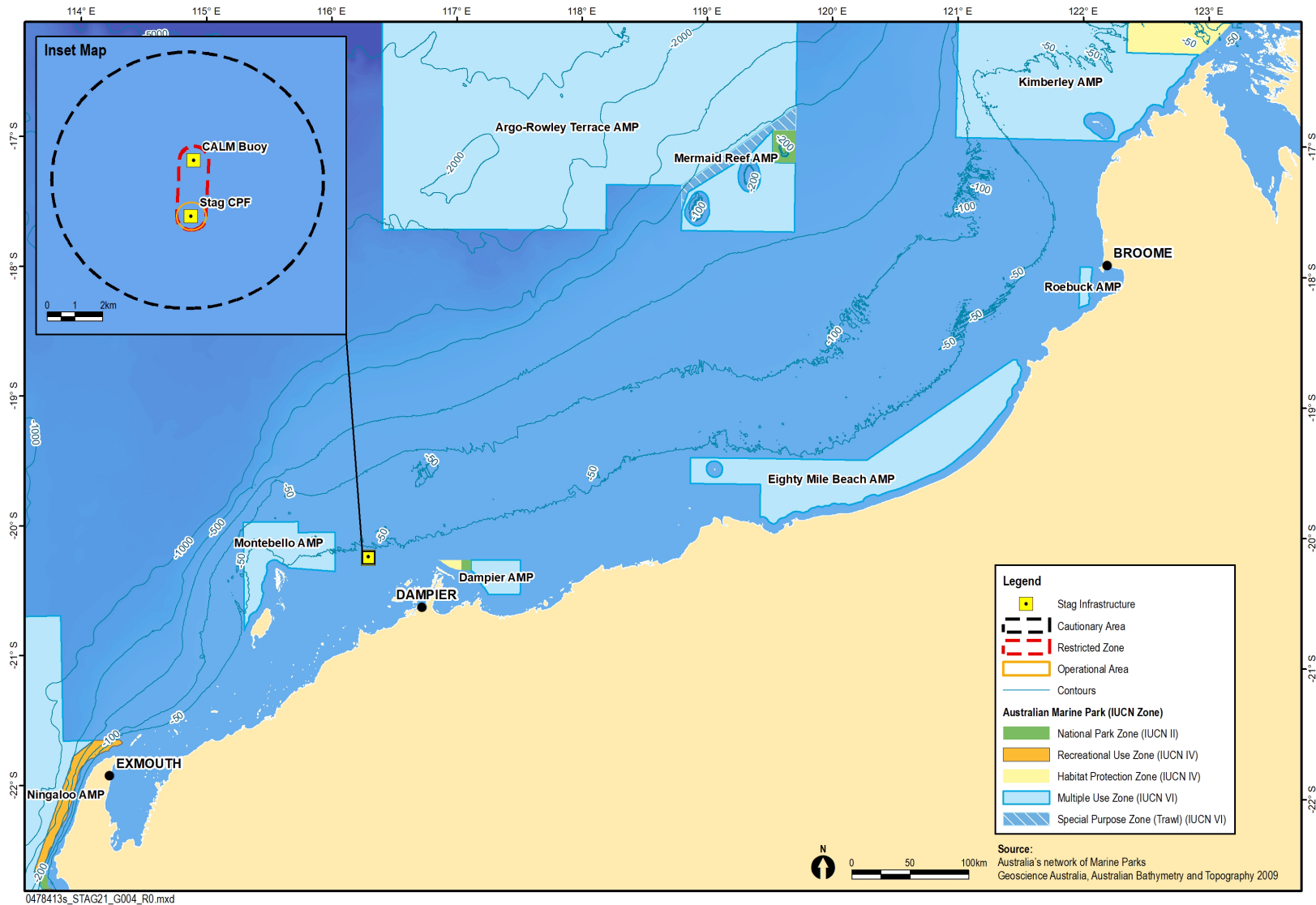


Figure 1 – Location map

Potential Risks and Management

A summary of potential risks to relevant persons who may have functions, activities or interests within the EMBA, that are common to all planned activities, is provided below. For each risk the associated management measures are summarised in Table 1.

TABLE 1: POTENTIAL RISKS AND MITIGATION/MANAGEMENT MEASURES COMMON TO BOTH ENVIRONMENT PLANS

Potential Risks	Mitigation and /or Management Measures
Light Emissions	<ul style="list-style-type: none"> - Potential impacts from lighting are assessed as occurring within 20 km of a vessel or facility based on the National Light Pollution Guidelines for Wildlife (Commonwealth of Australia 2019) - Facility and vessel navigation lights are compliant with the Navigation Act 2012.
Noise Emissions	<ul style="list-style-type: none"> - Vessels and helicopters comply with relevant parts of Environment Protection and Biodiversity Conservation (EPBC) Regulation (2000) Part 8 - Vessel and machinery are maintained in accordance with Flag State certification requirements. - All engines, compressors and machinery on the CPF and Mobile Offshore Drilling Rig (MODU) are maintained via a maintenance management system
Atmospheric Emissions	<ul style="list-style-type: none"> - Flag State Certificate and/or IAPP certifies measures are in place to manage air emissions - All engines, compressors and machinery on the CPF and MODU are maintained via a maintenance management system
Liquid (operational) discharges	<ul style="list-style-type: none"> - Emissions and discharges of liquid waste to sea are in accordance with legislative requirements, the impact and risk assessment process indicates that discharges will not result in significant effects to marine fauna - Waste Management Plan
Interaction with other users	<ul style="list-style-type: none"> - A pre-existing 500 m restricted zone is in place around the infrastructure and will remain in place for the duration of operations under the proposed EPs, including during the drilling activity as the MODU will be within the 500m restricted zone of the CPF. No fishing vessels are to enter this zone - Marine notifications will be made to relevant stakeholders, describing the location of the activity and a 500 m petroleum safety zone is present to prevent the risk of collisions and marked on charts - Commercial fishers are permitted to enter the wider 2.5 Nm cautionary zone and fish, transit or anchor for the duration of operations under the proposed EP, but not the 500m exclusion zone, as long as it is safe to do so - Consultation is undertaken with all relevant persons -
Physical Footprint	<ul style="list-style-type: none"> - Plans are in place for any future decommissioning including inspection and maintenance of all infrastructure - Surveys of seabed undertaken prior to integrity, maintenance or repair work - Seabed disturbance limited to planned activities and defined locations

In addition to the risks outlined in Table 1, the risk of produced water discharge is specific to the Stag Operations EP activities (Table 2).

TABLE 2: POTENTIAL RISKS AND MITIGATION/MANAGEMENT MEASURES ASSOCIATED ONLY WITH STAG OPERATIONS EP

Potential Risks	Mitigation and /or Management Measures
Produced water discharges	<ul style="list-style-type: none"> - Beyond temporary perturbation to water quality, no environmental impacts due to the discharge of produced water are expected - Produced water discharges are monitored and recorded with adaptive management processes in place if significant changes are identified

In addition to the risks outlined in Table 1, the risk of drilling discharges is specific to the Stag Drilling EP activities (Table 3).

TABLE 3: POTENTIAL RISKS AND MITIGATION/MANAGEMENT MEASURES ASSOCIATED ONLY WITH STAG DRILLING EP

Potential Risks	Mitigation and /or Management Measures
Drilling discharges	<ul style="list-style-type: none"> - Selection process for materials as part of NOPSEMA approval - Process for inventory control to minimise leftovers - Cuttings management system in place to manage muds (no synthetic based muds planned for use)

Additional risks that are associated with events that are not expected to occur during normal activities are outlined in Table 4.

TABLE 4: POTENTIAL RISKS AND MITIGATION/MANAGEMENT MEASURES ASSOCIATED ONLY WITH UNPLANNED EVENTS

Potential Risks	Mitigation and /or Management Measures
Introduced Marine Species (IMS)	<ul style="list-style-type: none"> - IMS Management will meet legal requirements and reduce risks to As Low As Reasonably Practicable (ALARP) and Acceptable levels. - Vessels will be required to adhere to ballast water management, quarantine and biofouling requirements if required
Interaction with fauna	<ul style="list-style-type: none"> - Vessels operating within the restricted zone must not exceed a speed of five (5) knots - Induction includes information on speed limits and requirements for interacting with marine fauna
Unplanned discharges	<ul style="list-style-type: none"> - No release of non-hazardous / hazardous solid wastes or non-hydrocarbon hazardous liquids to the marine environment - Limitations of flaring volumes - Integrity and maintenance requirements maintained - Dropped object prevention - Waste management plan implemented, and details included in induction materials - Competent and trained personnel are inducted and have appropriate qualifications - Spill kits available and incident response plans in place
Vessel/MODU collision	<ul style="list-style-type: none"> - Marine notifications will be made to relevant stakeholders, describing the location of the activity and a 500 m petroleum safety zone is present to prevent the risk of collisions - Vessels operating within the restricted zone must not exceed a speed of five (5) knots - Simultaneous Operations (SIMOPS) plan in place to interface between the Stag facility and MODU during drilling - Navigation lights installed and checked
Hydrocarbon release	<ul style="list-style-type: none"> - NOPSEMA accepted Oil Pollution Emergency Plan (OPEP) and well operations management plan (WOMP) - Procedures in place on CPF and FPSO to prevent hydrocarbon release to sea during operations - Procedures in place on MODU to prevent hydrocarbon release to sea during drilling - Maintenance and integrity checks and inspections - Appropriate vessel/MODU spill response plans, equipment and materials will be in place and maintained - Appropriate refuelling procedures and equipment will be used to prevent spills to the marine environment

Providing Feedback

If you would like to comment on the proposed activities outlined in this fact sheet or would like additional information, please contact Jadestone before 17th February 2023.

Email: consult@jadestone-energy.com

Phone: 08 9486 6600

The Atrium, Level 2, 168 St Georges Terrace, Perth WA 6000

NOTICES

www.theaustralian.com.au

POSSIBLE BENEFICIARIES

Would any children of **ALFRED LOWE, WILLIAM LOWE** and **FREDERICK GEORGE LOWE** or their father **ALFRED LOWE** or any person knowing their whereabouts or claiming to be related to them or **GEORGE ALFRED LOWE** also known as **ALFRED GEORGE LOWE** deceased please contact The Public Trustee of Queensland, G.P.O. Box 2251 Brisbane 4001, Queensland, Australia (or email maria.murphy@pt.qld.gov.au) quoting reference 20126241 and provide full details of their claim.

Notice is hereby given on or after the 25th May 2023 The Public Trustee intends, pursuant to Section 132 of the *Public Trustee Act 1978* to proceed to distribute the assets in the estate of **GEORGE ALFRED LOWE** deceased late of 2082 Wynnum Road, Wynnum West in the State of Queensland having regard only to the persons whose claims have been established to his satisfaction or who then appear to him to have the best claim in law.

SAMAY ZHOUAND
THE PUBLIC TRUSTEE OF QUEENSLAND AND CEO

M8337

POSSIBLE BENEFICIARIES

Would **MARION JOAN HARRINGTON** also known as **MARION JOAN SADER** or **EDWARD FRANCIS HARRINGTON** also known as **EDWARD HARRINGTON** or any children of **MARION JOAN HARRINGTON** also known as **MARION JOAN SADER** or **EDWARD FRANCIS HARRINGTON** also known as **EDWARD HARRINGTON** or any person knowing their whereabouts or claiming to be related to them or **PAMELA FLORENCE SHEAD** deceased please contact The Public Trustee of Queensland, G.P.O. Box 2251 Brisbane 4001, Queensland, Australia (or email maria.murphy@pt.qld.gov.au) quoting reference 20567893 and provide full details of their claim.

Notice is hereby given on or after the 1st June 2023 The Public Trustee intends, pursuant to Section 132 of the *Public Trustee Act 1978* to proceed to distribute the assets in the estate of **PAMELA FLORENCE SHEAD** deceased late of 1/26 Alice Street, Mount Isa in the State of Queensland having regard only to the persons whose claims have been established to his satisfaction or who then appear to him to have the best claim in law.

SAMAY ZHOUAND
THE PUBLIC TRUSTEE OF QUEENSLAND AND CEO

M8338

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Invitation for Consultation: Montara Project and Stag Field

Montara Project

Jadestone Energy (Jadestone) is the operator of the producing Montara Project in Australian waters, approximately 690 km west of Darwin in the Timor Sea. The Montara Project operations involve oil production using wellhead platform (WHP) wells for the Montara field, and subsea wells for the Swift, Skua and Swallow fields. The oil from the subsea wells is piped via flowlines to the unmanned WHP, and then to the Montara Venture floating production storage and offloading (FPSO) facility, which acts as a hub for the project in production since 2013.

Stag Field

Jadestone is also the operator of the producing Stag field in Australian waters and located approximately 60 km northwest of Dampier in the Indian Ocean. The Stag field was developed using a fixed leg, 12 well-slot, manned central processing facility platform in production since 1998. This is connected, by an eight-inch underwater export pipeline, to a pipeline end manifold where shuttle tankers directly load crude oil via a catenary anchor leg mooring buoy.

Environment Plans (EP)

Jadestone is updating the currently approved EPs, the Montara EP for the Montara Project, and the Stag EP for the Stag field. Each EP will govern production and maintenance activities for the next five years. The revised Montara EP and Stag EP will be assessed by the National Offshore Petroleum Safety and Environmental Management Authority for acceptance.

In addition, Jadestone is preparing an EP for the removal of three subsea wellheads at Montara that are no longer in use (the Wellhead Removal EP). This activity is tentatively planned to occur in 2023/2024.

Jadestone is also preparing an EP for the drilling activities at the Stag platform (the Stag Drilling EP). This will include new production wells from recovered well-slots and may include plugging and abandonment of other wells potentially involving wellhead removal.

The purpose of the EPs is to identify the risks and impact of each proposed petroleum activity on the environment. The EPs will also set out measures to reduce identified environmental impacts and describe how and to what level of performance those measures will be implemented throughout each activity.

Jadestone is inviting comments for consideration during the preparation of each of the EPs discussed above.

Further information on Jadestone's Montara Project is available on the company's website at:

www.jadestone-energy.com/assets/australia-portfolio/montara.

Further information on Jadestone's Stag field is available on the company's website at:

www.jadestone-energy.com/assets/australia-portfolio/stag.

Please let us know if you:

- require any further information; and/or
- have any comments on the activity and the potential impacts on your interests.

Jadestone is committed to ongoing dialogue with all its stakeholders and welcomes their comments at any time.

For further information or to make comment please email: consult@jadestone-energy.com.



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20 THE WEEKEND AUSTRALIAN,
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CSL gene therapy saving lives, for just \$3.5m a dose

JARED LYNCH

As CSL's former chief executive Paul Perreault was packing up his desk in Melbourne last month there was one milestone achieved during his 10 years at the helm that could not escape his attention.

"Who thought CSL would be the first one in the world with gene therapy for haemophilia?" Mr Perreault told this masthead.

"I mean, I can tell you, a decade ago, nobody thought we would."

CSL was originally solely in the plasma business. It was established in World War I as the Commonwealth Serum Laboratories, before branching out into vaccines, floating on the ASX in 1994 and becoming not only one of the biggest companies on the Australian sharemarket but a global pharmaceutical juggernaut.

Last November it took another step in cementing its position in the cutting edge of drug development - an area it spends about \$1bn a year on - when the US Food and Drug Administration approved CSL's new treatment Hemgenix.

The drug injects a functioning copy of the blood clotting gene into a patient with haemophilia B, providing a single dose fix to the debilitating illness that plagued the European royalty in the 19th and early 20th centuries and affects about one in 40,000 males today.

Crucially, the one shot replaces a lifetime of fortnightly infusions to control the blood disorder, effectively curing a patient.

European regulators were quick to follow the US FDA in approving Hemgenix. But seemingly miraculous treatment comes at a cost - about \$US3.5m (\$5.23m) a dose - becoming the world's most expensive drug.

It is one of the handful of approved gene therapies that have sparked a wave of drugs priced in the millions of dollars per patient. The high cost of the drugs - which promise to cure or treat diseases in a single course - has raised eyebrows. After all, big pharma was previously reluctant to charge any



AARON FRANCIS

Former CSL chief executive Paul Perreault is proud of CSL's accomplishments

more than six figures for a drug.

But patients say the massive expense is worth it, particularly when amortised over their lifetime. It is this rationale health funders need to face as they potentially balk at paying the handsome fee for these groundbreaking treatments - which have been approved to not only cure blood disorders such as Haemophilia B, but also muscle wasting conditions and rare childhood neurological diseases.

Steven Yatomi-Clarke, chief executive of ASX-listed biotech Prescient Therapeutics - which has developed a gene therapy to treat a rare and aggressive form of lymphoma - says while the treatments are expensive, they flip the traditional model of big pharma.

To put it in context, current haemophilia treatments cost \$US250,000 to \$US500,000 per patient, per year, for the rest of their lives.

"It's really flying in the face of the big pharma business model in many ways. They want someone

to stay on a drug for a very long time ... that's the big pharma model," Mr Yatomi-Smith says.

"But gene and cell therapy throws that playbook out the window. It's a single infusion.

"In the case of rare childhood diseases, if my child was normally not going to live past the age of eight years old, and you can cure my son, my son or daughter, then

'All of a sudden, \$2m or \$3m looks to be a bargain'

STEVEN YATOMI-CLARKE
PRESIDENT THERAPEUTICS CEO

they're going to live a long and productive life. They're going to be paying taxes, consuming goods and services. All of a sudden, \$2m or \$3m looks to be a bargain."

But government health budgets are under pressure as people live longer with chronic conditions. According to the latest

spending data, Australian federal and state governments spent \$142.6bn on healthcare in the 2020 financial year, a 5 per cent increase on the previous year. This accounted for 70 per cent of overall health spending, which totalled \$202.5bn.

Around the world, health spending accounts for about 10 per cent of global GDP, and the World Health Organisation forecasts that proportion to increase to 13 per cent in coming years.

For CSL, the move into gene therapy was not as dramatic as it sounds. For years the company produced a plasma-derived product that replaced the missing blood clotting factor IX in patients with haemophilia B.

CSL's head of research and development and chief medical officer, Bill Mezzanotte, said that product "helped patients a lot", but it required an intravenous injection about three times a week.

Then last decade it launched Idelvion: a recombinant factor IX product that lengthened the treat-

ment time for patients to once every two weeks. It continues to remain popular, with sales leaping 22 per cent to \$US363m in the six months to December 31.

"It's still an IV infusion on a regular basis and we thought we could do better. And because we had deep scientific and commercial expertise, we knew what we were looking for," Dr Mezzanotte said.

The solution was found when it licensed Dutch biotech uniQure's gene therapy technology, which underpins Hemgenix. CSL funded the later stage clinical trials and has the global rights to commercialise the treatment.

Wilson's analyst Shane Storey said the partnership allowed CSL to expand and fortify its "leadership position in haemophilia B".

"The potential to replace more than 10 years of regular prophylactic management for these patients with a single shot of Hemgenix is a powerful driver of sector dominance, which brings with it margin expansion and sales leverage opportunities within the CSL Behring recombinant haemophilia," Dr Wilson said in a note to investors when the FDA granted its approval.

For Dr Mezzanotte, it's about balance. He hopes the company's foray into gene therapy will not cannibalise its existing businesses.

"We won't walk away from plasma therapy, we won't walk away from recombinants. We believe they can all work together for the right patients because even Hemgenix won't be right for every patient," he said, adding it had nothing to do with the gene therapy's price.

"Not every patient would be a good candidate. Either their bleeding is not severe enough, and look, first of all, we still have to do studies in children. And people may be happy with Idelvion.

"So, we'll still have Idelvion available for many of those patients where (Hemgenix) is not right for them."

In regard to children, CSL's vice president of research Michael Wilson says the underlying technology has limitations.

TENDERS

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The Australian Coal Industry's Research Program

ACARP assists the Australian coal industry in developing and adopting technology and mining practice that leads the world. ACARP is seeking research in the following categories driving minimised emissions and environmental impact of industry:

- Underground Mining
- Open Cut Mining
- Environment and Community
- Coal Preparation
- Technical Market Support
- Mine Site Greenhouse Gas Mitigation

This program is entirely funded, owned and managed by the black coal producers.

Additional information including specific research priorities, the proposal format and proposal summary sheet can be obtained from www.acarp.com.au or by phoning 07 3225 3600.

The closing date for proposals is Wednesday, 26 April 2023.

DEATH & FUNERAL NOTICES

www.theaustralian.com.au

JOHNSTON AC, Robert Alan (Bob)

Dearly loved and loving Husband of Judith. Dearly loved Husband of Verna (dec). Devoted Father of Ian (dec), Bruce (dec), Helen and Margaret. Father-in-law of Linda, Jenny, Victor and Graeme. Proud Grandfather of Rebecca, Cameron, Andrew, Stephanie, Melanie, Philippa, Alexander, Alana, Alison and Rachel. Fond Great-Grandfather of their 17 Children.

Always in our Hearts

A Service for Bob will be held on Thursday, 30th March, 2023 commencing 11am, in St Stephen's Uniting Church, Macquarie Street, Sydney. In lieu of flowers, please consider a donation in Bob's memory to The Brain and Mind Centre - <https://www.sydneystudy.edu.au/engage/give/how-to-donate.html>

For details of how to live stream this service please contact enquiries@waltercarter.com.au



26-year-old Edward Craven paid more than \$80m for 29-31 St Georges Rd, Toorak



Billionaire central: The richest suburbs

Continued from Page 17

Toorak. Many of Melbourne's blue bloods gather around four main streets: Albany Rd, Irving Rd, Clendon Rd and St Georges Rd.

Vaucluse (12)

Billionaire Harry Triguboff is one big name who lives in Sydney's prime waterfront location. He and his wife have one of the largest privately held landholdings on Vaucluse's waterfront, which includes two dwellings.

Arthur Tzaneros, who owns ACFS Port Logistics with father Terry, paid \$38m in 2021 for a mansion on Olola Ave, complete with a tennis court and swimming pool.

But the biggest splash of late was fashion mogul Nicky Zimmermann paying \$60m last December for a three-storey residence on about 1700sq m of waterfront.

There are formal and informal living and dining rooms, a rumpus and billiard room, darkroom, home office, cellar, six bedrooms, nine bathrooms and garaging for four cars. There's also a boat shed, jetty and sauna.

Meanwhile, Jerry Schwartz is renovating his \$67m Phoenix Acres waterfront estate, which could include an ice rink, lap pool and cinema.

But they are all overshadowed by Menulog co-founder Leon Kamenev, who is putting the finishing touches to his lavish mansion that neighbours describe as "the best house in Sydney".

Kamenev paid \$80m to amal-

gamate several sites over 4200sq m of prime waterfront.

Point Piper (12)

Home to Australia's most expensive residential sale, Point Piper is where Australia's technology titans spend their money.

Atlassian co-founder Scott Farquhar has taken possession of his \$130m Uig Lodge without the need for a mortgage.

The cash transaction came about five years after Farquhar shelled out \$71m for an estate in the same suburb, though his refurbishment plans for that house have been stymied.

Farquhar's \$130m buy eclipsed the previous record of \$100m by his Atlassian co-founder Mike Cannon-Brookes, who bought the 1.12ha Fairwater in 2018.

Mosman Park (6)

Billionaire mining magnate Chris Ellison is the biggest name in Perth's most wealthy enclave. Ellison set a record in 2009 when he paid \$57.5m for Angela Bennett's mansion on Bennett St.

Five years later he snapped up two neighbouring properties for about \$12m. Nearby Saunders St is also considered an elite area.

Hunters Hill (6)

Billionaire Lang Walker's Millthorpe estate has been in his family's hands since 1986, when he paid \$4.25m for the 7280sq m site on Sydney's lower north shore.

The Gothic Revival residence was built in 1841 by the fourth Surveyor-General Sir Thomas Mitchell. Len Ainsworth is another resident, as is Dick Honan.

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Town of Port Hedland

Pickles E-Salvage 28.03.2023

By Public The Town of Port Hedland is selling 'Goods'. In accordance with Section 3.58(2)(a) of the Local Government Act 1995, disposal of property will be to the highest bidder at public auction.

The items offered for sale are 'as is where is'. The successful bidders must collect the goods by making an appointment with Ranger Services after 8am Monday 3 April 2023 and before Thursday 6 April 2023. Any goods not collected before this date will be forfeited along with any payment made.

Goods cannot be taken on the day of auction.

Interested parties requiring further information should contact Ranger Services on (08) 9158 9300 during business hours Monday to Friday or visit www.pickles.com.au

Canvassing of Staff or Councillors will disqualify.

Note: It is the responsibility of the purchaser of a vehicle to confirm the vehicle is not encumbered prior to any bids being made.

Carl Askew
CHIEF EXECUTIVE OFFICER

Land Administration Act 1997 Town of Port Hedland

EXTENSION OF TIME FOR COMMENT - NOTICE OF PUBLIC ADVERTISEMENT OF PEDESTRIAN ACCESS WAY CLOSURE - LOT 3280 STEAMER AVENUE, SOUTH HEDLAND

Notice is hereby given that that the Town of Port Hedland (Town) has received an application to close the above-mentioned pedestrian access way. Details of the proposal are available to view at the Town's Civic Centre during office hours up to and including close of business on 29 March 2023. Any queries can be directed to Development Services on 9158 9300. The proposal can also be viewed on the Town of Port Hedland website at:

<https://www.porthedland.wa.gov.au/planning-building-and-environment/planning/public-consultation.aspx>

Submissions on the proposal may be lodged in writing addressed to Development Services, Town of Port Hedland, PO Box 41, Port Hedland WA 6721 or via email: eplanning@porthedland.wa.gov.au. Submissions should be lodged with the Town on or before close of business on 29 March 2023.

Carl Askew
Chief Executive Officer



Invitation for Consultation: Stag Field

Jadestone Energy (Jadestone) is the operator of the producing Stag field in Australian waters, in a water depth of approximately 47 metres and located approximately 60 km northwest of Dampier in the Indian Ocean. The Stag field was developed using a fixed leg, 12-slot manned central processing facility platform. This is connected, by an eight-inch underwater export pipeline, to a pipeline end manifold where shuttle tankers directly load crude oil via a catenary anchor leg mooring buoy.

Jadestone is updating the currently approved environment plan (the Stag EP) for the Stag field, which will govern production and maintenance activities for the next five years. The revised Stag EP will be assessed by the National Offshore Petroleum Safety and Environmental Management Authority for acceptance.

Jadestone is also preparing an EP for the drilling activities at the Stag platform (the Stag Drilling EP). This will include new production wells from recovered well-slots and may include plugging and abandonment of other wells potentially involving wellhead removal.

The purpose of the EPs is to identify the risks and impacts of each proposed petroleum activity on the environment. The EPs will also set out measures to reduce identified environmental impacts and describe how and to what level of performance those measures will be implemented throughout the activity.

Jadestone is inviting comments for consideration during the preparation of the EPs discussed above. Further information on Jadestone's Stag field is available on the company's website at: www.jadestone-energy.com/assets/australia-portfolio/stag

Please let us know if you

- require any further information; and/or
- have any comments on the activity and the potential impacts on your interests.

Jadestone is committed to ongoing dialogue with all its stakeholders and welcomes their comments at any time.

For further information or to make comment please email: consult@jadestone-energy.com

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Seismic Survey Consultation Invitation

Searcher Seismic Pty Ltd is proposing to conduct 3D Marine Seismic Surveys (MSS) located Offshore in the North West Region of Western Australia. As such Searcher wishes to provide all potential stakeholders the opportunity to provide us with any values or sensitivities affecting your functions, interests or activities in order to address any issues or concerns.

Possum 3D MSS is approximately 211km offshore of Broome and 246km from Port Hedland. Survey duration will be about 70 days commencing sometime between Jan and July 2023.

Full Environment Plan: https://info.nopsema.gov.au/environment_plans/563/show_public

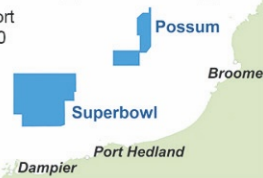
Superbowl 3D MSS is approximately 106km offshore of Port Hedland. Maximum annual survey duration will be about 80 days with acquisition between Jan 2023 to Dec 2025.

Project details are available on our website: searcherseismic.com/stakeholderfeedback

or contact us direct:

Phone: +61 (0)8 9327 0301

Email: feedback@searcherseismic.com



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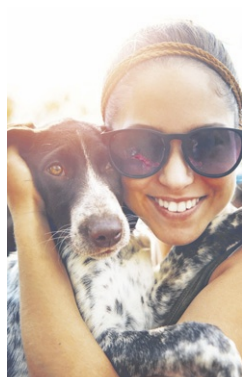
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2000M SUITS CASCADIAN

JAY ROONEY

Trainer James Cummings is confident Cascadian can go one better when he backs up in Saturday's \$3 million Group 1 Australian Cup (2000m) at Flemington.

The dual Group 1 winner stormed home to run a close second to Mr Brightside in the \$5m All-Star Mile (1600m) at Moonee Valley last Saturday.

Cummings expects the evergreen eight-year-old to relish stepping up in distance at Flemington.

"He pulled up beautifully from the All-Star Mile," Cummings said.

"The Australian Cup looks a really intriguing

race for him, third-up from a spell. For his first run at Moonee Valley against a horse who loves the Valley in Mr Brightside, I thought he acquitted himself exceptionally well.

"If he got into the clear a little earlier or had a better gate, what might have been?"

"He should be well suited up to 2000m in a solidly run Australian Cup."

Cascadian has been backed from \$4.60 into \$3 favouriteism.

He has drawn barrier 11 with Ben Melham booked to ride. Noncomforist, an impressive first-up winner of the Blamey Stakes (1600m) at Flemington, is the second favourite at

\$6.50. Cummings and Melham will also combine with consistent sprinter Kallos in the Listed ATA/Bob Hoysted Handicap (1000m) at Flemington.

Kallos is a \$6 chance after winning first-up down the Flemington straight on March 4.

"Kallos will need to be a little bit better again, but he puts himself right into the picture from the draw with plenty of natural pace," Cummings said.

"He enjoys the straight at Flemington, he ran beautifully there at his first run as a gelding and I can see him running another good race here.

"He gets a good draw and that sets up pretty well."

Results

MT BARKER

RACE 1: WORK HOME FRONT 10, MOVING ON 1, FIRST CONTACT 9. TAB Nos: 10 19 50. \$11.20; pl: \$2.60; \$4.60; \$2.00. Quinella: \$58.50. Exacta: \$171.40. Trifecta: (10-1-9) \$1,089.10. First 4: (10-1-9-6) \$5,145.40; Scratched 3 5 13.

RACE 2: MINE HOST 8, ARAMAT 9, WIN TO RETIRE 13. TAB Nos: 8 9 13. \$0. \$3.10; pl: \$1.90; \$3.00; \$2.90. Quinella: \$10.30. Exacta: \$15.90. Trifecta: (8-9-13) \$113.90. First 4: (8-9-13-14) \$2,408.70. Double: (10-8) \$40.00; Scratched 12.

RACE 3: DIVINE MERCY 5, DIGITAL MISS 2, ROSE OF DENMARK 8. TAB Nos: 5 2 8. \$0. \$5.00; pl: \$1.40; \$1.04; \$2.70. Quinella: \$4.10. Exacta: \$11.60. Trifecta: (5-2-8) \$52.70. First 4: (5-2-8-3) \$226.30. Double: (8-5) \$20.10; Scratched 7.

RACE 4: OXBRIDGE 5, GODS MOMENT 2, WINSALOT 6. TAB Nos: 5 2 6. \$0. \$5.00; pl: \$1.90; \$1.20; \$2.30. Quinella: \$8.60. Exacta: \$26.80. Trifecta: (5-2-6) \$127.80. First 4: (5-2-6-4) \$865.80. Double: (5-5) \$33.80. Quaddie: (10-8-5-5) \$1,553.90; Scratched 9.

RACE 5: BONNIE LAD 4, MILLIVOY 1, SPEEDY PYE 9. TAB Nos: 4 19 50. \$4.50; pl: \$1.60; \$1.04; \$2.10. Quinella: \$4.50. Exacta: \$8.50. Trifecta: (4-1-9) \$54.10. First 4: (4-1-9-3) \$430.20. Double: (5-4) \$15.80; No scratchings.

RACE 6: HIGHRIAR 10, SNEAKY FOX 6, TREVELLO 7. TAB Nos: 10 6 7. \$0. \$2.70; pl: \$1.60; \$1.20; \$2.30. Quinella: \$38.00. Exacta: \$130.70. Trifecta: (10-6-7) \$422.40. First 4: (10-6-7-11) \$3,524.00. Double: (4-10) \$143.20; No scratchings.

Trifecta: (7-11-4) \$320.70. First 4: (7-11-4-2) \$2,324.00. Double: (7-7) \$135.50. Quaddie: (4-4-7-7) \$5,708.80; Scratched 5 13 14 15.

RACE 5: VERY SHAMUS 16, WONDEREACH 3, IMASUPERSTAR 5. TAB Nos: 16 3 5. \$0. \$64.40; pl: \$9.00; \$1.04; \$3.60. Quinella: \$66.40. Exacta: \$287.90. Trifecta: (16-3-5) \$1,758.20. First 4: (16-3-5-14) \$14,097.70. Double: (7-16) \$40.70; Scratched 2 6 9 18.

RACE 6: SMILER MARSHALL 2, KAURAVA 11, BLUEGRASS BIJOUX 13. TAB Nos: 2 11 13. \$0. \$12.00; pl: \$3.70; \$1.90; \$1.50. Quinella: \$29.20. Exacta: \$69.20. Trifecta: (2-11-13) \$318.70. First 4: (2-11-13-5) \$1,252.40. Double: (16-2) \$120.00; Scratched 3 6 7 8 9 12 16 18.

RACE 7: BELTORO 4, MARSABIT 9, MANKAYAN 1. TAB Nos: 4 9 1. \$0. \$4.90; pl: \$2.10; \$6.80; \$1.20. Quinella: \$57.40. Exacta: \$97.80. Trifecta: (4-9-1) \$330.30. First 4: (4-9-1-14) \$3,938.50. Double: (2-4) \$65.80; Scratched 2 6 12.

RACE 8: MANTON 3, MANTON 3, MANTON 3. TAB Nos: 3 3 3. \$0. \$3.50; pl: \$2.00; \$1.20; \$1.80. Quinella: \$18.90. First 4: (2-3-8-6) \$59.30. Double: (8-2) \$31.60; Scratched 1 4.

RACE 9: TIERRA DEL FUEGO 1, ITS A PLOY 2, CAT IN THE RAINE 6. TAB Nos: 1 2 6. \$0. \$3.40; pl: \$1.10; \$2.70; \$1.40. Quinella: \$22.50. Exacta: \$35.10. Trifecta: (1-2-6) \$92.60. First 4: (1-2-6-9) \$480.60. Double: (2-1) \$21.90; Scratched 3.

SUNSHINE COAST

RACE 1: TENGUN READY 2, DIBBA DOBBA 6, KING YOSHI 1. TAB Nos: 2 6 1. \$0. \$9.40; pl: \$2.30; \$1.04; \$2.50. Quinella: \$11.30. Exacta: \$29.40. Trifecta: (2-6-1) \$93.00. First 4: (2-6-1-4) \$252.90; No scratchings.

RACE 2: AMERICAN PIONEER 4, LOOSE UNIT 2, CALL ME HILTON 6. TAB Nos: 4 2 6. \$0. \$4.00; pl: \$1.50; \$1.20; \$1.90. Quinella: \$4.30. Exacta: \$13.00. Trifecta: (4-2-6) \$58.80. First 4: (4-2-6-5) \$269.70. Double: (2-4) \$44.70; No scratchings.

RACE 3: BURNT BY BERNIE 2, AZURE PRIDE 1, DIFFERENT ROAD 5. TAB Nos: 2 1 5. \$0. \$2.90; pl: \$1.50; \$1.30; \$1.20. Quinella: \$4.30. Exacta: \$10.00. Trifecta: (2-1-5) \$22.50. First 4: (2-1-5-3) \$53.70. Double: (4-2) \$11.40; Scratched 4 10 12.

RACE 4: MISTER DOMINGO 6, TOMMY BLIGH 3. TAB Nos: 6 3. \$0. \$2.30; pl: \$1.40; \$3.10; NTD. Quinella: (3-6) \$6.70. Exacta: (6-3) \$84.00. Trifecta: (6-3-4) \$95.60. First 4: (6-3-4-5) \$386.30; No scratchings.

RACE 5: TORQUE LIKE MOTION 4, SUNRISE RUBY 3, ROCK SUPREME 7. TAB Nos: 4 3 7. \$0. \$2.90; pl: \$1.40; \$1.50; \$3.00. Quinella: \$15.20. Exacta: \$14.20. Trifecta: (4-3-7) \$122.90. First 4: (4-3-7-1) \$727.30. Double: (10-4) \$27.30; No scratchings.

RACE 6: THE GROGFATHER 4, CLASSICMAJOR 3, COMMODORE JUON 9. TAB Nos: 4 3 9. \$0. \$10.60; pl: \$2.60; \$1.70; \$2.10. Quinella: \$27.50. Exacta: \$41.70. Trifecta: (4-3-9) \$345.80. First 4: (4-3-9-1) \$1,676.60. Double: (6-4) \$110.20; No scratchings.

RACE 7: THE WATERBOY 3, LANOCH BOY 4, BOTTLE ROCK 1. TAB Nos: 3 4 1. \$0. \$3.70; pl: \$1.30; \$1.30. Quinella: \$135.50. Exacta: \$121.90. Trifecta: (3-4-1) \$446.90. First 4: (3-4-1-8) \$3,923.10. Double: (4-3) \$56.40. Quaddie: (4-6-4-3) \$1,050.30; No scratchings.

GLoucester Park

RACE 1: HECTOR 2, RAVEN BANNER 1, FEELING ACES 10. TAB Nos: 2 1 10. \$0. \$3.00; pl: \$1.20; \$1.04; \$1.70. Quinella: \$19.00. Exacta: \$73.50. Trifecta: (2-1-10) \$12.50. First 4: (2-1-10-3) \$170.00; Scratched 11.

RACE 2: JAMES BUTT 4, MASTER YOSHI 2, GRAN CHICO 3. TAB Nos: 4 2 3. \$0. \$8.40; pl: \$2.10; \$2.00; \$4.00. Quinella: \$15.10. Exacta: \$73.50. Trifecta: (4-2-3) \$831.90. First 4: (4-2-3-1) \$2,335.00. Double: (2-4) \$32.40; No scratchings.

NARROGIN

RACE 1: HEZA BEAUTY 1, BATAVIA PLAYBOY 7, GRAPPELLIS BOY 2. TAB Nos: 1 7 2. \$0. \$1.70; pl: \$1.30; \$1.20; \$2.00. Quinella: \$5.00. Exacta: \$6.30. Trifecta: (1-7-2) \$30.20. First 4: (1-7-2-9) \$430.20; No scratchings.

Equestrian Notices

Equine Health Southdale Equipment Saddle Wintec \$300 ono Fully mounted Also other horse equipment Phone 0428 104 760

TRUSTEES ACT 1962 DECEASED ESTATES

Bruce Haugrave Cullen, late of Castlegare Retirement Village, 109 Fern Road, Wilson, Western Australia, deceased. Creditors and other persons having claims (to which Section 63 of the Trustees Act 1962 relates) in respect of the estate of the deceased, who died on the 14th day of May 2021 are required by the Executors Lawrence James Richards and Gary Francis Glosop of 6 Kent Street Bicton, Western Australia 6157, to send particulars of their claims within one month of the date of publication of this notice to them, after which date they may convey or distribute the assets, having regard only to claims of which they then have notice.

Public Notices

GENERAL

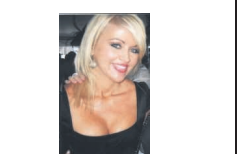
SEEKING WHEREABOUTS OF Neil Lambrecht and Lee Hutchison, who worked at Nookawarra Station, via Cue WA between 1977 and 1981. Please contact Rodney 0428 881 115 for reunion.

Psychics and Clairvoyants

AMERICAN Psychic Detective Spiritual Clairvoyant, Advising on all matters, Powerful Predictions - See to Believe! 28yrs Exp. Ph 0466 881 618

The Meeting Place

INTRODUCTIONS



ALONE? I'M SINGLE... I enjoy Camping, Fishing and Cooking. Text the word CINDY to 0419 240 205

SINCERE/GENUINE MATURE aged guy seeking lady - same. Sor. Friendship is the basis of a true, caring relationship. Pls text/call Ian 0452 642 569

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Tall, Blonde, European background, looking for similar gentleman. PO Box 514 South Fremantle WA 6162.

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Our experienced matchmakers arrange for you to meet face to face. No computers, no texts, you meet real people for real relationships. Ph 1300 060 646 Or txt 'meetup' 0450 345 300 www.successnetwork.com.au

Personal

GENERAL



Langtrees VIP Escorts available incall outcall 24/7 0402 743 999 www.langtreesofperth.com.au Girls 18+ Welcome



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Lady give best sexy massage Morley * I/O 0452 573 460

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21yo Slim Busty Long Hair Priv In/Out 0405 411 775 24 hrs

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Jadestone Energy INVITATION FOR CONSULTATION: MONTARA PROJECT AND STAG FIELD

Montara Project Jadestone Energy (Jadestone) is the operator of the producing Montara Project in Australian waters, approximately 690 km west of Darwin in the Timor Sea. The Montara Project operations involve oil production using wellhead platform (WHP) wells for the Montara field, and subsea wells for the Swift, Skua and Swallow fields. The oil from the subsea wells is piped via flowlines to the unmanned WHP, and then to the Montara Venture floating production storage and offloading (FPSO) facility, which acts as a hub for the project in production since 2013.

Stag Field Jadestone is also the operator of the producing Stag field in Australian waters and located approximately 60 km northwest of Dampier in the Indian Ocean. The Stag field was developed using a fixed leg, 12 well-slot, manned central processing facility platform in production since 1998. This is connected, by an eight-inch underwater export pipeline, to a pipeline end manifold where shuttle tankers directly load crude oil via a catenary anchor leg mooring buoy.

Environment Plans (EP) Jadestone is updating the currently approved EPs, the Montara EP for the Montara Project, and the Stag EP for the Stag field. Each EP will govern production and maintenance activities for the next five years. The revised Montara EP and Stag EP will be assessed by the National Offshore Petroleum Safety and Environmental Management Authority for acceptance.

In addition, Jadestone is preparing an EP for the removal of three subsea wellheads at Montara that are no longer in use (the Wellhead Removal EP). This activity is tentatively planned to occur in 2023/2024.

Jadestone is also preparing an EP for the drilling activities at the Stag platform (the Stag Drilling EP). This will include new production wells from recovered well-slots and may include plugging and abandonment of other wells potentially involving wellhead removal.

The purpose of the EPs is to identify the risks and impact of each proposed petroleum activity on the environment. The EPs will also set out measures to reduce identified environmental impacts and describe how and to what level of performance those measures will be implemented throughout each activity.

Jadestone is inviting comments for consideration during the preparation of each of the EPs discussed above.

Further information on Jadestone's Montara Project is available on the company's website at: www.jadestone-energy.com/assets/australia-portfolio/montara.

Further information on Jadestone's Stag field is available on the company's website at: www.jadestone-energy.com/assets/australia-portfolio/stag.

Please let us know if you: require any further information; and/or have any comments on the activity and the potential impacts on your interests.

Jadestone is committed to ongoing dialogue with all its stakeholders and welcomes their comments at any time.

For further information or to make comment please email: consult@jadestone-energy.com

ROTTNEST ISLAND AUTHORITY

Help shape the future of Wadjemup / Rottneest Island

Rottneest Island Management Plan 2023-28

Public notification of planning proposal Rottneest Island Authority Act 1987

Wadjemup / Rottneest Island has firmly established itself as Western Australia's leading tourism destination.

The island provides a quintessential Australian experience combining holiday activities with the pristine natural environment of a Class A reserve and marine sanctuaries, a rich cultural history, and unique opportunities for the occasional or regular visitor.

Offering spectacular Indian Ocean bays, sheltered beaches and the world-famous quokka, the island is a favourite holiday destination for local, domestic and international visitors.

A short boat ride from Perth, Fremantle and Hillarys, the island is entering a period of renewal and dynamic infrastructure change. This has included more than \$100 million for major upgrades to the island's energy and water networks, roads, jetties and visitor amenities.

Rottneest Island Authority (RIA) seeks community views on the proposed Rottneest Island Management Plan (RIMP) 2023-28 which has been prepared in accordance with the Rottneest Island Authority Act 1987 (section 19).

The purpose of the RIMP is to guide the island's key management actions for the period 1 July 2023 - 1 July 2028. The RIMP captures the McGowan Government's priority tourism, recreational, infrastructure, environmental, cultural and heritage initiatives for the next five years.

RIA welcomes feedback from all island stakeholders, including the general community, on the draft RIMP 2023-28.

The draft RIMP 2023-28 includes the draft Rottneest Island Land Use Plan. The draft Land Use Plan defines the permitted land uses within the settlement and importantly classifies the remainder of the island as a reserve for the purpose of conservation and recreation.

The draft RIMP document will be available:

- online at ria.wa.gov.au, or
to view at:
Rottneest Island Authority offices at 1 Mews Rd, Fremantle between the hours of 8.30am and 5.00pm, Monday to Friday; or
Rottneest Island Visitor Centre (on Rottneest Island) between the hours of 7.30am and 5.00pm, Monday to Sunday.

Written submissions on the draft RIMP 2023-28 can be:

- emailed to enquiries@rotnnestisland.com
delivered to RIA offices at Fremantle or Rottneest Island, or
posted to PO Box 693, Fremantle WA 6959.

The closing date for submissions is 5pm on Tuesday 9 May 2023. Submissions will be reviewed, and an analysis of stakeholder feedback will be published on RIA's website; however, responses will not be provided to individual submissions.

Rottneest Island Authority PO Box 693, FREMANTLE WA 6959

Invitation for Consultation: Montara Project and Stag Field



Montara Project

Jadestone Energy (Jadestone) is the operator of the producing Montara Project in Australian waters, approximately 690 km west of Darwin in the Timor Sea. The Montara Project operations involve oil production using wellhead platform (WHP) wells for the Montara field, and subsea wells for the Swift, Skua and Swallow fields. The oil from the subsea wells is piped via flowlines to the unmanned WHP, and then to the Montara Venture floating production storage and offloading (FPSO) facility, which acts as a hub for the project in production since 2013.

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those measures will be implemented throughout each activity. Jadestone is inviting comments for consideration during the preparation of each of the EPs discussed above.

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Further information on Jadestone's Stag field is available on the company's website at: www.jadestone-energy.com/assets/australia-portfolio/stag.

Please let us know if you:

- require any further information; and/or
- have any comments on the activity and the potential impacts on your interests.

Jadestone is committed to ongoing dialogue with all its stakeholders and welcomes their comments at any time.

For further information or to make comment please email: consult@jadestone-energy.com.



NOTICE TO GRANT MINING TENEMENTS

NATIVE TITLE ACT 1993 (CTH) SECTION 29

The State of Western Australia HEREBY GIVES NOTICE that the Minister for Mines and Petroleum, C/- Department of Mines, Industry Regulation and Safety, 100 Plain Street, East Perth WA 6004 may grant the following tenement applications under the *Mining Act 1978*:

Tenement Type	No.	Applicant	Area*	Locality	Centroid	Shire
Exploration Licence	15/1713	JINDALEE RESOURCES LIMITED	9BL	20.1km SW'ly of Kambalda	Lat: 31° 21' S; Long: 121° 33' E	COOLGARDIE SHIRE
Exploration Licence	16/627	NZE MINING RESOURCES PTY LTD	1BL	40.6km SW'ly of Ora Banda	Lat: 30° 37' S; Long: 120° 45' E	COOLGARDIE SHIRE
Exploration Licence	26/245	JAVELIN MINERALS LIMITED	1BL	23.3km NE'ly of Kambalda	Lat: 31° 2' S; Long: 121° 49' E	KALGOORLIE-BOULDER CITY
Exploration Licence	26/248	JAVELIN MINERALS LIMITED	2BL	28.1km NE'ly of Kambalda	Lat: 31° 5' S; Long: 121° 56' E	KALGOORLIE-BOULDER CITY
Exploration Licence	28/3271	CARAWINE RESOURCES LIMITED	12BL	158.2km N'ly of Balladonia	Lat: 31° 2' S; Long: 123° 58' E	KALGOORLIE-BOULDER CITY
Exploration Licence	29/1210	RIO TINTO EXPLORATION PTY LIMITED	16BL	78.5km S'ly of Leinster	Lat: 28° 35' S; Long: 120° 25' E	MENZIES SHIRE
Exploration Licence	38/3617	DUKETON MINING LIMITED	8BL	125km N'ly of Laverton	Lat: 27° 29' S; Long: 122° 20' E	LAVERTON SHIRE
Exploration Licence	38/3714	JINDALEE RESOURCES LIMITED	6BL	21.5km S'ly of Laverton	Lat: 28° 48' S; Long: 122° 19' E	LAVERTON SHIRE
Exploration Licence	38/3811	ENCOUNTER YENEENA PTY LTD	70BL	66.9km NW'ly of Laverton	Lat: 28° 12' S; Long: 121° 54' E	LAVERTON SHIRE, LEONORA SHIRE
Exploration Licence	40/435	ULYSSES MINING PTY LTD	1BL	57.5km SE'ly of Leonora	Lat: 29° 21' S; Long: 121° 34' E	MENZIES SHIRE
Exploration Licence	45/6432	FMG RESOURCES PTY LTD	1BL	40.5km N'ly of Nullagine	Lat: 21° 31' S; Long: 120° 5' E	EAST PILBARA SHIRE
Exploration Licence	45/6471	HAWKER GEOLOGICAL SERVICES PTY LTD	5BL	51km NW'ly of Nullagine	Lat: 21° 42' S; Long: 119° 39' E	EAST PILBARA SHIRE
Exploration Licence	46/1437	ODETTE TWO PTY LTD	5BL	40.4km NE'ly of Nullagine	Lat: 21° 42' S; Long: 120° 27' E	EAST PILBARA SHIRE
Exploration Licence	51/2135	WARRINGA BLUE PTY LTD	1BL	47.4km SE'ly of Peak Hill	Lat: 25° 55' S; Long: 119° 4' E	MEEKATHARRA SHIRE
Exploration Licence	51/2136	LIL BOYTEETH PTY LTD	1BL	48.7km SE'ly of Peak Hill	Lat: 25° 55' S; Long: 119° 5' E	MEEKATHARRA SHIRE
Exploration Licence	51/2140	MT RESOURCES PTY LTD	10BL	76.9km W'ly of Wiluna	Lat: 26° 29' S; Long: 119° 27' E	MEEKATHARRA SHIRE
Exploration Licence	57/1220	AUSTRALIAN TITANIUM PTY LTD	29BL	31.3km N'ly of Sandstone	Lat: 27° 42' S; Long: 119° 16' E	SANDSTONE SHIRE
Exploration Licence	57/1273	AURUMIN GIDGEE PTY LTD	19BL	54.5km NE'ly of Sandstone	Lat: 27° 32' S; Long: 119° 31' E	SANDSTONE SHIRE
Exploration Licence	70/5788	WEPNER EXPLORATION PTY LTD	172BL	76.8km S'ly of Paynes Find	Lat: 29° 57' S; Long: 117° 43' E	DALWALLINU SHIRE, MOUNT MARSHALL SHIRE
Exploration Licence	70/6352	TERRAIN MINERALS LTD	32BL	24.9km E'ly of Mukinbudin	Lat: 30° 53' S; Long: 118° 27' E	MUKINBUDIN SHIRE, NUNGARIN SHIRE
Exploration Licence	70/6359	EXPLORATION AUSTRALIA PTY LTD	11BL	38.4km NE'ly of Mukinbudin	Lat: 30° 36' S; Long: 118° 24' E	MUKINBUDIN SHIRE
Exploration Licence	70/6379	SYNDICATE MINERALS PTY LTD CURIOSITY EXPLORATION PTY LTD	40BL	29.1km NE'ly of Mukinbudin	Lat: 30° 46' S; Long: 118° 27' E	MUKINBUDIN SHIRE
Exploration Licence	77/2948	POLARIS METALS PTY LTD	1BL	58.1km N'ly of Southern Cross	Lat: 30° 42' S; Long: 119° 24' E	YILGARN SHIRE
Exploration Licence	77/3016	SENTINEL EXPLORATION LTD	1BL	150km E'ly of Paynes Find	Lat: 29° 37' S; Long: 119° 10' E	MENZIES SHIRE
Exploration Licence	77/3017	SENTINEL EXPLORATION LTD	3BL	152.1km E'ly of Paynes Find	Lat: 29° 43' S; Long: 119° 9' E	MENZIES SHIRE
Exploration Licence	77/3018 & 77/3035	SENTINEL EXPLORATION LTD	6BL	147.7km E'ly of Paynes Find	Lat: 29° 39' S; Long: 119° 8' E	MENZIES SHIRE
Exploration Licence	77/3039	L13 MINERALS PTY LTD	65BL	29.9km SE'ly of Marvel Loch	Lat: 31° 41' S; Long: 119° 40' E	YILGARN SHIRE
Exploration Licence	77/3042	SYNDICATE MINERALS PTY LTD CURIOSITY EXPLORATION PTY LTD	53BL	37km NE'ly of Mukinbudin	Lat: 30° 44' S; Long: 118° 32' E	MUKINBUDIN SHIRE, WESTONIA SHIRE
Exploration Licence	77/3043	TERRAIN MINERALS LTD	62BL	33.5km E'ly of Mukinbudin	Lat: 30° 57' S; Long: 118° 33' E	MUKINBUDIN SHIRE, NUNGARIN SHIRE, WESTONIA SHIRE
Exploration Licence	80/5840	CHANDLER, Ross Berge	25BL	137.9km SW'ly of Halls Creek	Lat: 19° 15' S; Long: 126° 56' E	HALLS CREEK SHIRE
Exploration Licence	80/5889	BARACUS PTY LTD	55BL	83.6km S'ly of Wyndham	Lat: 16° 13' S; Long: 127° 58' E	WYNDHAM-EAST KIMBERLEY SHIRE
Exploration Licence	80/5890	BARACUS PTY LTD	21BL	103.3km S'ly of Wyndham	Lat: 16° 23' S; Long: 127° 54' E	WYNDHAM-EAST KIMBERLEY SHIRE
Prospecting Licence	15/6778	POTTER, Vernan John	9.39HA	19km W'ly of Kambalda	Lat: 31° 14' S; Long: 121° 28' E	COOLGARDIE SHIRE
Prospecting Licence	16/3411	FORTUNA RESOURCES PTY LTD	1.81HA	28.8km S'ly of Ora Banda	Lat: 30° 37' S; Long: 121° 3' E	COOLGARDIE SHIRE
Prospecting Licence	25/2713-S	BRANCH, Ian Robert	4.96HA	39.8km NE'ly of Kambalda	Lat: 30° 58' S; Long: 121° 59' E	KALGOORLIE-BOULDER CITY
Prospecting Licence	25/2744-S	BRANCH, Ian Robert	9.93HA	47.7km NE'ly of Kambalda	Lat: 30° 59' S; Long: 122° 6' E	KALGOORLIE-BOULDER CITY
Prospecting Licence	37/9625	MT MALCOLM GOLD HOLDINGS PTY LTD	113.28HA	21.7km E'ly of Leonora	Lat: 28° 56' S; Long: 121° 32' E	LEONORA SHIRE
Prospecting Licence	38/4562-S	LEBILLON, Lou	9.81HA	40.6km SE'ly of Laverton	Lat: 28° 49' S; Long: 122° 44' E	LAVERTON SHIRE
Prospecting Licence	39/6369	KILKENNY MINERALS PTY LTD	114.05HA	43.2km E'ly of Leonora	Lat: 28° 57' S; Long: 121° 45' E	LEONORA SHIRE
Prospecting Licence	39/6379	14 MILE WELL GOLD PTY LTD	182.00HA	44.6km W'ly of Laverton	Lat: 28° 46' S; Long: 121° 58' E	LAVERTON SHIRE
Prospecting Licence	39/6380 & 39/6382	14 MILE WELL GOLD PTY LTD	392.56HA	46.5km W'ly of Laverton	Lat: 28° 46' S; Long: 121° 57' E	LAVERTON SHIRE
Prospecting Licence	39/6381	14 MILE WELL GOLD PTY LTD	160.48HA	44.1km SW'ly of Laverton	Lat: 28° 47' S; Long: 121° 59' E	LAVERTON SHIRE
Prospecting Licence	77/4629-4631	WEST AUSTRALIAN PROSPECTORS PTY LTD	480.01HA	83km NE'ly of Mukinbudin	Lat: 30° 29' S; Long: 118° 54' E	YILGARN SHIRE
Prospecting Licence	77/4634	WHITE, Andrew Roy	167.45HA	8.5km S'ly of Southern Cross	Lat: 31° 17' S; Long: 119° 17' E	YILGARN SHIRE
Prospecting Licence	80/1885	YNEMA, Marten Hendrick	122.79HA	26.5km SE'ly of Halls Creek	Lat: 18° 26' S; Long: 127° 45' E	HALLS CREEK SHIRE

Nature of the act: Grant of prospecting licences which authorises the applicant to prospect for minerals for a term of 4 years from date of grant. Grant of Special Prospecting Licences, which authorises the applicant to prospect for minerals for a term up to 4 years from the date of grant. Grant of exploration licences, which authorises the applicant to explore for minerals for a term of 5 years from the date of grant.

Notification day: 22 March 2023

Native title parties: Under section 30 of the *Native Title Act 1993 (Cth)*, persons have until 3 months after the notification day to take certain steps to become native title parties in relation to applications. The 3 month period closes on **22 June 2023**. Any person who is, or becomes a native title party, is entitled to the negotiation and/or procedural rights provided in Part 2 Division 3 Subdivision P of *Native Title Act 1993 (Cth)*. Enquiries in relation to filing a native title determination application to become a native title party should be directed to the Federal Court of Australia, 1 Victoria Avenue, Perth WA 6000, telephone (08) 9268 7100.

Expedited procedure: The State of Western Australia considers that these acts are acts attracting the expedited procedure. Each licence may be granted unless, within the period of 4 months after the notification day (i.e. **22 July 2023**), a native title party lodges an objection with the National Native Title Tribunal against the inclusion of the statement that the State considers the grant of the licence is an act attracting the expedited procedure. Enquiries in relation to lodging an objection should be directed to the National Native Title Tribunal, Level 5, 1 Victoria Avenue, Perth, or GPO Box 9973, Perth, WA 6848, telephone (08) 9425 1000.

For further information about the act (including extracts of plans showing the boundaries of the applications), contact the Department of Mines, Industry Regulation and Safety, 100 Plain Street, East Perth WA 6004, or telephone (08) 9222 3518.

* - 1 Graticular Block = 2.8 km²

DMIRS 14143

Classifieds

9482 2300

Place an ad: regionalclassifieds@wanews.com.au or go to pilbaranews.com.au

PUBLIC NOTICES

Annual General Meeting Notice

Karratha Business Enterprise Centre Inc.

When: Thursday 30th March 2023
Time: 5:00pm

Where: Enterprise Hub Karratha Boardroom
Level 1, 18 Hedland Place
Karratha WA 6714

Refreshments will be provided.
Please register your interest & RSVP to
admin@businesscentre.org.au
by Friday 17th March 2023



4733925

**Show
off your
sports
results
HERE!**

Share
it with
Classifieds



Invitation for Consultation: Stag Field

Jadestone Energy (Jadestone) is the operator of the producing Stag field in Australian waters, in a water depth of approximately 47 metres and located approximately 60 km northwest of Dampier in the Indian Ocean. The Stag field was developed using a fixed leg, 12-slot manned central processing facility platform. This is connected, by an eight-inch underwater export pipeline, to a pipeline end manifold where shuttle tankers directly load crude oil via a catenary anchor leg mooring buoy.

Jadestone is updating the currently approved environment plan (the Stag EP) for the Stag field, which will govern production and maintenance activities for the next five years. The revised Stag EP will be assessed by the National Offshore Petroleum Safety and Environmental Management Authority for acceptance.

Jadestone is also preparing an EP for the drilling activities at the Stag platform (the Stag Drilling EP). This will include new production wells from recovered well-slots and may include plugging and abandonment of other wells potentially involving wellhead removal.

The purpose of the EPs is to identify the risks and impacts of each proposed petroleum activity on the environment. The EPs will also set out measures to reduce identified environmental impacts and describe how and to what level of performance those measures will be implemented throughout the activity.

Jadestone is inviting comments for consideration during the preparation of the EPs discussed above. Further information on Jadestone's Stag field is available on the company's website at:
www.jadestone-energy.com/assets/australia-portfolio/stag

Please let us know if you

- require any further information; and/or
- have any comments on the activity and the potential impacts on your interests.

Jadestone is committed to ongoing dialogue with all its stakeholders and welcomes their comments at any time.

For further information or to make comment please email: consult@jadestone-energy.com

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EMPLOYMENT



Government of Western Australia
Western Australia Police Force

Children's Crossings Unit

VACANCIES - TRAFFIC WARDENS

The WA Police Force are looking to establish a pool of applicants to fill current and future vacancies in Karratha.

Duties:

The position of Traffic Warden is to ensure safe pedestrian access of essentially primary age children across carriageways at children's crossings.

Working Conditions:

- School Days, Monday to Friday.
- Contract: casual contract opportunities are available. (Terms and conditions of employment are those provided by the Western Australia Police School Traffic Wardens Agreement 2011).
- Standard Children's Crossing Hours: 1 hour in morning and 1 hour in afternoon
- Hourly Rate: \$25.90 per hour, which includes 20% loading in lieu of payment for public holidays, annual leave and sick leave.
- Laundry Allowance: \$0.70 per week.
- Motor Vehicle Allowance payable under certain conditions.
- Full training and uniform provided.

For Further Information and an Application Package Telephone:

(08) 6274 8731 or email Childrenscrossingsunitsmail@police.wa.gov.au

PLEASE NOTE: Applicants must have a current WA driver's licence and use of a motorised vehicle. Applicants will be required to complete a health assessment, integrity and criminal check, training and if successful, will also be required to apply for a 'Working with Children' card.

The cost of the Working with Children Card and up to \$70 towards a health assessment will be reimbursed after working one month.



WAP_13802



PROPOSAL TO DISPOSE OF PROPERTY

The City proposes to sell the following lots that form part of the Hancock Way subdivision located on Lot 651 Bayview Road, Bulgarra.

Lot	Size	Buyer	Offer
4	600m ²	Karratha Housing Pty Ltd	\$178,500
7	663m ²	Karratha Housing Pty Ltd	\$199,500

The market value of Lot 651 Bayview Road, Bulgarra as assessed on 12 August 2021 was \$1.3M and the individual lots is equal to the Offers received.

Members of the public are invited to make submissions in relation to the proposal.

Submissions should be made to leasing@karratha.wa.gov.au or City of Karratha, PO Box 219, Karratha WA 6714 no later than 6 April 2023.

Virginia Miltrup
Chief Executive Officer

AUCTIONS

REGISTER AND START BIDDING

TRAILERS, MOBILE & STATIONARY EQUIPMENT ONLINE AUCTION

109 Bedrock Turn, Gap Ridge, Karratha
Ends: Wednesday 12th April at 1pm

MOBILE PLANT: Caterpillar 2.5T Forklifts, TCM 10t Forklift, JLG Scissor Lift, Komatsu WA320 Wheeled Loader, Sky Jack Boom Lift, ASV RT30 Posi Trak, 2T Electric Reach Stacker.
STATIONARY PLANT: 3X 20KVA Diesel Gen Sets. **TRAILERS & TRAILER MOUNTED PLANT:** 40FT Tri Axle Flat Bed, 2T Excavator Trailer, 3T Plant Trailer, Vermeer Vacuum, Water Tankers, Nifty Boom Lift, JLG & BriteForce Led Lighting Towers.

Contact: Mark Davenport 0429 085 606

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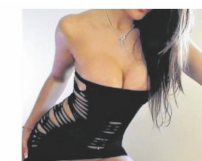


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FUNERAL NOTICES

MACLEOD:
Family and friends of the late Angus Guy MacLeod of Geraldton are respectfully informed that a Funeral Service to pay tribute to Angus's life will take place at GERALDTON Crematorium on THURSDAY (23.03.2023) at 10.00am.



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EMPLOYMENT



Government of Western Australia
Department of Biodiversity, Conservation and Attractions

Operations Officer

Parks and Wildlife Service

Web Search No: DBCA3128414

Level/Salary: Level 4, \$84,582 - \$88,927 p.a. plus Superannuation

Under the general direction of the Marine Park Coordinator; this position delivers parks and conservation compliance services in the district, leads investigations as appropriate, conducts nature protection issue and licence assessments, maintains a close technical relationship within the wildlife compliance program at district and regional level to provide for an integrated delivery of wildlife protection and marine park compliance. The role is responsible for all aspects of workplace safety in the district and ensures / facilitates Job Prescriptions, Job Safety Analysis (JSA), job inductions, Occupational Health and Safety (OH&S) training and appropriate safety equipment is used for work undertaken.

To Access Detailed Information: Visit <https://search.jobs.wa.gov.au> and key in the Web Search No. to access detailed information.

For Specific Inquiries: Please contact Abby Leyendekkers on 9948 2226.

Location: Denham

Closing Date: Friday, 24 March 2023 at midday

DBCA_14037



Government of Western Australia
Western Australia Museum

Engagement Assistant

Salary: Level 2, PS CSA Agreement 2022, \$34.40 - \$37.00 (plus 25% casual loading) per annum pro rata

Position number: 14540

Work type: Casual

Location: Carnarvon

Closing date: 31st March 2023, 4pm

This recruitment process is for a 12 month casual pool.

We currently have casual vacancies for Engagement Assistants for immediate filling up to the 30 June 2024 with the possibility of extension.

The Department recognises Aboriginality as a genuine qualification for this position under 50D of the Equal Opportunity Act 1984. To apply you must be of Aboriginal or Torres Strait Islander (ATSI) descent, identify as ATSI and be recognised as such by the ATSI community.

About the role

The Engagement Assistant's primary purpose is to enhance Gwoonwardu Mia's public profile through the delivery of high-quality customer service and positive interaction with the public.

This position is responsible for presenting/facilitating a range of educational and interpretive experiences to diverse audiences including school groups, general public and special interest groups.

This role also provides a retail and merchandise service to visitors as well as supporting the Artist in Residence program.

About you

We are looking for an outgoing, self-motivated individual who loves working with the public, in a positive team environment, enjoys a challenge and wants to make a positive difference in their community.

Further Information

If you would like further information on this opportunity please contact Carleen Ryder, Operations Manager 0448 369 681.

To apply

To submit your application, please visit search.jobs.wa.gov.au and key in the position number (14540).

WAM_14163

Applications are invited for the following positions:
English Teacher - Ongoing
Please see College website for further details and the application form.
www.ncc.wa.edu.au/employment

PUBLIC NOTICES



Invitation for Consultation: Stag Field

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- require any further information; and/or
- have any comments on the activity and the potential impacts on your interests.

Jadestone is committed to ongoing dialogue with all its stakeholders and welcomes their comments at any time.

For further information or to make comment please email: consult@jadestone-energy.com

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Appendix F – Analyte list for biannual characterisation of produced water

Contaminant group	Analyte	Units
Hydrocarbons	Oil in water	mg/L
	Oil and grease	mg/L
	Total petroleum hydrocarbons	mg/L
Aromatic hydrocarbons	Benzene	mg/L
	Toluene	mg/L
	Ethylbenzene	mg/L
	Xylene	mg/L
	Total PAHs	mg/L
	Naphthalene	mg/L
	Phenanthrene	mg/L
	C ₆ –C ₉	mg/L
	C ₁₀ –C ₁₄	mg/L
	C ₁₅ –C ₂₈	mg/L
C ₂₉ –C ₃₆	mg/L	
>C ₃₆	mg/L	
Trace metals	Arsenic	mg/L
	Barium	mg/L
	Cadmium	mg/L
	Chromium	mg/L
	Hexavalent Chromium	mg/L
	Copper	mg/L
	Iron	mg/L
	Lead	mg/L
	Manganese	mg/L
	Mercury	mg/L
	Nickel	mg/L
	Silver	mg/L
	Strontium	mg/L
	Zinc	mg/L
Nutrients	Total Organic Carbon	mg/L
	Ammonia	mg/L
	Nitrate	mg/L
	Total Kjeldahl Nitrogen	mg/L

Contaminant group	Analyte	Units
	Total Nitrogen	mg/L
	Tertiary Amines	mg/L
	Total Phosphorous	mg/L
	Total Dissolved Solids	mg/L
	Total Suspended Solids	mg/L
	Chemical Oxygen Demand	mg/L
Naturally occurring radioactive material	Ra ²²⁶ , Ra ²²⁸	Bq/L
PSD		µm

APPENDIX G – STAG CRUDE OIL ASSAY (INTERTEK, 2008)

Sample ID	2063		1	Cut Points					
Crude ID	STAG CPF EXPORT			2	3	4	5	6	7
Client ID	APACHE ENERGY LIMITED		Whole	LPG	IBP - 230C	230 - 360C	360 - 540C	360C +	540C +
Date	19 September 2008								
Test	Method	Unit							
Mass Yield	D2892/D5236	%mass		Nil	4.9	48.2	36.4	47.0	10.8
Volume Yield		%volume		Nil	5.2	49.4	35.4	45.4	10.0
Density @15°C	D5002/D4052	kg/L	0.9428		0.8788	0.9175	0.9670	0.9754	0.9937
Specific Gravity @60/60°F		-	0.9433		0.8793	0.9180	0.9676	0.9760	0.9943
API Gravity		API	18.5		29.4	22.6	14.7	13.5	10.8
Aniline Point	D611	°C			519	54.5	62.3	68.8	
Aniline Gravity Product	Calc	-			3685	2940	2119	2103	
Arsenic	ICPMS	mg/kg	2.3						
Ash	D482	%mass	0.0004					0.0070	
Asphaltenes	IP143	%mass	0.14					0.40	
Carbon Residue - Micro	D4530	%mass	105					2.48	
Cetane Index - Procedure A	D4737	-				33.2			
Cetane Index - Procedure B	D4737	-				33.0			
Characterisation Factor	UOP375	-	11.3					11.5	
Cloud Point	D2500	°C				<-45.0			
Colour - ASTM	D1500	-				L0.5			
Copper Corrosion (3hrs @ 50C)	D130	-				1A			
FIA - Aromatics	D1319	%volume			18				
Flash Point	D93	°C	110						
Freeze Point	D5972	°C			<-70.0				
Heat of Combustion - Gross	D4868	MJ/kg	43.98					43.5	
Heat of Combustion - Net	D4868	MJ/kg	41.48					41.1	
Hydrocarbon - Mono-Aromatics	IP391	%mass				23.4			
Hydrocarbon - Di-Aromatics	IP391	%mass				4.8			
Hydrocarbon - Polycyclic-Aromatics	IP391	%mass				5.0			
Kinematic Viscosity @-20°C	D445	cSt			11.32				
Kinematic Viscosity @20°C	D445	cSt	122.5		3.476				
Kinematic Viscosity @40°C	D445	cSt	37.26		2.282	7.342			
Kinematic Viscosity @50°C	D445	cSt					200.2	675.2	
Kinematic Viscosity @100°C	D445	cSt					14.69	33.54	
Mercury Content	UOP938	wt ppb	<1						
Metal - Nickel	ICP-OES	wt ppm	4.0					7.2	314
Metal - Vanadium	ICP-OES	wt ppm	<10					<1	<1
Nitrogen - Basic	UOP269	wt ppm	299					158	
Nitrogen - Total	D4629	wt ppm	516				830	1284	3421
PIONA (Benzene)	D6730	%volume			NA				
Pour Point	D5950/D5853	°C	-33			<-39.0	-3.0	0.0	48.0
Reid Vapour Pressure	D323	kPa	<1						
Reid Vapour Pressure	D323	psi	<0.15						
Sediment by Extraction	D4737	%wt	<0.01						
Smoke Point	D1322	mm			16.5				
Sulphur - Mercaptan	D3227	wt ppm							
Sulphur - Total	IP336	%mass	0.14		<0.030	0.057	0.20	0.22	0.31
Total Acid Number	D664	mg KOH/g	0.50			0.08	0.80	0.9	
Water Content	D4006	%volume	0.150						
Wax Content	UOP46	%mass	<5						

APPENDIX H – HYDROCARBON THRESHOLDS

Hydrocarbon thresholds

Hydrocarbon impact pathways and thresholds

The modelling method described is able to track hydrocarbon concentrations of floating oil, entrained oil and dissolved aromatic hydrocarbons below biologically significant impact levels. Consequently, threshold concentrations are specified for the model to control what contact is recorded for surface (floating oil) and subsurface locations (entrained oil and dissolved aromatic hydrocarbons) to ensure that recorded contacts are for biologically meaningful concentrations.

The determination of biologically 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 mixture making the contact. The toxicity of a hydrocarbon will change over time, due to weathering processes altering the composition of the hydrocarbon. To ensure conservatism in the environmental impact assessment process, the threshold concentrations applied to the model are selected to adopt the most sensitive receptors that may be exposed, the longest likely exposure times and the more toxic hydrocarbons.

Impact pathways and impact threshold concentrations are detailed below for surface (floating) oil, entrained oil and dissolved aromatic hydrocarbons (DAHs).

Surface (floating) oil

The impact threshold concentration for exposure to surface (floating) oil is derived from levels likely to cause adverse impacts to marine/ coastal fauna and habitats. Marine/ coastal fauna, habitats and socio-economic receptors may be impacted by floating oil in the following way:

- Marine mammals, reptiles and birds can be exposed to oil when at the water surface. For marine mammals and reptiles this can occur when surfacing within a slick to breathe while for birds this includes contact from diving into a slick or floating on the sea surface while feeding or resting. For marine fauna surfacing in floating oil contact to sensitive areas may occur (e.g. eyes, mouth and respiratory system) creating irritation and potentially cell damage. Volatile compounds evaporating from surface oil may be inhaled by marine mammals and reptiles, particularly when the oil is fresh and relatively unweathered. Inhalation of these compounds may cause damage to internal respiratory structures. It is generally considered that marine mammals with smooth skin (e.g. cetaceans) are less susceptible to coating of oil than those covered with hair given hair has a greater potential to trap and retain oil causing longer exposure times. Birds are particularly susceptible to impact from floating oil in that feathers retain oil, particularly when the oil is 'sticky' (e.g. heavy crudes). The coating of oil on birds may hinder flight and feeding, reduce the ability of the bird to thermoregulate (control body temperature) and irritate/damage sensitive surfaces such as eyes, ears and nasal structures. Secondary impacts can occur through the ingestion of oil as birds attempt to preen contaminated feathers. Ingestion may lead to oil absorption and further toxic impacts;
- Surface oil can coat emergent habitats such as coral or rocky reefs and intertidal and shoreline areas around islands or along coastlines. Habitats that can be affected include rocky shorelines, sandy beaches, mangrove communities and intertidal areas which may support seagrass, algae and coral reef communities. The physical coating of mangroves, in particular their root system, can prevent gas exchange and/or cause toxicity at the cellular level. Mangrove response to oil contact includes deforestation, yellowing of leaves and mortality. Other chronic responses include reduced growth, reduced reproductive output and success and genetic mutation. Intertidal areas may be contacted at low tides where emergent habitat is coated by oil. Seagrass, algae and sessile fauna such as hard corals, soft corals and sponges may be smothered as well as small low mobility fauna that live in close association with these and other benthic habitats or within/on sediments. Smothering of intertidal photosynthetic organisms such as seagrass, algae and hard coral may reduce their capacity for photosynthesis (energy production) or lead to a

toxic response at the cellular level. For seagrass and algae this could lead to plant death, shedding of leaves/thalli, reduced growth, reduced reproductive output/success and genetic mutation. Similarly, for hard corals, bleaching, colony death, reduced growth and reduced reproductive capacity may occur. Such impacts may be exacerbated if these organisms are already under stress from marginal environmental conditions or if impacts occur during critical life-history stages (e.g. spawning periods). Small fauna smothered by oil may be hindered in their ability to move and feed or may suffer a toxic response from mortality to reduced growth rate or reproductive success. The coating of habitats can lead to secondary impacts to marine/coastal fauna. For example, marine turtles and shorebirds may be contacted by oil when using nesting beaches or when roosting/feeding along shorelines, respectively. Marine/coastal fauna may also ingest oil when feeding on coated habitats, e.g. dugongs or turtles ingesting coated seagrass/algae and shorebirds ingesting coated intertidal organisms such as molluscs and crabs; and

- Surface oil may impact on socio-economic receptors such as the oil and gas industry, commercial shipping, fisheries/aquaculture and tourism. The presence of floating oil may pose a human health risk from volatile compounds depending on the nature and freshness of the oil (i.e. fresh light oils and condensates posing the greatest risk) while oil spill response activities targeting floating oil may preclude or disrupt activities by other users in the area both offshore and at oil affected shorelines. This could have an economic impact on affected industries. In addition, floating and stranded oil may be highly visible to the general public and have a resultant negative effect on tourism in affected areas. Real or perceived deterioration of nearshore and coastal habitats may also have long lasting effect on the tourism value of an area and of fisheries activities that may rely on those areas to support healthy fish stocks.

There is a paucity of data on floating oil concentrations with respect to impacts to marine organisms. The impact of floating oil on birds is better understood than other receptors. Estimates for the minimum oil thickness that will harm seabirds (through ingestion from preening of contaminated feathers or loss of thermal protection of their feathers) range from at 10 g/m² (O'Hara and Morandin, 2010) to 25 g/m² (Koops *et al.*, 2004). A conservative threshold of 10 g/m² has been applied to impacts from floating diesel and crude oil. This hydrocarbon threshold is also considered appropriate for turtles, sea snakes and marine mammals (NRDAMCME, 1997) and has also been applied herein to determine impacts of surface oils to emergent habitat such as coral reefs.

A 1g/m² threshold was also modelled which may appear as a rainbow sheen and may be indicative of socio-economic impacts.

Entrained oil

Entrained oil is oil that is dispersed within the water column as oil droplets. For oil spills released at surface, entrained oil is created in the top few meters of the water column through mixing of surface oil by wave action. For oil spills released subsea (e.g. pipelines leaks, well blowouts) entrained oil may be distributed deeper within the water column.

The concentrations of entrained droplets output by SIMAP represent hydrocarbons that are not bioavailable. The soluble and semi-soluble fractions dissolve from the droplets over time, and a potential effects analysis based on the dissolved hydrocarbons characterizes their risk.

Because PAHs are the most toxic components of oil and crude oils typically contain about 1% PAHs by mass (French-McCay 2002; Forth *et al.* 2017), the sublethal concentration threshold (PNEC) expressed as total hydrocarbon concentration (THC, not TPH) based on the most toxic components would be ~100 µg/L (100 ppb) for fresh oil. However, as oil weathers, PAHs are lost to volatilization and degradation. Thus, the whole-oil threshold of 100 ppb is appropriate for fresh oil and conservative (highly protective of aquatic resources) for weathered oil. An exposure concentration of 1,000 ppb (1 ppm or 1 mg/L) of (total) oil hydrocarbons was deemed a low level of concern for sensitive life stages in marine organisms by Kraly *et al.* (2001). The 1 mg/L concentration is at the low

end of the range where sub-lethal impacts from acute exposure have been observed (NRC, 2005). Based on the review of toxicity studies by Bejarano et al. (2017), a THC lethal threshold of 3–28 mg/L (or 3–30 mg/L with rounding, given uncertainties) would be appropriate for a range of oils and states of weathering for species from all geographical areas globally.

Based on this information, a contact threshold of 100 ppb was considered a conservative contact threshold for the assessment of impacts from entrained oil.

Dissolved Aromatic Hydrocarbons

Dissolved hydrocarbons are taken up into organisms directly through external surfaces and gills, as well as through the digestive tract. Thus, soluble and semi-soluble hydrocarbons are bioavailable, whereas insoluble compounds in oil are not bioavailable to aquatic organisms. Laboratory studies have shown that the dissolved hydrocarbons exert the most effects on aquatic biota (Carls et al. 2008; Nordtug et al. 2011; Redman 2015). The volatilization rates of hydrocarbons from surface slicks are faster than the dissolution rates. Thus, dissolution from oil droplets in the water column is the main source of concentrations dissolved in the water.

The most toxic components of oil to water-column and benthic organisms are lower-molecular-weight compounds, which are both volatile and soluble in water (generally in the water accommodated fraction – WAF). The polynuclear aromatic hydrocarbons (PAHs) exert the most toxic effects because they are semi-soluble and not highly volatile, so they persist in the environment long enough for significant exposure to occur (Anderson et al., 1974, 1987; Neff and Anderson, 1981; Malins and Hodgins, 1981; McAuliffe, 1987; NRC 2003, 2005). The monoaromatic hydrocarbons (MAHs), including BTEX (benzene, toluene, ethylbenzene, and xylenes), and the soluble alkanes also contribute to toxicity, but these compounds are highly volatile, so exposures of aquatic biota are minimal or negligible except when light oils are discharged at depth where volatilization does not occur (French-McCay 2002).

French McCay (2018) provides an outline of the measured total PAH concentrations within the water accommodated fraction of medium crude oils as being 74.9 to 282 µ/l.

Within the soluble and semi-soluble hydrocarbons, toxicity is inversely related to solubility, typically quantified by the octanol-water partition coefficient (K_{ow}), a measure of hydrophobicity (Nirmalakhandan and Speece 1988; Hodson et al. 1988; Blum and Speece 1990; McCarty 1986; McCarty et al. 1992a, b; Mackay et al. 1992; McCarty and Mackay 1993; Verhaar et al. 1992, 1999; Swartz et al. 1995; French-McCay 2002; McGrath et al 2009).

Due to the toxic nature of MAHs and low molecular weight PAHs, and the ability for these to be transferred across cellular structures, DAHs contribute to the acute toxicity of an oil. The proportion of BTEX, and other DAHs that are readily dissolved or evaporated, diminish over time. DAH concentration is therefore higher around fresh oil than weathered oil. The toxicity of DAHs to an organism is dependent on both the concentration of the oil and the amount of time an organism is exposed to a given concentration.

The range of LC50s varies from ~10 mg/L (ppb) for 3-ring PAHs (which are semi-soluble) to ~10-100 mg/L (ppm) for the highly soluble BTEX compounds (French-McCay 2002). Thus, the toxicity of an oil hydrocarbon mixture is strongly related to the chemical composition, which varies as the oil weathers since the soluble and semi-soluble hydrocarbons are all volatile to varying degree. Aurand and Coelho (2005) suggest that, based on the wide variation of toxicity data, a threshold of 1,000 ppb will represent a reasonable level for protection of more sensitive life stages of organisms residing in the water column.

For most oil spills, exposures of water column biota to concentrations above potential thresholds of concern are typically on time scales of minutes to hours, even for spills lasting weeks or months because of the varying movements of the oil in the water, dilution and losses to biodegradation and

volatilization. Furthermore, the concentrations vary in time over the short exposure periods (McAuliffe et al. 1980, 1981; McAuliffe 1987; Lunel 1994; French McCay 2002, 2004; Bejarano et al. 2014). Thus, the use of LC50s for >48 hours of exposure, or chronic endpoints for longer exposure times, as thresholds for oil spills is highly conservative. Acute aquatic toxicity thresholds would be sufficiently conservative for oil spills in open water systems (as opposed to ponds or other contained systems). There is no need for an ACR correction for evaluating acute toxicity to aquatic biota from oil spills in open waters.

Based on this information, a contact threshold of 70 ppb was considered a conservative contact threshold for the assessment of impacts from dissolved aromatic hydrocarbons.

APPENDIX I – PROTECTION PRIORITY VALUES AND SPILL MODELLING SUMMARY

Key: NM = Not Modelled; NC = Not Contacted. Also note the worst case is represented for each value but could be from different seasons.

Protection Priority	Key Values	Relevant Key Periods (Vulnerability)	Oil Spill Modelling Parameter		Scenario Result	
					Subsea Crude (86.5m ³)	Surface Diesel (250m ³)
Dampier Archipelago	<p>Physical Habitats</p> <p>Coral reefs -approximately 120 species of coral - significant (>70% coverage) are on slopes of eastern half of archipelago -high sponge diversity</p> <p>Seagrass -largest areas between Keast and Legendre Is, and West Intercourse Is and Cape Preston -takes forms of interspersed seagrass/macroalgal beds rather than extensive meadows</p> <p>Macroalgae -macro-algae dominate shallow (<10m) submerged limestone reefs and grow on stable rubble and boulder surfaces -approx. 200 species -counts for 70% of marine habitat</p> <p>Mangroves - throughout area but EPA regionally significant at West Intercourse and Enderby Is</p> <p>Intertidal mud/sand flats -wide sandflats and mudflats</p> <p>Sandy Beaches -present and used for turtle and seabird nesting</p> <p>Contact from floating oil is likely to impact emergent coral and sandy beaches resulting in smothering of coral and stranded oil on beaches, although tidal movements will mobilise oil and add to dispersion of oil. Contact from entrained oil may impact submerged corals/seagrasses/macroalgae resulting in smothering and/or</p>	<p>Turtle nesting and breeding Nov-Mar with peak in late Dec/early Jan. Humpback whale annual migration July to September</p>	Probability of films arriving at receptors at >1g/m ²	%	<1	<1
			Probability of contact by floating oil at >10g/m ²	%	<1	<1
			Probability of contact by entrained oil at >100ppb	(%)	<1	<1
			Probability of contact by dissolved aromatics at >70 ppb	(%)	<1	<1
			Maximum accumulated volume on shorelines with concentrations exceeding 100 g/m ²	m ³	19	NC
			Minimum time to shoreline contact by floating oil at >100 g/m ²	days	7	NC
			Maximum concentration of entrained oil in the worst replicate	ppb	44	40
			Maximum concentration of dissolved aromatics	ppb	7	5

Protection Priority	Key Values	Relevant Key Periods (Vulnerability)	Oil Spill Modelling Parameter		Scenario Result	
					Subsea Crude (86.5m ³)	Surface Diesel (250m ³)
	<p>contact toxic impacts; although constant tidal and current motions will re-mobilise oil and create further dilution</p> <p>Marine Fauna</p> <p>Invertebrates</p> <ul style="list-style-type: none"> -abundant, molluscs <p>Finfish and Rays</p> <ul style="list-style-type: none"> -high fish biodiversity approx. 650 species, dwarf sawfish EPBC protected - 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 -inter-island passages have rich soft bottom fauna <p>Birds</p> <ul style="list-style-type: none"> -16 species of seabirds, some protected under EPBC, JAMBA and CAMBA species with significant breeding on Goodwyn, Keast Islands, Nelson Rocks -migratory seabird resting, foraging and breeding areas on beaches and mudflats -breeding occurs predominantly in winter months -nesting can occur on sandy beaches and dunes <p>Marine reptiles</p> <p>Turtles</p> <ul style="list-style-type: none"> - nesting and foraging <p>(Hawksbill - largest known nesting for NW pop is NW of Rosemary Is and Delambre, nesting all year)</p> <p>(Flatbacks - nest on Legendre, Huay, Delambre)</p> <p>(Green – significant rookery in NWS)</p> <p>(Olive Ridley – known to forage)</p> <p>(Loggerhead – nesting and foraging)</p>		in the worst replicate			

Protection Priority	Key Values	Relevant Key Periods (Vulnerability)	Oil Spill Modelling Parameter		Scenario Result	
					Subsea Crude (86.5m ³)	Surface Diesel (250m ³)
	<p>Sea snakes</p> <ul style="list-style-type: none"> - possible transient presence <p>Marine mammals</p> <ul style="list-style-type: none"> - Eight species (dugong, whales, dolphins) - migratory pathway for protected humpback whale in July-Sept. <p>Contact from floating oil is likely to impact marine fauna by smothering (causing skin/eye irritation and affect ability to thermo-regulate), oil coating from movement across shorelines and inhalation of oil if surfacing to breathe. In addition, ingestion may occur from preening/cleaning body and/or eating tainted food resulting in internal toxicity. Contact from entrained oil may impact marine fauna by causing skin or eye irritation/toxicity as fauna move through water, or internal toxicity from ingesting oil tainted food or breathing oil entrained water (fish). Although constant tidal and current motions will re-mobilise oil and create further dilution and fauna are mobile</p> <p>Protected Area</p> <ul style="list-style-type: none"> - Commonwealth Marine Reserve <p>The habitat and marine fauna which may be contacted by oil (as described above) will then impact upon the CMR values</p> <p>Socio-economic and heritage values</p> <ul style="list-style-type: none"> -National Heritage Listed -Aboriginal rock art on shorelines, Burrup Peninsula -42 islands within 45km radius of Dampier -25 islands are nature reserves -Recreational fishing (high values by community) -Camping beaches, social amenities -High use port for shipping and industry and shipping fairway -Aquaculture 					

Protection Priority	Key Values	Relevant Key Periods (Vulnerability)	Oil Spill Modelling Parameter		Scenario Result	
					Subsea Crude (86.5m ³)	Surface Diesel (250m ³)
	<p>-Aquarium fishery</p> <p>-tourism around water based activities and nature (whale watching and turtles)</p> <p>Shipwreck sites</p> <p>Oil contacting will impact upon these values, in particular, tourism, industry, indigenous values and fishing activities being impacted from visible floating oil and tainted fish</p>					
Barrow Island Inc. surrounds	<p>Bandicoot Bay - conservation area created to protect benthic fauna and seabirds. Class A Nature Reserve</p> <p><i>Note that there is No Contact by Dissolved Oil above the threshold</i></p> <p>Physical Habitats</p> <p>Coral reefs</p> <ul style="list-style-type: none"> - Biggada Reef <p>Seagrass</p> <ul style="list-style-type: none"> - No significant meadows, some present in shallow areas <p>Macroalgae</p> <ul style="list-style-type: none"> - Dominant benthic habitat on hard substrates (~40%) <p>Mangroves</p> <ul style="list-style-type: none"> - Some restricted areas of stunted growth mangroves <p>Sandy beaches</p> <ul style="list-style-type: none"> - Important beaches for turtle nesting (Green & Flatback) <p>Rocky shorelines</p> <ul style="list-style-type: none"> - Cliffs up to 30 m high - Some intertidal limestone platforms provide food for shorebirds <p>Intertidal mud/sandflats</p>	<p>Green turtle nesting: All year round (peak Dec-Jan)</p> <p>Hawksbill turtle nesting: Oct-Jan</p> <p>Flatback turtles: Dec-Jan</p> <p>Loggerhead nesting: Dec-Jan</p> <p>Birds: Sept-Feb</p>	Probability of films arriving at receptors at >1g/m ²	%	1	<1
			Probability of contact by floating oil at >10g/m ²	%	<1	<1
			Probability of contact by entrained oil at >100ppb	(%)	1	2
			Probability of contact by dissolved aromatics at >70 ppb	(%)	<1	<1
			Maximum accumulated volume on shorelines with concentrations exceeding 100 g/m ²	m ³	2	NC
			Minimum time to shoreline contact by floating oil at >100 g/m ²	Days	26	NC

Protection Priority	Key Values	Relevant Key Periods (Vulnerability)	Oil Spill Modelling Parameter		Scenario Result	
					Subsea Crude (86.5m ³)	Surface Diesel (250m ³)
	<ul style="list-style-type: none"> - largest intertidal sand/mudflat community in the reserves, high in invertebrate diversity - important feeding area for migratory birds <p>KEF</p> <p>Contact from floating oil is likely to impact the shoreline and result in accumulated stranded oil at discrete locations. Mangroves and intertidal areas may be impacted by being smothered, although continuous tidal movements will mobilise oil and add to dispersion. Contact from entrained oil may impact shoreline through accumulation and may impact submerged corals/seagrasses/macroalgae resulting in smothering and/or contact toxic impacts; although constant tidal and current motions will re-mobilise oil and create further dilution.</p> <p>Marine Fauna</p> <p>Invertebrates</p> <ul style="list-style-type: none"> - High invertebrate density on mud/sand flats - Diversity typical of NWS and Indo-Pacific region - Filter feeding communities dominant >10m depths <p>Turtles</p> <ul style="list-style-type: none"> - Regionally and nationally sig Green (western side) and flatback turtle (eastern side) nesting beaches, - Foraging and nesting areas around Barrow Island for green, flatback and hawksbill; mating flatback turtles; - John Wayne Beach, logger heads + hawksbill (low density) - Turtle Bay is an important turtle aggregation and feeding area <p>Seabirds</p> <ul style="list-style-type: none"> - Migratory birds (important habitat) (important bird area) 10th of top 147 bird sites, - Highest pop of migratory birds in BI Nature reserve (south-south east island) and in tidal mudflats e.g. Bandicoot Bay 		<p>Maximum concentration of entrained oil in the worst replicate</p> <p>ppb</p>	2	544	
			<p>Maximum concentration of dissolved aromatics in the worst replicate</p> <p>ppb</p>	343	30	

Protection Priority	Key Values	Relevant Key Periods (Vulnerability)	Oil Spill Modelling Parameter		Scenario Result	
					Subsea Crude (86.5m ³)	Surface Diesel (250m ³)
	<ul style="list-style-type: none"> - Along the East Asian-Australasian Flyway migration route of migratory sea and shorebirds - Double island important bird nesting (shearwaters, sea eagles) <p>Fish/sharks</p> <ul style="list-style-type: none"> - Intertidal flats provide foraging habitat for sharks/rays at high tide - High species richness and diversity of fish fauna >400 species <p>Marine mammals</p> <p>Fish</p> <ul style="list-style-type: none"> - Similar species found throughout Indo-west Pacific region - Blind gudgeon found at Barrow Island (in caves/groundwater) <p>Seabirds</p> <ul style="list-style-type: none"> - Foraging area for Migratory and seabirds <p>Marine mammals</p> <ul style="list-style-type: none"> - Whale and dolphin species may occasionally visit the Barrow/Montebello islands region <p>Contact from floating oil is likely to impact marine fauna by smothering (causing skin/eye irritation and affect ability to thermo-regulate), oil coating from movement across shorelines and inhalation of oil if surfacing to breathe. In addition, ingestion may occur from preening/cleaning body and/or eating tainted food resulting in internal toxicity. Contact from entrained oil may impact marine fauna by causing skin or eye irritation/toxicity as fauna move through water, or internal toxicity from ingesting oil tainted food or breathing oil entrained water (fish). Although constant tidal and current motions will re-mobilise oil and create further dilution and fauna are mobile</p> <p>Socio-Economic and Heritage values</p> <p>National heritage</p> <ul style="list-style-type: none"> - Barrow Island and Montebello-Barrow Islands CMR 					

Protection Priority	Key Values	Relevant Key Periods (Vulnerability)	Oil Spill Modelling Parameter		Scenario Result	
					Subsea Crude (86.5m ³)	Surface Diesel (250m ³)
	<ul style="list-style-type: none"> - Barrow Island marine park is zoned a sanctuary zone. Commonwealth Marine Reserve and Barrow Island MMA and Montebello Islands MP (Multiple Use) <p>The habitat and marine fauna which may be contacted by oil (as described above) will then impact upon the marine park values</p> <p>Commercial fishing</p> <ul style="list-style-type: none"> - Pearling leaseholders in the area, some zones prohibit pearling - A number of State managed fisheries occur in the area <p>Tourism</p> <ul style="list-style-type: none"> - Nature based tourism (charter vessels, diving snorkelling) - Limited visitors given remote location - Shore based fishing - Marine Park allows passive recreational activities (diving, snorkelling, boating) - Very important for recreational fishing - Significant for recreational fishing and charter boat tourism <p>Cultural Heritage</p> <ul style="list-style-type: none"> - No recorded seabed Aboriginal sites <p>Recreational Fishing</p> <ul style="list-style-type: none"> - Significant for recreational fishing and charter boat tourism <p>Industry</p> <ul style="list-style-type: none"> - Oil and gas facility and pipelines, RO Plant and operations <p>Oil contacting will impact upon these values from visible floating oil and stranded oil</p>					
Montebello Islands, inc. CMR	<p>Montebello Islands are important for turtle nesting and seabirds. Montebello CMR is in place to protect foraging areas for migratory</p>	Pygmy blue whale migration: Apr-Aug	Probability of films arriving at receptors at >1g/m ²	%	8	<1

Protection Priority	Key Values	Relevant Key Periods (Vulnerability)	Oil Spill Modelling Parameter		Scenario Result	
					Subsea Crude (86.5m ³)	Surface Diesel (250m ³)
	<p>seabirds, whale sharks and marine turtles; includes part of the migratory pathway of the humpback whale.</p> <ul style="list-style-type: none"> - The reserve includes shallow shelf environments with depths ranging from 15 metres to 150 metres and provides protection for shelf and slope habitats, as well as pinnacle and terrace seafloor features - Examples of the seafloor habitats and communities of the Northwest Shelf Province provincial bioregions as well as the Pilbara (offshore) meso-scale bioregion - One key ecological feature for the region: ancient Coastline (a unique seafloor feature that provides areas of enhanced biological productivity) is represented in this reserve - Important for recreational fishing <p>Contact from entrained and dissolved oil may impact submerged habitats resulting in smothering and/or contact toxic impacts; although constant tidal and current motions will re-mobilise oil and create further dilution</p> <p>Physical Habitats</p> <p>Reefs</p> <p>Algae (40%)</p> <p>Mangroves (globally unique as offshore)</p> <p>Fish habitat</p> <p>Intertidal sand flat communities</p> <p>Contact from floating oil is likely to impact the shoreline and result in accumulated stranded oil at discrete locations. Mangroves and intertidal areas may be impacted by being smothered, although continuous tidal movements will mobilise oil and add to dispersion. Contact from entrained oil may impact shoreline through accumulation and may impact submerged corals/seagrasses/macroalgae resulting in smothering and/or</p>		Probability of contact by floating oil at >10g/m ²	%	1	<1
			Probability of contact by entrained oil at >100ppb	(%)	2	40
			Probability of contact by dissolved aromatics at >70 ppb	(%)	<1	2
			Maximum accumulated volume on shorelines with concentrations exceeding 100 g/m ²	m ³	33	NC
			Minimum time to shoreline contact by floating oil at >100 g/m ²	Days	NC	NC
			Maximum concentration of entrained oil in the worst replicate	ppb	1,288	5,973
			Maximum concentration of dissolved aromatics in the worst replicate	ppb	34	168

Protection Priority	Key Values	Relevant Key Periods (Vulnerability)	Oil Spill Modelling Parameter		Scenario Result	
					Subsea Crude (86.5m³)	Surface Diesel (250m³)
	<p>contact toxic impacts; although constant tidal and current motions will re-mobilise oil and create further dilution</p> <p>Marine Fauna</p> <p>Turtles</p> <ul style="list-style-type: none"> - Logger head, green significant rookery, hawksbill, flatback - Northwest and Eastern Trimouille Islands (Hawksbill), western reef and Southern Bay at Northwest Island (Green) <p>Seabirds</p> <ul style="list-style-type: none"> - Migratory and threatened seabirds - 14 species - Significant nesting, foraging and resting areas <p>Invertebrates</p> <ul style="list-style-type: none"> - Filter feeding communities dominant >10m depths <p>Fish</p> <ul style="list-style-type: none"> - Similar species found throughout Indo-west Pacific region <p>Marine mammals</p> <ul style="list-style-type: none"> - Whale and dolphin species may occasionally visit the Barrow/Montebello islands region - Only the humpback whale is a regular visitor to these areas (foraging) - Pygmy blue whale northern migration (Apr - Aug) - Dugongs regularly seen in shallow waters <p>Marine Reptiles</p> <ul style="list-style-type: none"> - Foraging area for marine turtles <p>Contact from floating oil is likely to impact marine fauna by smothering (causing skin/eye irritation and affect ability to thermo-regulate), oil coating from movement across shorelines and inhalation of oil if surfacing to breathe. In addition, ingestion may occur from preening/cleaning body and/or eating tainted food resulting in internal toxicity. Contact from entrained oil may impact</p>					

Protection Priority	Key Values	Relevant Key Periods (Vulnerability)	Oil Spill Modelling Parameter		Scenario Result	
					Subsea Crude (86.5m ³)	Surface Diesel (250m ³)
	<p>marine fauna by causing skin or eye irritation/toxicity as fauna move through water, or internal toxicity from ingesting oil tainted food or breathing oil entrained water (fish). Although constant tidal and current motions will re-mobilise oil and create further dilution and fauna are mobile</p> <p>Socio-Economic and Heritage values</p> <p>Pearling (inactive/pearling zones)</p> <p>Significant for recreational fishing and charter boat tourism</p> <p>Marine Park allows passive recreational activities (diving, snorkelling, boating)</p> <p>Social amenities and other tourism</p> <p>European history/maritime heritage</p> <p>Nominated place (National heritage)</p> <p>Commonwealth Marine Reserve and and Montebello Islands MP (Multiple Use)</p> <p>Cultural heritage: No recorded Aboriginal sites</p> <p>Oil contacting will impact upon these values from visible floating oil and stranded oil</p>					
Lowendal Islands	<p>Physical Habitats</p> <p>Important shallow lagoons with seagrass for dugongs</p> <p>Deep water benthic (soft sediment) habitats</p> <p>Dugong and batman reef (eastern side IS),</p> <p>Mangroves are considered globally unique as they are offshore</p> <p>Macro algal reefs (40%)</p> <p>Contact from floating oil is likely to impact the shoreline and result in accumulated stranded oil at discrete locations. Mangroves and</p>	Green turtle nesting: All year round (peak Dec-Jan)	Probability of films arriving at receptors at >1g/m ²	%	<1	<1
		Hawksbill turtle nesting: Oct-Jan	Probability of contact by floating oil at 10g/m ²	%	<1	<1
		Flatback turtles: Dec-Jan	Probability of contact by entrained oil at >100ppb	(%)	<1	2

Protection Priority	Key Values	Relevant Key Periods (Vulnerability)	Oil Spill Modelling Parameter		Scenario Result	
					Subsea Crude (86.5m ³)	Surface Diesel (250m ³)
	<p>intertidal areas may be impacted by being smothered, although continuous tidal movements will mobilise oil and add to dispersion. Contact from entrained oil may impact shoreline through accumulation and may impact submerged corals/ seagrasses/ macroalgae resulting in smothering and/or contact toxic impacts; although constant tidal and current motions will re-mobilise oil and create further dilution</p> <p>Marine Fauna</p> <p>Turtles</p> <ul style="list-style-type: none"> - Important hawksbill (Beacon, Parakeelya, Kaia and Pipeline), Loggerhead and green turtle nesting (minor) Varanus pipeline, Harriet and Andersons), - Nesting is reported to occur throughout the year in WA, peaking between October and January - Significant Flatback rookery, nesting season for Flatback turtles peaks in December and January with subsequent peak hatchling emergence in February and March <p>Seabirds</p> <ul style="list-style-type: none"> - Approximately 89 species of avifauna, 12 -14 species of migratory and seabirds <p>Marine mammals</p> <ul style="list-style-type: none"> - Seagrass beds around the Lowendal islands thought to provide valuable food source for dugongs <p>Contact from floating oil is likely to impact marine fauna by smothering (causing skin/eye irritation and affect ability to thermo-regulate), oil coating from movement across shorelines and inhalation of oil if surfacing to breathe. In addition, ingestion may occur from preening/cleaning body and/or eating tainted food resulting in internal toxicity. Contact from entrained oil may impact marine fauna by causing skin or eye irritation/toxicity as fauna move through water, or internal toxicity from ingesting oil tainted</p>	<p>Loggerhead nesting: Dec-Jan</p> <p>Birds: Sept-Feb</p>	<p>Probability of contact by dissolved aromatics at >70 ppb</p>	(%)	<1	<1
			<p>Maximum accumulated volume on shorelines with concentrations exceeding 100 g/m²</p>	m ³	7	NC
			<p>Minimum time to shoreline contact by floating oil at >100 g/m²</p>	days	26	NC
			<p>Maximum concentration of entrained oil in the worst replicate</p>	ppb	<1	424
			<p>Maximum concentration of dissolved aromatics in the worst replicate</p>	ppb	2	16

Protection Priority	Key Values	Relevant Key Periods (Vulnerability)	Oil Spill Modelling Parameter		Scenario Result		
					Subsea Crude (86.5m ³)	Surface Diesel (250m ³)	
	<p>food or breathing oil entrained water (fish). Although constant tidal and current motions will re-mobilise oil and create further dilution and fauna are mobile</p> <p>Protected Areas</p> <ul style="list-style-type: none"> - The Barrow Island Marine Management Area most of the waters around Barrow Island, the Lowendal Islands and the Barrow Island Marine Park. [See Barrow Island and Montebellos for information] <p>The habitat and marine fauna which may be contacted by oil (as described above) will then impact upon the MMA and marine park values</p> <p>Socio-economic and Heritage values</p> <ul style="list-style-type: none"> - Social amenities and other tourism, very significant for recreational fishing and charter boat tourism <p>Oil contacting will impact upon these values from visible floating oil and stranded oil</p>						
Greater North Coast/Eighty Mile Beach; inc. CMR and Ramsar Site	<p>Eighty Mile Beach management plan recognises oil spills as a potential pressure on emergent features: mangroves and saltmarsh, intertidal sand and mudflats (DPaW, 2014). CMR in place to protect communities and seafloor habitats, Eighty Mile Beach marine park also in place.</p> <p>Physical Habitat</p> <p>Coral reefs</p> <ul style="list-style-type: none"> - Subtidal filter feeding communities present, likely provide foraging habitat for flatback turtles - High diversity intertidal and subtidal coral reef communities <p>Seagrasses</p> <ul style="list-style-type: none"> - Seasonally present but sparsely distributed 	Birds: Aug-Nov	Probability of films arriving at receptors at >1g/m ²	%	1	<1	
		Nesting Turtles: Nov-Dec					
		Hatchling turtles: Feb-Mar	Probability of contact by floating oil at 10g/m ²	%	<1	<1	
			Probability of contact by entrained oil at >100ppb	(%)	<1	<1	
			Probability of contact by dissolved aromatics at >70 ppb	(%)	<1	<1	

Protection Priority	Key Values	Relevant Key Periods (Vulnerability)	Oil Spill Modelling Parameter		Scenario Result	
					Subsea Crude (86.5m ³)	Surface Diesel (250m ³)
	<ul style="list-style-type: none"> - Dugongs regularly found feeding on seagrass meadows here <p>Macroalgae</p> <ul style="list-style-type: none"> - Provide habitat and feeding opportunities for fish, invertebrates and dugong <p>Mangroves</p> <ul style="list-style-type: none"> - Limited stretch along coastline and in Mandora Saltmarsh area. minor stands 10-20 km close to tidal creeks. <p>Intertidal mud/sand flats</p> <ul style="list-style-type: none"> - 225km intertidal mudflats provide important food source for many of the bird species from the infauna present - Mandora Saltmarsh area contains rare group of wetlands <p>Sandy Beaches</p> <ul style="list-style-type: none"> - Sandy shores occupy the landward edge of the intertidal zone (approx. 220km), provide important turtle nesting habitat and some tourism (see below). <p>Rocky shorelines</p> <ul style="list-style-type: none"> - Not identified in emergent area <p>Contact from floating oil is likely to impact the shoreline and result in accumulated stranded oil at discrete locations. Mangroves and intertidal areas may be impacted by being smothered, although continuous tidal movements will mobilise oil and add to dispersion. Contact from entrained oil may impact shoreline through accumulation, although constant tidal and current motions will re-mobilise oil and create further dilution.</p> <p>Contact from entrained and dissolved oil (although well below threshold levels) may impact submerged habitats resulting in smothering and/or contact toxic impacts; although constant tidal and current motions will re-mobilise oil and create further dilution</p> <p>Marine Fauna</p> <p>Invertebrates</p>		<p>Maximum accumulated volume on shorelines with concentrations exceeding 100 g/m²</p> <p>Minimum time to shoreline contact by floating oil at >10 g/m²</p> <p>Maximum concentration of entrained oil in the worst replicate</p> <p>Maximum concentration of dissolved aromatics in the worst replicate</p>	<p>m³</p> <p>DAYS</p> <p>ppb</p> <p>ppb</p>	<p>7</p> <p>NC</p> <p><1</p> <p><1</p>	<p>NC</p> <p>NC</p> <p>15</p> <p><1</p>

Protection Priority	Key Values	Relevant Key Periods (Vulnerability)	Oil Spill Modelling Parameter		Scenario Result	
					Subsea Crude (86.5m ³)	Surface Diesel (250m ³)
	<ul style="list-style-type: none"> - Large number and diversity of invertebrates within the intertidal mudflat areas - Oil can reduce invertebrate abundance or alter the intertidal invertebrate community that provides food for non-breeding shorebirds <p>Fish and sharks</p> <ul style="list-style-type: none"> - Fish populations dependent on habitat and substrate type - Several fish species targeted by recreational commercial fisheries - Sawfish foraging, nursing and pupping; diversity of sharks and rays (including protected species) - Diversity of fish species provide recreational and commercial fishing opportunities <p>Birds</p> <ul style="list-style-type: none"> - Ramsar site - 97 wetland bird species, 42 of which are listed under CAMBA, JAMBA and ROKAMBA - 500,000 birds use the area as a migration terminus annually, key period is Aug-Nov when contact with oil spill could result in impacts at a population level <p>Marine reptiles</p> <ul style="list-style-type: none"> - Flatback turtles nest at scattered locations along shoreline. - Green, hawksbill, loggerhead, olive ridley and leatherback may frequent the waters all year round <p>Marine Mammals</p> <ul style="list-style-type: none"> - Humpback whale migration pathway though the CMR - Dugongs and other cetaceans inhabit or migrate through the CMR/marine park although unlikely to be larger whale species due to water depths 					

Protection Priority	Key Values	Relevant Key Periods (Vulnerability)	Oil Spill Modelling Parameter		Scenario Result	
					Subsea Crude (86.5m ³)	Surface Diesel (250m ³)
	<p>Contact from floating oil is likely to impact marine fauna by smothering (causing skin/eye irritation and affect ability to thermo-regulate) and oil contact from movement across the shoreline. In addition, ingestion may occur from preening/cleaning body and/or eating oil covered food resulting in internal toxicity. Contact from entrained oil may impact marine fauna by causing skin irritation/toxicity as fauna move through water, or internal toxicity from ingesting oil tainted food. Although constant tidal and current motions will re-mobilise oil and create further dilution and fauna are mobile</p> <p>Protected Area</p> <ul style="list-style-type: none"> Listed Ramsar site. The site comprises of two separate areas: 220km of beach and associated intertidal mudflats from Cape Missiessy to Cape Keraudren (“the beach”) and Mandora Salt Marsh 40km to the east (inland). <p>Oil unlikely to contact Mandora Salt Marsh, however ‘the beach’ area consists of sandy beach, mangroves and intertidal mudflats which may be contacted by oil (as described above) impacting upon the Ramsar values</p> <p>Socio-economic and heritage values</p> <ul style="list-style-type: none"> Tourism activities include camping nearby, nature appreciation, nature based, fishing and wildlife viewing from vessels. Some vessel based fishing (mostly shore based recreational fishing in Eighty Mile Beach area) and four wheel driving Indigenous values: wetlands are significant to 3 local groups; several aboriginal heritage sites present. The adjacent CMR contains land and sea important to traditional indigenous owners, 4 special purpose zones included in marine park <p>Oil contacting shorelines will impact upon these values, in particular, tourism and fishing activities from visible stranded oil and tainted fish</p>					

Protection Priority	Key Values	Relevant Key Periods (Vulnerability)	Oil Spill Modelling Parameter		Scenario Result	
					Subsea Crude (86.5m ³)	Surface Diesel (250m ³)
	<ul style="list-style-type: none"> - Heritage value: two shipwrecks and one plane wreck present that could be contacted by entrained oil - Pearl Producers Association have previously indicated this is area is important as a seed stock. Diving for pearl oysters is limited to the 35m depth contour (adjacent to the marine park) - Commercial fishing: a number are licensed to operate in the CMR <p>The habitat and marine fauna which may be contacted by oil (as described above) will then impact upon the CMR and socio-economic values</p>					

APPENDIX J – AMSA MOU

MEMORANDUM OF UNDERSTANDING
BETWEEN THE
AUSTRALIAN MARITIME SAFETY AUTHORITY ('AMSA')
AND
JADESTONE ENERGY, ACN 613 671 819 ('THE TITLEHOLDER')
ON
SUPPORT FOR OIL SPILL PREPAREDNESS AND RESPONSE

BACKGROUND

1. Under the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* ('the Regulations'), the Titleholder is required to have an accepted *Environment Plan* ('EP').
2. The EP must include an *Oil Pollution Emergency Plan*, and this must provide for consultation with relevant persons.
3. For those petroleum titles subject to a joint venture, the Titleholder has been nominated under section 775B(2) of the *Offshore Petroleum and Greenhouse Storage Act 2006* ('OPGG Act') as the party who is authorised to take eligible voluntary actions on behalf of the titleholders and under regulation 11A.04(2) of the *Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011* as the party to whom notices can be given.
4. In order for NOPSEMA to accept the EP under the Regulations, the EP must demonstrate that the Titleholder has carried out the consultation required by the Regulations.
5. This Memorandum of Understanding ('MOU') is the result of consultation between the Titleholder and AMSA, and sets out their understanding of their respective roles and responsibilities when responding to ship-sourced marine pollution incidents and non-ship-sourced marine pollution incidents.
6. This MOU supersedes any previous agreement or understandings between AMSA and the Titleholder about oil spill preparedness and response.
7. This MOU does not create or give rise to any rights or obligations for either participant.

RESPONSE TO SHIP-SOURCED MARINE POLLUTION INCIDENTS

8. AMSA and the Titleholder acknowledge that AMSA retains Combat Agency responsibility for all ship-sourced marine pollution incidents. AMSA will respond in accordance with its *Marine Pollution Response Plan* as approved by the AMSA Executive.
9. The Titleholder agrees to provide all available support to AMSA in AMSA's performance of its Combat Agency responsibilities.

10. If the Titleholder is required by the OPGGS Act or the Regulations, or both, to develop an *Oil Pollution Emergency Plan* for ship-sourced incidents, the following words will be contained within the appropriate section of that plan:
 - The Australian Maritime Safety Authority (AMSA) is the designated Combat Agency for oil spills from vessels within the Commonwealth jurisdiction. Upon notification of an incident involving a ship, AMSA will assume control of the incident and respond in accordance with AMSA's *Marine Pollution Response Plan*.
 - AMSA's *Marine Pollution Response Plan* is the operational response plan for the management of ship-sourced incidents.
 - AMSA is to be notified immediately of all ship-sourced incidents through RCC Australia on +61 2 62306811.
11. The Titleholder acknowledges that in addition to marine pollution incidents, AMSA has specific national interest responsibilities with regard to the management of maritime casualties (as defined within the *National Plan for Maritime Environmental Emergencies* and *International Convention on the High Seas in Cases of Oil Pollution Casualties*) and specifically with regard to the application of the *Protection of the Sea (Powers of Intervention) Act 1981*. AMSA and the Titleholder agree to work cooperatively to manage maritime casualty incidents in accordance with the arrangements within the *National Plan for Maritime Environmental Emergencies*.

RESPONSE TO NON-SHIP-SOURCED MARINE POLLUTION INCIDENTS

12. All *Oil Pollution Emergency Plans* prepared by the Titleholder that wish to draw on the support of AMSA and the *National Plan for Maritime Environmental Emergencies* will contain the following words within that plan:
 - The Australian Maritime Safety Authority ('AMSA') will coordinate the resources of the National Plan for Maritime Environmental Emergencies on the formal request of the appointed Incident Controller. Notification of AMSA will be through RCC Australia on +61 2 62306811.
13. The Titleholder agrees that access to the National Plan arrangements and support is contingent upon AMSA acknowledging receipt of the most recent version of the *Oil Pollution Emergency Plan* that has been accepted by the relevant Regulator(s).
14. The Titleholder agrees to formally include an advisor or liaison officer from AMSA within the Incident Management Team defined within the *Oil Pollution Emergency Plan* to facilitate the effective and efficient coordination of National Plan resources.
15. The Titleholder agrees to notify AMSA immediately of any marine pollution incident in the interests of facilitating the most efficient and effective response to the incident.
16. AMSA agrees, in the event of a significant non-ship-sourced marine pollution incident requiring regional or national level support, to provide services and resources under its direct control, including (but not limited to):
 - Technical and response advice;
 - Response equipment, through the AMSA National Equipment Stockpiles;
 - Response contractors and services, including Fixed Wing Aerial Dispersant Capability and oil and chemical spill modelling; and
 - Response personnel, including management and operational staff.

17. AMSA agrees, in the event of a significant non-ship-sourced marine pollution incident, to support the Titleholder or a third party appointed by the Titleholder in its role as Combat Agency. This support will be provided in accordance with the cooperative arrangements detailed within the *National Plan for Maritime Environmental Emergencies*, and may include the coordination of National Plan response equipment and resources, response and advisory services and personnel.
18. AMSA agrees to respond in accordance with the *Incident Action Plan* approved by the appointed Incident Controller. The only exception will be where AMSA believes that an operation presents unacceptable risks to the health and safety of personnel and resources coordinated or controlled by AMSA. In these circumstances AMSA will seek to resolve these issues at the earliest opportunity with the Incident Controller in accordance with normal incident action planning processes.

COST RECOVERY

19. The Titleholder acknowledges that the *Australian Maritime Safety Authority Act 1990* authorises AMSA to charge for some of its activities.
20. The Titleholder agrees to reimburse AMSA for all costs incurred in responding to incidents for which the Titleholder has responsibilities under the OPGGS Act and the Regulations.
21. AMSA agrees that in the case of ship-sourced marine pollution incidents, AMSA will seek to recover all possible costs from the ship owner and their respective insurers before seeking reimbursement from the Titleholder.

ONGOING CONSULTATION AND COOPERATION

22. AMSA and the Titleholder will nominate contact points for the ongoing management of this MOU.
23. AMSA and the Titleholder agree to maintain a cooperative approach to preparing and responding to marine pollution incidents, including the open exchange of information and technical advice.
24. AMSA will facilitate an annual workshop to provide an open forum to exchange information on best practice and review and update operational procedure.

RESOLUTION OF DISPUTES

25. Any dispute which arises under or in relation to this MOU will be resolved by consultation and negotiation between the participants and will not be referred to any third party.

REVIEW & AMENDMENT

26. This MOU may be reviewed and amended if agreed in writing and signed by the participants.

COMMENCEMENT & EXPIRY

27. This MOU commences on the date both participants have signed the document and expires 5 years from commencement

TERMINATION

28. This MOU may be terminated at any time by either participant upon giving the other four weeks' notice in writing.

Signed as a non-legally binding understanding

.....	<i>Julian Mitchell</i>	
Signature	Date	Foby Stone	General Manager
<i>[Signature]</i>	<i>26/06/17</i>		Response
Signature	Date	Name	<i>Julian Mitchell</i>
		Mark Robertson	General Manager

**APPENDIX K – MANAGEMENT OF CHANGE PROCEDURE (JS-90-PR-G-00017) APPENDIX 5: ENVIRONMENT
PLAN (EP) MOC**

APPENDIX 5 – Environment Plan (EP) MOC

Environment Plan (EP) MOC			
MOC Ref.		Date Raised:	

Note: To comply with the OPGGS Regulations the EP MOC process must consider the change in the context of the demonstration of impacts and risks to levels that are acceptable and ALARP, and whether the change may alter the basis upon which the EP was accepted.

1. INITIATION			
Document Name			
Document No.		Rev.	
1.1 Brief description of specific change(s) or proposed change(s) <i>List multiple changes if it relates to the same EP. The Activity can refer to operational details, management control and performance standards, etc.</i>			
1.2 Is the proposed change already included in the EP/approval document?			
1.2.1 The proposed change covered by existing the approved document (i.e. further assessment of the change is not required).	<input type="checkbox"/>	<i>Go to Section 4 for sign off</i>	
References to relevant sections of document:			
1.2.2 The proposed change differs from arrangements described in the approved document.	<input type="checkbox"/>	<i>Complete Sections 2 and 3</i>	

2. CHANGE & RISK ASSESSMENT		
2.1 Risk Assessment		
2.1.1 Personnel involved in the risk assessment:		
<p><i>Either copy the details below or attach separate document. The completed risk assessment needs to justify some of the check boxes in this Section. Refer to Environmental Hazard Identification and Assessment Procedure (JS-70-PR-I-00036).</i></p>		
2.2 Check against Regulatory requirements		
Requirement	YES	NO
2.2.1 Does the change constitute a significant modification or new stage of the activity that is not provided for in the current EP?	<input type="checkbox"/>	<input type="checkbox"/>
2.2.2 Does the change result in one of the following:		
a. The occurrence of any significant new environmental impact or risk, or significant increase in an existing environmental impact or risk, not provided for in the EP in force for the activity;	<input type="checkbox"/>	<input type="checkbox"/>
b. The occurrence of a series of new environmental impacts or risks, or a series of increases in existing environmental impacts or risks, which, taken together, amount to the occurrence of:		
i. A significant new environmental impact or risk or	<input type="checkbox"/>	<input type="checkbox"/>
ii. a significant increase in an existing environmental impact or risk	<input type="checkbox"/>	<input type="checkbox"/>
that is not provided for in the EP in force for the activity?		
2.2.3 Is the change or proposed change contrary or incompatible with existing EP?	<input type="checkbox"/>	<input type="checkbox"/>
2.2.4 Are all the new or existing risks reduced to ALARP? Ensure ALARP demonstration remains in place if a management control is changed or deleted, or if the activity is modified. Reduction of risks to ALARP means the cost of further risk reduction is grossly disproportionate to the benefit gained	<input type="checkbox"/>	<input type="checkbox"/>



<p>If YES to any of the above, then a proposed revision of the EP must be submitted for assessment by NOPSEMA.</p>
<p>Justification for selections made in 2.2.1 to 2.2.4:</p>

3. IMPLEMENTATION		
3.1 Document Revision Requirement		
3.1.1 Revise and re-submit approval document to Regulator	<input type="checkbox"/>	
OR		
3.1.2 Conduct internal 'minor' revision of the approval document and issue for use.	<input type="checkbox"/>	
3.2 Other considerations		
	YES	NO
3.2.1 Can we commence or continue on the work (if it has already started)? <i>(If NO, discuss & assess impact with General Manager and obtain sign off)</i>	<input type="checkbox"/>	<input type="checkbox"/>
3.2.2 Does this change require Legal review? <i>(If YES, obtain Legal review and sign off)</i>	<input type="checkbox"/>	<input type="checkbox"/>
3.2.3 Does this change require deviation from BMS, EPBC Act, licence or other approval? <i>(If YES, assess impact on current activity and determine whether further discussion with relevant Regulator or re-approval will be required)</i>	<input type="checkbox"/>	<input type="checkbox"/>
3.2.4 Does this change require Spill Scenario re-modelling? <i>(If YES, capture this in the task table below)</i>	<input type="checkbox"/>	<input type="checkbox"/>
3.2.5 If there is a change to the spill scenario, does this require review of Financial Assurance under the OPGGS Act (ref. Financial Assurance Calculation, GF-70-REP-I-00002)? <i>(If YES, obtain Finance Manager review and sign off)</i>	<input type="checkbox"/>	<input type="checkbox"/>



Environment Plan (EP) MOC Rev 1

3.2.6 Does this change require further stakeholder consultation? <i>(If YES, capture this in the task table below)</i>	<input type="checkbox"/>	<input type="checkbox"/>
3.3 List any critical MoC implementation tasks below (if applicable):		
MoC Tasks	Responsible	Due date

4. APPROVALS			
Title	Name:	Signature:	Date:
Engineering Coordinator			
HSE Manager			
Operations Superintendent			

**APPENDIX L – ENVIRONMENTAL RISK ASSESSMENT OF CHEMICALS FOR OPERATIONAL ACTIVITIES
(EXTRACT FROM CHEMICAL SELECTION EVALUATION AND APPROVAL PROCEDURE (JS-70-PR-I-00033))**

APPENDIX 8 – ENVIRONMENTAL RISK ASSESSMENT OF CHEMICAL FOR OPERATIONAL ACTIVITIES



**Environmental Risk Assessment of Chemical for Operational
Activities**

Chemical Name: _____

Supplier: _____

Prepared by:

Document Owner(s)	Activity/ Facility

Report Version Control

Version	Date	Author	Change Description

Environmental scientist Signature

OIM Signature

Date: _____

Date: _____

STEP 1		CHEMICAL INFORMATION	
Propose a new chemical for use	Yes	No	Attach Safety Data Sheet (SDS) and ecotoxicity report summary
Is all information required to perform an environmental risk assessment of a chemical available? (Refer to checklist in Appendix 3)	<input type="checkbox"/>	<input type="checkbox"/>	
<p>➤ If the answer to the above question is YES > Go to STEP 2</p> <p>➤ If the answer to the above question is NO > Seek ecotoxicity data from the supplier. If ecotoxicity data is not available and cannot be sourced from a literature search, the proposed chemical cannot be used, seek an alternative chemical.</p>			
STEP 2		CHEMICAL DISCLOSURE REPORT	
Down-hole chemical use	Yes	No	Provide all information required for full chemical disclosure
Is the fate of the chemical down-hole in state waters?	<input type="checkbox"/>	<input type="checkbox"/>	
<p>➤ If the answer to the above question is YES > complete Chemical Disclosure Reporting Form (http://www.dmp.wa.gov.au/documents/ENV-PEB-166.docx), submit chemical to DMP for approval. If chemical is approved by DMP, accept chemical for use. If chemical is rejected by DMP, find a substitute chemical.</p> <p>➤ If the answer to the above question is NO > Go to STEP 3</p>			
STEP 3		CHEMICAL USAGE AND VOLUME	
Planned discharge or potential for unplanned release (>80 L) to the marine environment	Yes	No	Indicate end-fate of the chemical
Is any discharge planned or potential risk of an unplanned release (>80L) to the marine environment or land?	<input type="checkbox"/>	<input type="checkbox"/>	
<p>➤ If the answer to the above question is YES > Go to STEP 4</p> <p>➤ If the answer to the above question is NO > Detailed environmental risk assessment of chemical is not required, evaluate chemical on New Chemical Introduction Form.</p>			
STEP 4		OCNS CLASSIFICATION CHECK	
OSPAR Pose Little or NO Risk to the Environment (PLONOR) List	Yes	No	List the PLONOR substances
Is the chemical or all constituents of the chemical on the OSPAR PLONOR List (approved list can be found at www.ospar.org/)?	<input type="checkbox"/>	<input type="checkbox"/>	
<p>➤ If the answer to the above question is YES > Accept chemical for use.</p> <p>➤ If the answer to the above question is NO > Go to STEP 5</p>			
STEP 5		OCNS CLASSIFICATION CHECK	

OCNS Hazard Quotient (HQ) (CHARM model)	Yes	No	Indicate CHARM HQ Colour-Band (GOLD, SILVER, WHITE, BLUE, ORANGE or PURPLE)
Is Product OCNS risk classified on the CEFAS CHARM database? (http://www.cefas.defra.gov.uk/in-dustry-information/offshore-chemical-notification-scheme.aspx)	<input type="checkbox"/>	<input type="checkbox"/>	
<p>➤ If the answer to the above question is YES and the chemical is colour-banded GOLD or SILVER > Chemical is environmentally acceptable, no requirement for detailed risk assessment. If the answer to the above question is YES and the chemical is colour- banded WHITE, BLUE, ORANGE or PURPLE> Go to STEP 9</p>			
<p>➤ If the answer to the above question is NO > Go to STEP 6</p>			
STEP 6		OCNS CLASSIFICATION CHECK	
OCNS Hazard Grouping (non-CHARM method)	Yes	No	Indicate OCNS Final non-CHARM Grouping (E, D, C, B or A)
Is the chemical OCNS risk classified on the CEFAS non-CHARM chemical grouping database? (http://www.cefas.defra.gov.uk/in-dustry-information/offshore-chemical-notification-scheme.aspx)	<input type="checkbox"/>	<input type="checkbox"/>	
<p>➤ If the answer to the above question is YES and the product is grouped E or D > Chemical is environmentally acceptable, no requirement for detailed risk assessment. If the answer to the above question is YES and the product is rated C, B or A > go to STEP 9</p>			
<p>➤ If the answer to the above question is NO > Go to STEP 7</p>			
STEP 7		ENVIRONMENTAL RISK ASSESSMENT OF CHEMICAL	
Ecotoxicity data required for environmental risk assessment of chemical	Yes	No	Provide ecotoxicity data summary (use CHARM model software or for the non-CHARM method, use the OCNS Grouping Tables)
Is sufficient ecotoxicity data available for the chemical or its chemical ingredients in order to determine the hazard level (using the OCNS CHARM Model or non-CHARM method, if applicable) and subsequent risk to the receiving marine environment? (Refer to Appendix 7)	<input type="checkbox"/>	<input type="checkbox"/>	
<p>➤ If the answer to the above question is YES > go to STEP 9.</p>			
<p>➤ If the answer to the above question is NO > go to STEP 8.</p>			
STEP 8		ENVIRONMENTAL RISK ASSESSMENT OF CHEMICAL	
Ecotoxicity data of a comparable chemical required for environmental risk assessment	Yes	No	Provide ecotoxicity data summary for comparable chemical

Is ecotoxicity data available for a comparable chemical or for the product's chemical ingredients (i.e. no less than 95% similar in composition including all hazardous components)?	<input type="checkbox"/>	<input type="checkbox"/>	
➤ If the answer to the above question is YES > go to STEP 9.			
➤ If the answer to the above question is NO > Seek an alternative chemical. If the answer to the above is NO and there is no alternative chemical available, laboratory testing should be implemented by the supplier (Refer to ecotoxicity testing recommendations in Appendix 6).			
STEP 9		ENVIRONMENTAL RISK ASSESSMENT OF CHEMICAL	
Risk justification for chemical use	Yes	No	Provide environmental risk assessment summary
<p>If a pseudo-OCNS rating can be applied to the chemical, provide assessment summary and risk justification.</p> <p>If a pseudo-OCNS rating cannot be applied, is this chemical acceptable for use in the marine environment based on the normal dose rate (i.e. concentration and quantity per day), end-fate (i.e. discharge) and available ecotoxicity information?</p> <p>If there is no alternative to using a non-CHARM A, B or C rated chemical, or a CHARM rated purple, orange, blue or white colour-band chemical, provide a technical justification for use.</p>	<input type="checkbox"/>	<input type="checkbox"/>	
➤ If the answer to the above question is YES > Accept chemical for use.			
➤ If the answer to the above question is NO > Reject the chemical and find an alternative chemical.			
<p>Overall Risk:</p> <p style="text-align: center;">High Medium Low</p>			
Comments:			