Summary of Stag Field Environment Plan Permit WA-15-L
GF-70-PLN-I-00002.01
Rev 1

Rev No.	Date	Owner	Reviewer	Approver	Revision Notes
0	22-Dec-2017	HSE Manager	Document Controller	General Manager	Issued to NOPSEMA. Based on Stag Field Environment Plan Permit WA-15-L accepted by NOPSEMA on 13 Dec 2017.
1	16-Feb-2017	HSE Manager	Document Controller	General Manager	Revised in response to NOPSEMA's assessment and comments dated 06 Feb 2018

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ABBREVIATIONS

Abbreviation	Description
AFZ	Australian Fishing Zone
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
AUV	Autonomous underwater vehicle
CALM	Catenary Anchor Leg Mooring
CMMS	Computerised Maintenance Management System
CPF	Central Production Facility
DBCA	Department of Biodiversity, Conservation and Attractions
DEC	Department of Environment and Conservation (now DBCA)
DEWHA	Department of the Environment, Water, Heritage and the Arts (now DoEE)
DoEE	Department of the Environment and Energy
DPaW	Department of Parks and Wildlife (now DBCA)
DPIRD	Department of Primary Industries and Regional Development (previously Department of Fisheries)
DSWEPaC	Department of Sustainability, Environment, Water, Population and Communities (now DoEE)
dwt	Dry weight tonnes
EMBA	Environment that may be affected
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
EP	Environment Plan
ESD	Emergency Shut-Down system
ESP	Electric Submersible Pump
FSO	Floating Storage and Offtake
HVAC	Heating ventiliation air conditioning (system)
IMR	Integrity, maintenance and repair
KEFs	Key Ecological Features
kL	Kilolitre
LAT	Lowest astronomical tide
mg/L	Milligrams per litre

Abbreviation	Description
mmscfd	Million Standard Cubic Feet per Day
NEBA	Net Environmental Benefit Assessment
NES	National Environmental Significance
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NORMs	Naturally Occurring Radioactive Materials
NWS	North-West Shelf
NWSTF	North-West Slope Trawl Fishery
OCNS	Offshore Chemical Notification Scheme
OIM	Offshore Installation Manager
OIW	Oil-in-water
OPEP	Oil Pollution Emergency Plan
OPGGS Act	Offshore Petroleum and Greenhouse Gas Storage Act 2006
OPGGS (E) Regs	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
OPMF	Onslow Prawn Managed Fishery
PAH	Polycyclic aromatic hydrocarbons
PW	Produced water
PLEM	Pipeline end manifold
ROV	Remote Operated Vehicle
SBFTF	Southern Bluefin Tuna Fishery
WA	Western Australia
WSTF	Western Skipjack Tuna Fishery
WTBF	Western Tuna and Billfish Fishery

1. INTRODUCTION

Jadestone Energy (Australia) Pty Ltd (Jadestone Energy) is the operator and titleholder of the Stag Field Production and Export Facility (Stag Field) located in permit area WA-15-L.

1.1 Titleholder

Jadestone Energy (Australia) Pty Ltd is the titleholder for petroleum activities covered under this EP within WA-15-L.

Jadestone Energy's Australian office is located at:

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1.3 Purpose of EP Summary

The overall purpose of the Stag Field Operations Environment Plan GF-70-PLN-I-00002 (the EP) is to comply with statutory requirements of the Commonwealth *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (OPGGS (E) Regulations) and to ensure that the activity is planned and conducted in line with Jadestone Energy's environmental policies and standards.

The EP was assessed and accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) on the 13 December 2017. This EP Summary has been prepared in accordance with the requirements of regulation 11 (4) of the OPGGS (E) Regulations, and with the guidance of the NOPSEMA Guideline N-04750-GL1566 Rev. 1, Environment plan summaries.

1.4 Activity Duration and Timing

Profitable production is expected to be achievable at the Stag Field for another 8 to 10 years. Operation Activity at the Facility is 24 hours per day.

2. DESCRIPTION OF THE STAG FIELD

2.1 Operations Overview

The Stag Field operations shown in Figure 2-1 and Figure 2-2 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;
- A Floating Storage and Offtake (FSO) tanker, the Dampier Spirit, which receives oil through a flexible import hose from the CALM buoy and periodically exports oil to third-party offtake tankers;
- Water injection flowlines and wells to assist reservoir fluid recovery. The water injection flowlines run 1,100 m north-east 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.
- Support/ supply vessels, work vessels and tug boats supporting third-party offtake tanker movement, facility logistics, maintenance and provisioning; and
- Helicopter support.

Oil is loaded continuously to the FSO at a production rate of approximately 4,000 bbl/d. Conventional trading tankers (third-party offtake tankers) that periodically moor astern of the FSO in a tandem arrangement, load oil in parcels of typically 250,000 bbls. The CPF has been in production since 1998 with only minor modifications carried out.

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

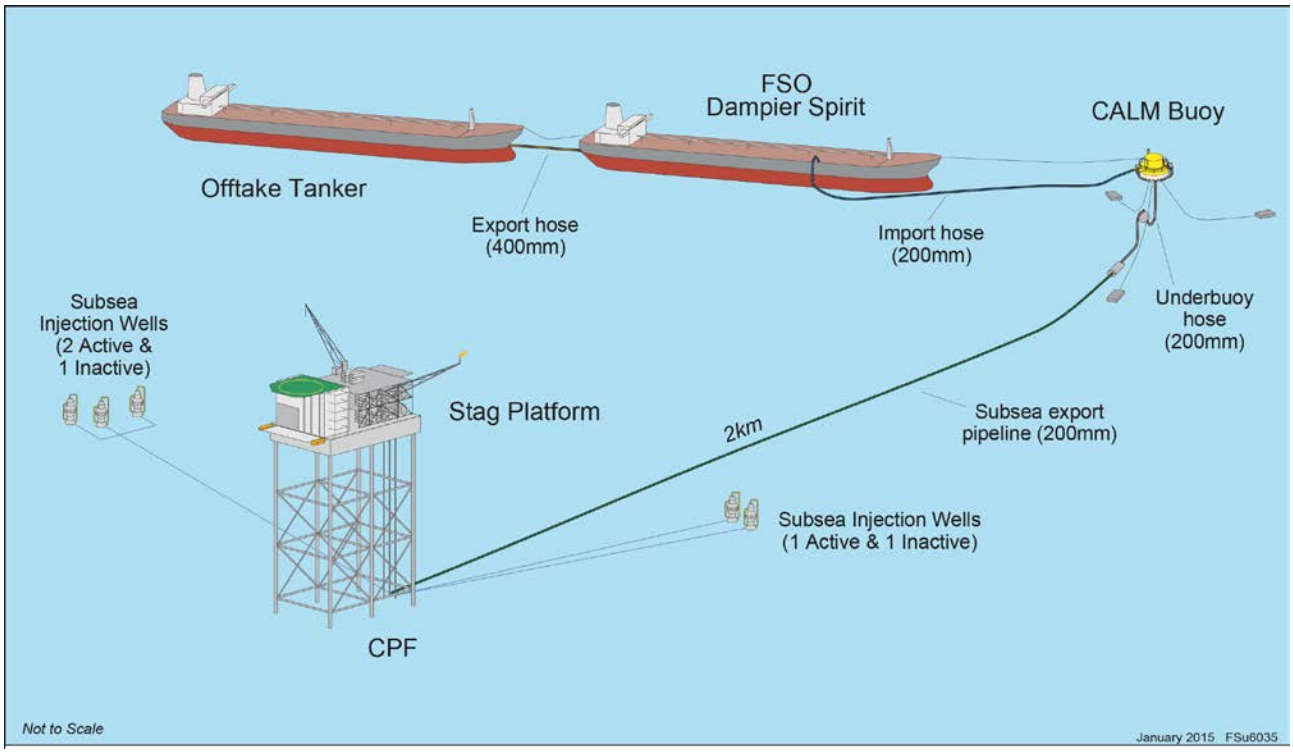

Figure 2-1: Schematic of the Stag Field

Figure 2-2: Aerial View of Stag Field

2.2 Location

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

Table 2-1: 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)

The CPF is located above the original Stag-6H well. The 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 47 m below lowest astronomical tide (LAT), approximately 2 km to the north of the Stag CPF (**Table 1-1**).

Table 2-2: Stag CPF and the CALM Buoy Coordinates

Facility	Latitude	Longitude
Stag CPF	20° 16.5’ S	116° 15.433’ E
CALM Buoy	20° 15.395’ S	116° 15.492’ E

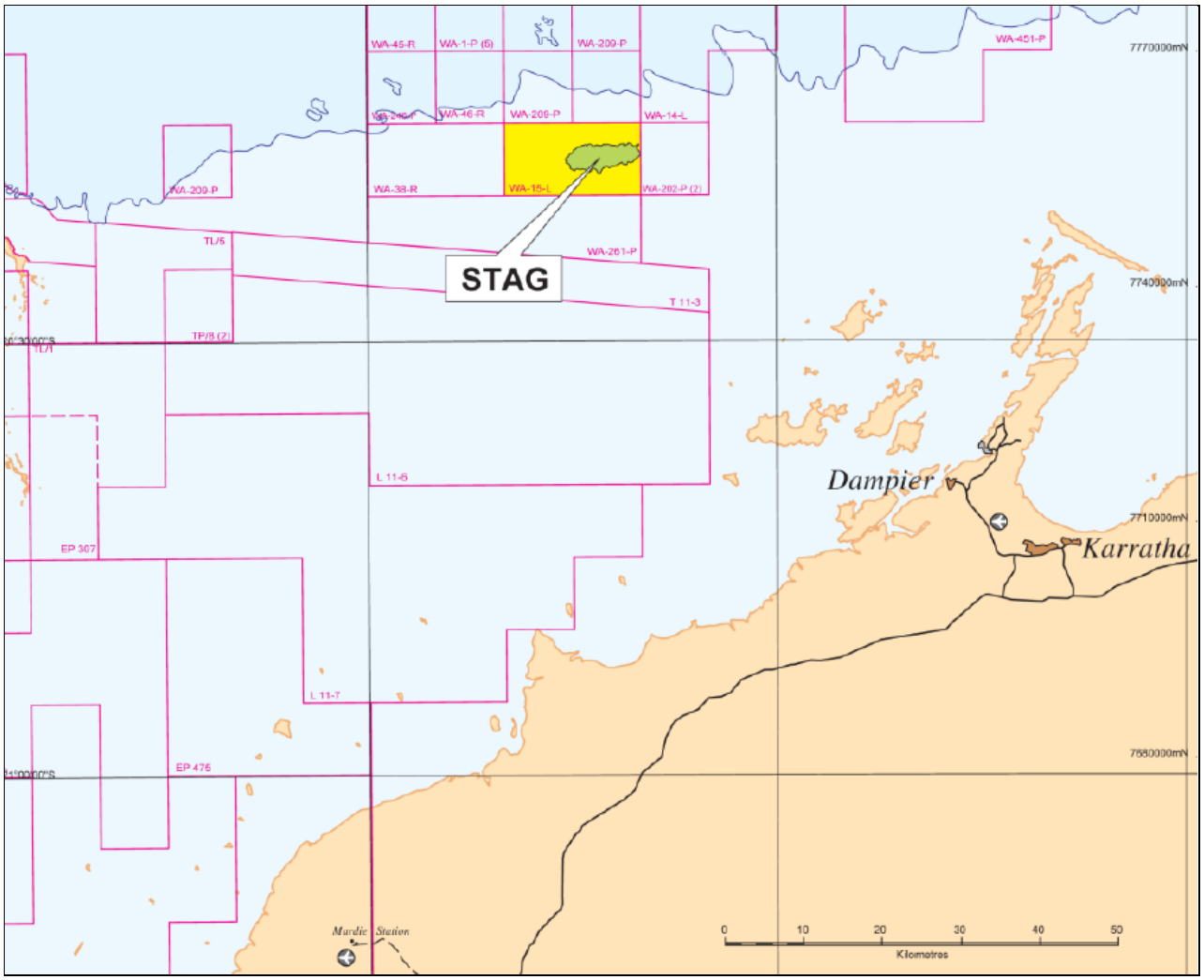

Figure 2-3: Location of the Stag Field

2.2.1 Restricted Zones and Cautionary Areas

There is a restricted zone of 500 m radius around the CPF, CALM buoy, pipeline and FSO (whilst at CALM buoy mooring). Vessels operating within this zone must not exceed a speed of five (5) knots. There is also a cautionary area circle as designated by AMSA of 3 nautical mile radius charted around the Stag Field facilities, with the centre located 1,365 m due north of the CPF. This location is arranged such that the limits of the circle sweep out by the FSO, third-party offtake tanker and support vessel at the same distance from the edge of the cautionary area as the CPF.

2.3 Layout and Description

2.3.1 Central Processing Facility

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 on board.

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 m^2). 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 north-east of the facility, with the other three being located approximately 3,200 m west of the facility.

2.3.2 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.

2.3.3 CALM Buoy

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

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 offtake tankers up to 150,000 dwt.

2.3.4 Floating Storage and Offtake (FSO) Vessel

The FSO Dampier Spirit is operated by Teekay Shipping (Australia) and operates under its own accepted safety case. The FSO, whilst in the field, is moored to the CALM buoy and used as a storage and offtake vessel for crude oil from the Stag CPF.

The following operations are carried out on the FSO:

- Connection and disconnection from the CALM Buoy;
- Crude oil import and export operations;
- Maintenance operations;
- Helicopter operations;
- Dewatering of cargo tanks;
- Diving/ ROV operations; and
- Accommodation facilities for up to 28 persons.

2.4 Operations and Process Description

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

- Production including water re-injection;
- 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;
- Oil export operations, including loading and unloading of crude from FSO; and

- Inspection, Maintenance and Repair (IMR) activities (topsides and subsea) including well intervention, 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.

2.4.1 Crude Oil Production

Oil is currently produced from eleven production wells and supported by seawater injected into dedicated injection wells. The current layout of the Stag Field is shown in Figure 2-4.

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 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 FSO. Hot crude ready for export is cooled by heat exchangers and pumped to the oil export system. Some crude oil is drawn from the export line, conditioned and used as fuel in the main power generators.

2.4.2 Flaring

The FSO uses Stag crude oil as a fuel supply for its engines. 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 400 sm^3/h) is used as fuel for equipment with the balance (80%) being flared.

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

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.

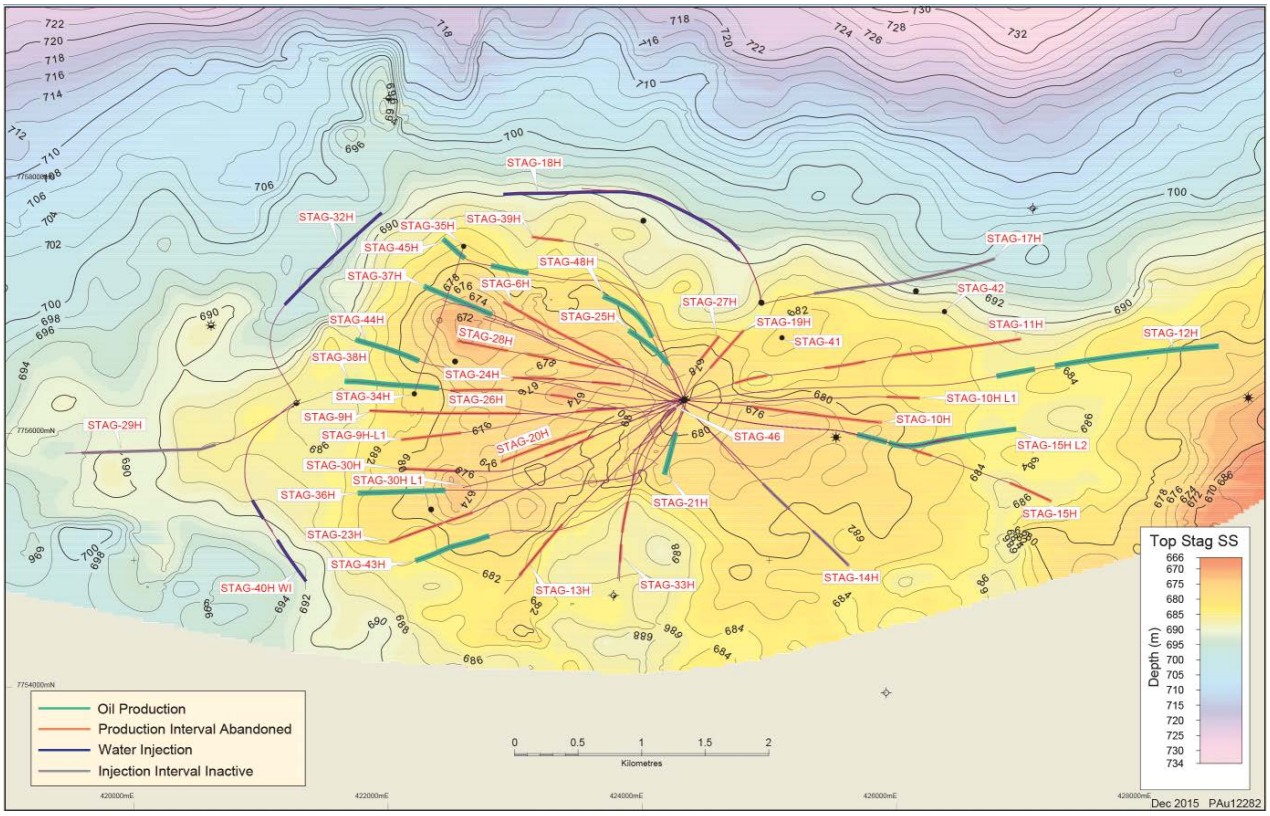

Figure 2-4: Stag Production Field Depth Structure

2.4.3 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.

2.4.4 Processing and Discharge of Produced Water

Produced water and hydrocarbons from the reservoir arrive in a multi-phase state at the CPF where produced water is separated and treated.

Produced water from the Stag field contains a mixture of dissolved hydrocarbons and suspended oil droplets), 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, and at very low levels naturally occurring radioactive materials (NORMs).

Produced water is then treated through the CPF produced water treatment system which cools, degasses and removes residual oil. Periodically an emulsion breaker is injected into the process to assist with oil/ water separation.

Exported crude from Stag to the FSO can contain up to 0.5% water. The FSO treats produced water through its slop system and intermittently discharges to the sea.

Recovered oil is pumped back through the separator to join the export oil stream. A continuous produced water stream is discharged overboard (0.5 m above sea surface) at the CPF at a rate of approximately 3,816 m^3/d with an average oil-in-water (OIW) concentration of not greater than 30 mg/L over any 24-hour period.

2.4.5 Drainage Systems

The Stag CPF drainage system collects hydrocarbon-based and other liquid wastes (rain and washwater 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 m^3. All drains into the tanks are via stand pipes 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 rain water, 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.

2.4.6 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;) are scheduled through Bassnet and generally involve up to four campaigns per year.

IMR activities include maintenance of the topside component of the CPF as well as subsea infrastructure and 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)

Inspection of subsea infrastructure is the process of physical verification and assessment of components detect changes to its as-built state. Inspections are planned to occur every three years and techniques may include general visual inspections, cathodic protection 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.

2.4.7 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 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 control program. 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.

2.4.8 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 m^3/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 salt water 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.

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 m^3/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 with a capacity of 215 m^3 is 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.

2.4.9 Well Intervention and Workover Operations

A range of well intervention activities are undertaken at the Stag CPF including:

- Workover to replace Electric Submersible Pump (ESP), including
    - Well kill operations,
    - Pull out of hole and lay down faulty completions,
    - Rig up and run in hole new completion,
    - Cementing, and
    - Casing integrity tests.
- Wireline interventions;
- Annulus monitoring/ treatment;
- Perforating;
- Water shut-off/ zonal isolation;
- Production logging;
- Sand clean out;
- Casing milling, cutting recovery and patch work; and
- Commissioning of new production wells may occur during Stag CPF operations as required.

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.

2.4.10 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.

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

2.4.11 Oil Export Facility Operations

Loading Operations

Stag crude Oil production is approximately 640 kL/d (4,000 bbl/d). Continuous transfer of the product from the CPF to the FSO is through a rigid 8" riser and subsea flowline, PLEM and flexible riser at the PLEM; the under-buoy hose, up to the CALM buoy and from there through a 200 mm (8"), 189 m long, double carcass type floatation hose. The length of hose has been designed to allow mooring of third party offtake tankers whenever the FSO is not available.

Unloading Operations

Transfer of cargo from the FSO to a third-party offtake tanker moored in tandem astern, is through a long double carcass type flotation hose.

2.4.12 Support Vessels

Supply/ support vessels provide support activities to the facility during operations, including transport materials, fuel and chemicals, for offloading and backload any equipment, waste and materials. Support vessels are also used to provide services for handling the hawser and offtake hose between the FSO and third party offtake tanker, and maintenance activities if required.

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

2.4.13 Helicopter Operations

Helicopter operations contracted for Stag Field 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.

2.4.14 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.

Typical diving activities are summarised in Table 2-3. These activities may be initiated to maintain the safety and productivity of the facility and are carried out using detailed planning and maintenance procedures.

Table 2-3: Typical diving and ROV Activities Undertaken at the Stag Field

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 inspection; photography and video; condition monitoring.
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; under buoy hose removal and replacement; mooring chain maintenance and replacement.

Diving/ ROV tasks	Specifications
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.

2.4.15 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 Energy's Chemical Selection Evaluation and Approval Procedure, which prioritises the use of environmentally low risk chemicals by undertaking a risk assessment of the product. 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.

The selection of chemicals that fall into the last two assessment types require the additional development of an ALARP justification 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 ALARP through routine sampling and assessment.

3. DESCRIPTION OF THE ENVIRONMENT

3.1 Environment that May Be Affected (EMBA)

This section describes aspects of the existing environment including the physical environment, habitats, matters protected by the Environmental Protection and Biodiversity Conservation (EPBC) Act, State waters marine reserves, marine fauna and the socio-economic environment.

In addition to describing the area that may be impacted from planned events (Operational Area), features that could be impacted by unplanned events have been described within a larger 'environment that may be affected' (EMBA), i.e. the largest area within which impacts to the environment could occur from unplanned events. For Stag Operations, the EMBA is derived from a worst case credible Stage Crude release from the FSO (refer Section 7). It should be noted that this worst-case scenario would not lead to impacts within the entire EMBA, but rather a smaller subset since the EMBA represents the combined area from 100 spill model iterations under a range of potential environmental conditions. Where relevant, the environment description outlines sensitivities within both the Operational Area and EMBA that may be affected.

The spatial extent of the EMBA and therefore the scope for this environment description is as presented in Figure 3-1. Please note that although modelling indicates that hydrocarbons have minimal to no contact with the Pilbara coastline, for completeness, the environment description includes the onshore environment from Ningaloo to Eighty Mile Beach.

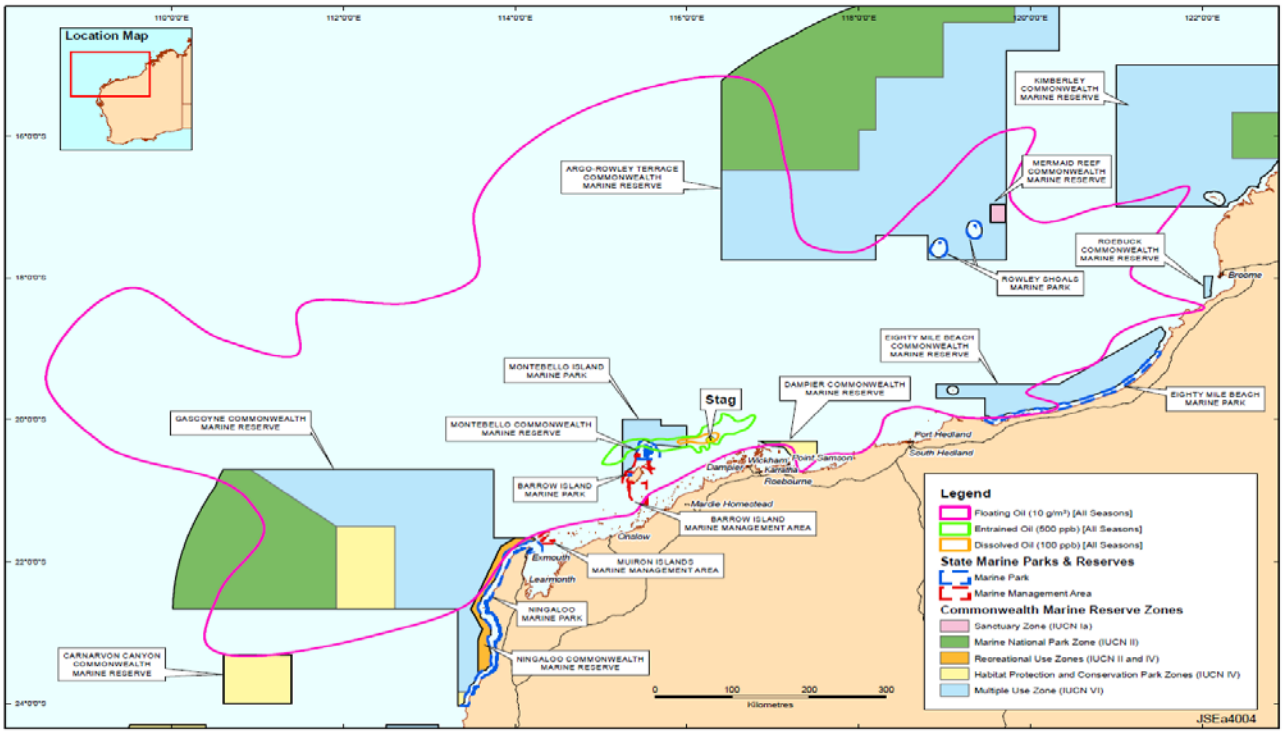

Figure 3-1: EMBA for Worst Case Scenario Hydrocarbon Spill

3.2 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.

3.3 Physical Environment

3.3.1 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).

3.3.2 Seawater Temperature and Salinity

Salinity is relatively uniform at 34–35 ppt throughout the water column and across the North-West Shelf. Due to the low rainfall, there is little freshwater run-off from the adjacent mainland (Blaber et al. 1985). North-West Shelf 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).

3.3.3 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 water spouts. Tropical cyclones generate the most significant storm conditions on the North-West Shelf (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.

3.3.4 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).

3.3.5 Tides and Currents

Sea surface currents over the North-West Shelf 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 North-West Shelf 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, 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 North-West Shelf (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 North-West Shelf 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 2012a).

3.3.6 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 Stag Operations area:

- Type A: Low relief unconsolidated calcareous fine to medium sand; and

- Type B: Low relief unconsolidated calcareous gravelly medium to coarse sand.

3.4 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 LAT to more than 6,000 m at the Argo and Cuvier Abyssal Plains (DEWHA 2008).

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).

3.4.1 Operational Area

The benthic habitat within the Operational Area of the Stag Field consists of unconsolidated fine-medium and medium-coarse sands with patches of coral rubble (CSIRO 2001).

While there are no benthic primary producers (benthic photosynthetic organisms) associated with the soft sediment habitat within the Operational Area, subsea infrastructure such as the CPF platform, CALM buoy mooring and FSO hull likely provides attachment points with sufficient light availability for algae as well as other filter feeding organisms (e.g. hydroids, bryozoans and molluscs).

Apache Energy Ltd conducted sampling of the infauna within the Operational Area prior to development drilling as a baseline for comparison to the post-development and post-commissioning situation (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 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.

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 (IRCE 2001).

3.4.2 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 North-West Shelf, 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 macroalage 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). 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.

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 Broome, shallow waters around offshore islands extending from North-West Cape to Broome (including Muiron, Thevenard, Montebello/ Barrow/ Lowendal, Dampier Archipelago and Turtle islands) and offshore shoals (e.g. Rowley shoals) Figure 3-2, Figure 3-3 and Figure 3-4.

A summary of the benthic primary producers within the EMBA is provided below.

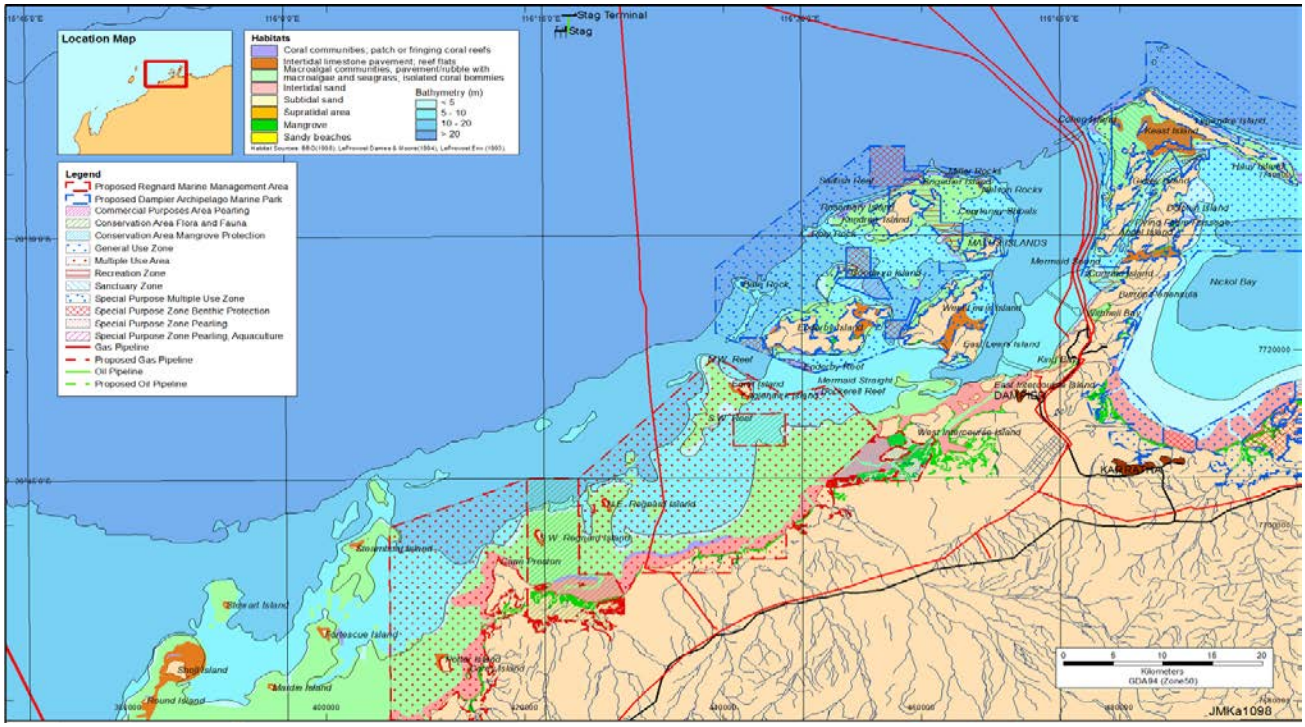

Figure 3-2: Marine Habitats Surrounding the Dampier Archipelago

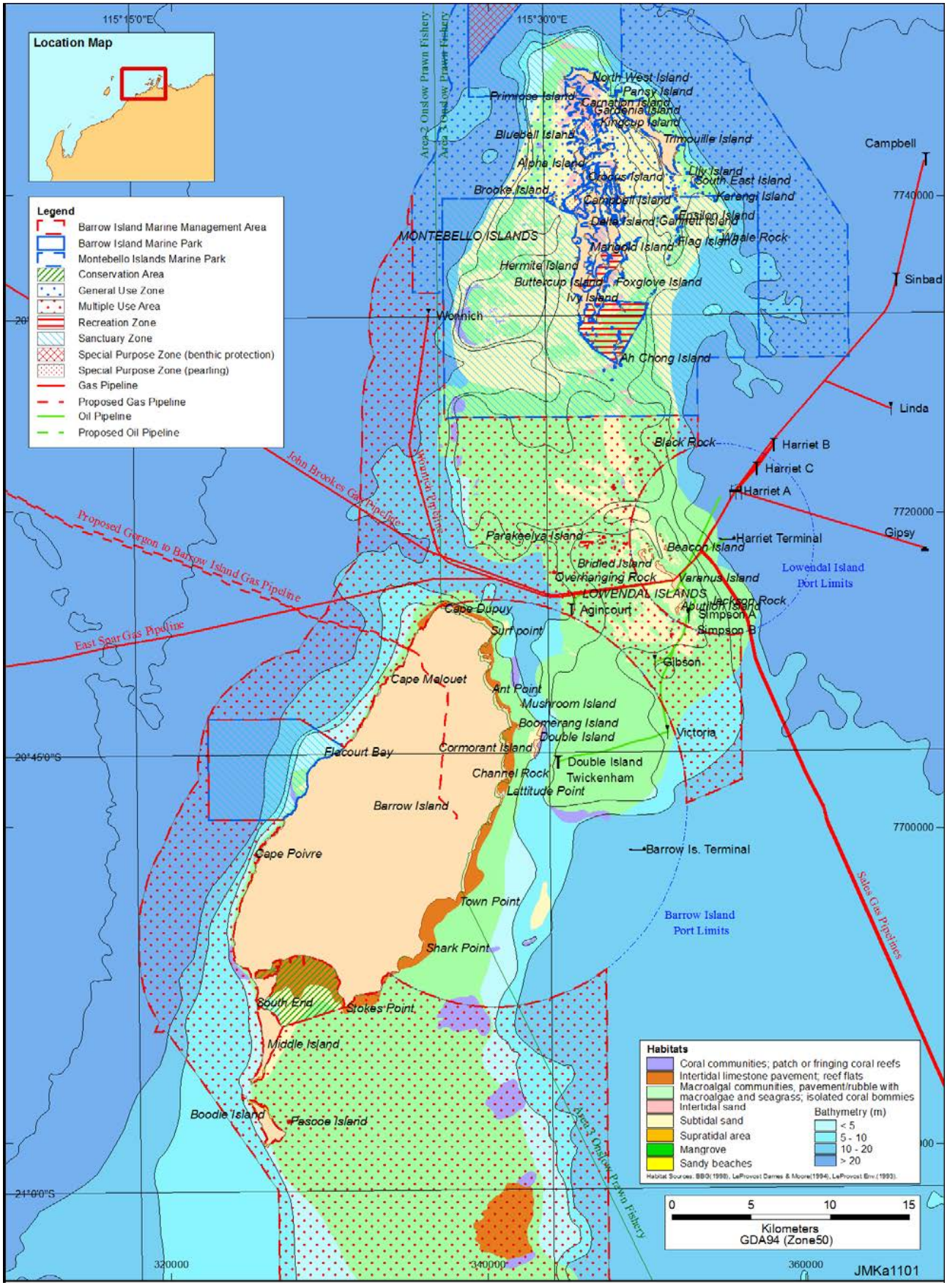

Figure 3-3: Marine Habitats Surrounding the Montebello, Lowendal and Barrow Islands

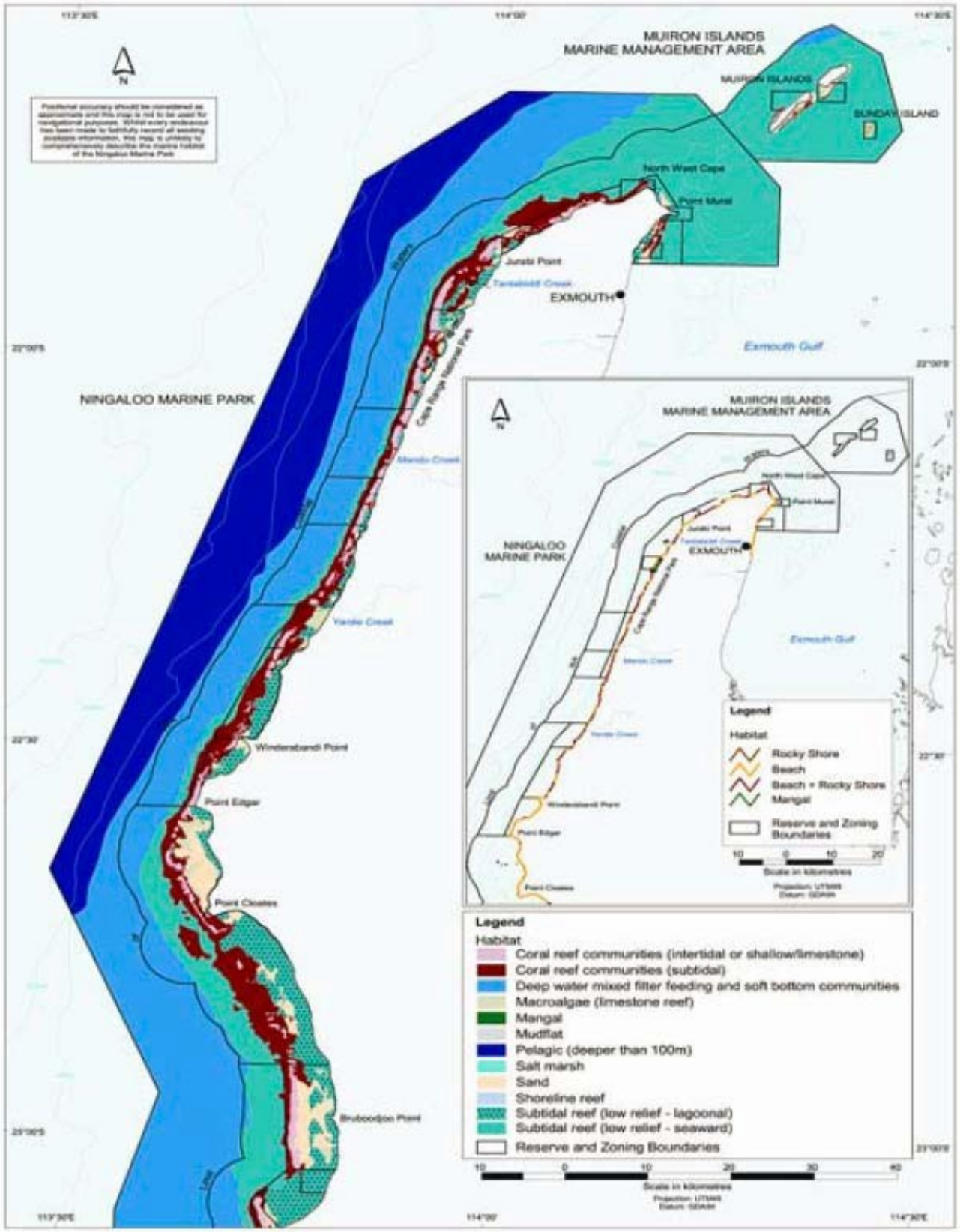

Figure 3-4: Marine Habitats Surrounding the Ningaloo Marine Park North of Point Cloates

3.5 Intertidal Shoreline Habitats

3.5.1 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 Broome 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. Western Australia does not support any unusual endemic or restricted mangrove species. All mangrove species within Western Australia are common and widespread elsewhere, either in northern Australia, or in the Indo-pacific region proximal to northern Australia.

3.5.2 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 features 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.

3.5.3 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, 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 grounds for small wading birds that migrate to the area each summer, travelling from countries thousands of kilometres away. It is also a listed Ramsar wetland.

3.5.4 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. Intertidal sand and mudflats support a wide range of benthic infauna and epifauna which graze on microscopic algae and microbenthos, such as bivalves, molluscs, polycheate worms and crustaceans.

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.

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 (2012).

3.5.5 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 and some species of shore birds. 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. 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 and are also common within the Dampier Archipelago, notably King and Conzinc Bays, and Angel, Gidley, Enderby and the Lewis Islands.

3.5.6 Habitats within the Operational Area and EMBA

Table 3-1 summarises the habitats that may be affected by routine events at the Stag Field 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 Operational Area and EMBA

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.
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 Broome

Habitats	Environmental value	Sensitivities within the Operational Area	Sensitivities within the EMBA
Sandy beaches	Shorebird foraging/ breeding habitat; turtle nesting habitat Crested tern nesting post-wet season; turtle nesting October to February; hatchling emergence November to April	**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 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.

3.6 Marine Fauna

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

Table 3-2 summarises the fauna that may be affected by routine events at the Stag Field within the Operational Area as well as unplanned events that may arise within a larger EMBA.

3.7 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 November 2016 identified 55 threatened species (endangered, vulnerable, and critically endangered) as occurring or having habitat within the EMBA (Table 3-2). 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 Stag Field.

No threatened ecological communities were identified within the EMBA. Further detail on species identified as threatened or migratory is presented in the following sections.

Table 3-2: Marine Fauna and Management Considerations in the Operational Area and EMBA

Class	Common Name	Scientific Name	EPBC Act Status	WC Act	Cons Advice	Recovery Plan	Threat Abatement Plan	BIA	Identified /relevant risks
Threat abatement plan for the impacts of marine debris on vertebrate marine life (DEWHA 2009)									
Sharks and Fish	Whale shark	*Rhincodon typus*	V; M	OPF (S7)		Ceased 2010		EMBA 9km from PW	Vessel interaction Habitat disturbance
	White shark	*Carcharodon carcharias*	V; M	V (S3)	No		Marine debris		
	Green sawfish	*Pristis zijsron*	V; M		No				
	Grey nurse shark (west coast population)	*Carcharias taurus*	V	V (S3)	No		Marine debris		
	Northern River Shark	*Glyphis garricki*	E	P1	No				
	Dwarf sawfish	*Pristis clavata*	V	P1	No				
	Shortfin mako	*Isurus oxyrinchus*	M		No	No			
	Longfin mako	*Isurus paucus*	M		No	No			
	Porbeagle mackerel shark	*Lamna nasus*	M		No	No			
	Reef Manta Ray	*Manta alfredi*	M		No	No			
	Giant Manta Ray	*Manta birostris*	M		No	No			
The Action Plan for Australian Mammals 2012 (Woinarski et al. 2014) **Threat abatement plan for the impacts of marine debris on vertebrate marine life (DEWHA 2009)**									
Marine mammals	Sei whale	*Balaenoptera borealis*	VM	E (S2)		Ceased in 2015	Marine debris		Noise Habitat degradation/ pollution vessels

Class	Common Name	Scientific Name	EPBC Act Status	WC Act	Cons Advice	Recovery Plan	Threat Abatement Plan	BIA	Identified /relevant risks
	Fin whale	*Balaenoptera physalus*	VM	E (S2)		Ceased 2015	Marine debris		
	Humpback whale	*Megaptera novaeangliae*	VM			Ceased 2015	Marine debris	PW EMBA	Noise Vessels Pollution
	Blue whale	*Balaenoptera musculus*	EM	E (S2)	No		Marine debris	PW EMBA	Noise Vessels
	Southern right whale	*Eubalaena australis*	EM	V (S3)	No		Marine debris		Noise Habitat disturbance vessels
	Antarctic minke whale	*Balaenoptera bonaerensis*	M						
	Bryde's whale	*Balaenoptera edeni*	M			No			
	Sperm whale	*Physeter macrocephalus*	M	V		No			
	Killer whale	*Orcinus orca*	M			No			
	Spotted bottlenose dolphin (Arafura/Timor Sea populations)	*Tursiops aduncus*	M			No			
	Indo-Pacific humpback dolphin	*Sousa chinensis*	M			No			
	Irrawaddy dolphin	*Orcaella brevirostris*	M	P4		No			
	Dugong	*Dugong dugon*	M	OPF (S7)		No			

Class	Common Name	Scientific Name	EPBC Act Status	WC Act	Cons Advice	Recovery Plan	Threat Abatement Plan	BIA	Identified /relevant risks
Marine reptiles	**Turtle Recovery Plan (Commonwealth of Australia, 2017)** **Threat abatement plan for the impacts of marine debris on vertebrate marine life (DEWHA 2009)**								
	Hawksbill turtle	*Eretmochelys imbricata*	VM	V S3					
	Flatback turtle	*Natator depressus*	VM	V S3				PFW EMBA	Light Vessel interaction
	Green turtle	*Chelonia mydas*	VM	V S3			Marine debris		
	Loggerhead turtle	*Caretta caretta*	EM	E S2			Marine debris		
	Leatherback turtle	*Dermochelys coriacea*	EM	V S3			Marine debris		Marine debris vessel interaction
	Short-nosed seasnake	*Aipysurus apraefrontalis*	CE	CE (S1)		No			
	Salt-water crocodile	*Crocodylus porosus*	M	OPF (S7)		No			
Birds	Curlew Sandpiper	*Calidris ferruginea*	CE Mw	V S3		No			Loss wetlands human disturbance habitat loss pollution
	Great Knot	*Calidris tenuirostris*	CE Mw	V S3		No			Pollution
	Bar-tailed Godwit (menzbieri)	*Limosa lapponica menzbieri*	CE Mw	V S3		No			
	Eastern Curlew	*Numenius madagascariensis*	CE Mw	V S3		No			Loss wetlands human disturbance habitat loss pollution

Class	Common Name	Scientific Name	EPBC Act Status	WC Act	Cons Advice	Recovery Plan	Threat Abatement Plan	BIA	Identified /relevant risks
	Lesser Sand Plover	*Charadrius mongolus*	E Mw	E S2		No			Habitat loss Disturbance
	Red Knot	*Calidris canutus*	E Mw	V S3		No			Habitat loss Disturbance
	Southern giant-petrel	*Macronectes giganteus*	E Mw	P4		Yes		EMBA	
	Australian painted snipe	*Rostratula australis*	E Mw	E S2		No			Habitat loss/disturbance
	Soft-plumaged petrel	*Pterodroma mollis*	V			Ceased in 2015			Feral cats habitat destruction (erosion)
	Australian fairy tern	*Sternula nereis nereis*	V	V		No		EMBA	Habitat disturbance
	Bar-tailed Godwit (baueri)	*Limosa lapponica baueri*	V Mw	V S3					
	Greater Sand Plover	*Charadrius leschenaultii*	V Mw	V S3					Pollution Habitat loss
	Shy Albatross	*Thalassarche cauta cauta*	V M	M S5		Yes			
	White-capped Albatross	*Thalassarche cauta steadi*	V M	V S3		Yes			N/A (bycatch and predation)
	Campbell Albatross	*Thalassarche impavida*	V M	V S3		Yes			N/A commercial fishing
	Black-browed Albatross	*Thalassarche melanophris*	V M	E S2		Yes			N/A commercial fishing
	Common noddy	*Anous stolidus*	M	LC		No			

Class	Common Name	Scientific Name	EPBC Act Status	WC Act	Cons Advice	Recovery Plan	Threat Abatement Plan	BIA	Identified /relevant risks
	Fork-tailed swift	*Apus pacificus*	M	LC		No			
	Streaked shearwater	*Calonectris leucomelas*	M	LC		No			
	Lesser frigatebird	*Fregata ariel*	M	LC		No			
	Great frigatebird	*Fregata minor*	M	LC		No			
	White-tailed tropicbird	*Phaethon lepturus*	M	LC		No			
	Red-tailed tropicbird	*Phaethon rubricauda*	M	LC		No			
	Flesh-footed Shearwater	*Puffinus carneipes*	M	LC		No			
	Wedge-tailed shearwater	*Puffinus pacificus*	M	LC		No		EMBA PW	
	Little tern	*Sterna albifrons*	M	LC		No			
	Bridled tern	*Sterna anaethetus*	M	LC		No			
	Lesser crested tern	*Sterna bengalensis*	M	LC		No			
	Caspian tern	*Sterna caspia*	M	LC		No			
	Roseate tern	*Sterna dougallii*	M	LC		No			
	Masked booby	*Sula dactylatra*	M	LC		No			
	Brown booby	*Sula leucogaster*	M	LC		No			
	Red-footed booby	*Sula sula*	M	LC		No			
	Common sandpiper	*Actitis hypoleucos*	Mw	LC		No			
	Ruddy turnstone	*Arenaria interpres*	Mw	LC		No			

Class	Common Name	Scientific Name	EPBC Act Status	WC Act	Cons Advice	Recovery Plan	Threat Abatement Plan	BIA	Identified /relevant risks
	Sharp-tailed sandpiper	*Calidris acuminata*	Mw	LC		No			
	Sanderling	*Calidris alba*	Mw	LC		No			
	Pectroral Sandpiper	*Calidris melanotos*	Mw	LC		No			
	Red-necked Stint	*Calidris ruficollis*	Mw	LC		No			
	Long-toed Stint	*Calidris subminuta*	Mw	LC		No			
	Double-banded Plover	*Charadrius bicinctus*	Mw	LC		No			
	Oriental Plover	*Charadrius veredus*	Mw	LC		No			
	Oriental Pratincole	*Glareola maldivarum*	Mw	LC		No			
	Grey-tailed Tattler	*Heteroscelus brevipes*	Mw	LC		No			
	Broad-billed Sandpiper	*Limicola falcinellus*	Mw	LC		No			
	Asian Dowitcher	*Limnodromus semipalmatus*	Mw	LC		No			
	Little Curlew	*Numenius minutus*	Mw	LC		No			
	Whimbrel	*Numenius phaeopus*	Mw	LC		No			
	Osprey	*Pandion haliaetus*	Mw	LC		No			
	Ruff	*Philomachus pugnax*	Mw	LC					
	Pacific Golden Plover	*Pluvialis fulva*	Mw	LC					
	Grey Plover	*Pluvialis squatarola*	Mw	LC					
	Crested Tern	*Thalasseus bergii*	Mw	LC					

Class	Common Name	Scientific Name	EPBC Act Status	WC Act	Cons Advice	Recovery Plan	Threat Abatement Plan	BIA	Identified /relevant risks
	Wood Sandpiper	*Tringa glareola*	Mw	LC					
	Common Greenshank	*Tringa nebularia*	Mw	LC					
	Marsh Sandpiper	*Tringa stagnatilis*	Mw	LC					
	Common Redshank	*Tringa tetanus*	Mw	LC					
	Terek Sandpiper	*Xenus cinereus*	Mw	LC					

Table 3-3: Threatened and Migratory Species in the EMBA

Class	Common Name	Scientific Name	EPBC Act – Status
Fish	Whale shark	*Rhincodon typus*	Vulnerable; Migratory – marine
	White shark	*Carcharodon carcharias*	Vulnerable; Migratory – marine
	Green sawfish	*Pristis zijsron*	Vulnerable; Migratory – marine
	Grey nurse shark (west coast population)	*Carcharias taurus*	Vulnerable
	Northern River Shark	*Glyphis garricki*	Endangered
	Dwarf sawfish	*Pristis clavata*	Vulnerable
	Shortfin mako	*Isurus oxyrinchus*	Migratory – marine
	Longfin mako	*Isurus paucus*	Migratory – marine
	Porbeagle mackerel shark	*Lamna nasus*	Migratory – marine
	Reef Manta Ray	*Manta alfredi*	Migratory – marine
	Giant Manta Ray	*Manta birostris*	Migratory – marine
Marine mammals	Sei whale	*Balaenoptera borealis*	Vulnerable; Migratory – marine
	Fin whale	*Balaenoptera physalus*	Vulnerable; Migratory – marine
	Humpback whale	*Megaptera novaeangliae*	Vulnerable; Migratory – marine
	Blue whale	*Balaenoptera musculus*	Endangered; Migratory – marine
	Southern right whale	*Eubalaena australis*	Endangered; Migratory – marine
	Antarctic minke whale	*Balaenoptera bonaerensis*	Migratory – marine
	Bryde's whale	*Balaenoptera edeni*	Migratory – marine
	Sperm whale	*Physeter macrocephalus*	Migratory – marine
	Killer whale	*Orcinus orca*	Migratory – marine
	Spotted bottlenose dolphin (Arafura/ Timor Sea) populations)	*Tursiops aduncus*	Migratory – marine
	Indo-Pacific humpback dolphin	*Sousa chinensis*	Migratory – marine
	Irrawaddy dolphin	*Orcaella brevirostris*	Migratory – marine
	Dugong	*Dugong dugon*	Migratory – marine
Marine reptiles	Hawksbill turtle	*Eretmochelys imbricata*	Vulnerable; Migratory – marine
	Flatback turtle	*Natator depressus*	Vulnerable; Migratory – marine
	Green turtle	*Chelonia mydas*	Vulnerable; Migratory – marine
	Loggerhead turtle	*Caretta caretta*	Endangered; Migratory – marine
	Leatherback turtle	*Dermochelys coriacea*	Endangered; Migratory – marine
	Short-nosed sea-snake	*Aipysurus apraefrontalis*	Critically Endangered
	Salt-water crocodile	*Crocodylus porosus*	Migratory – marine
Birds	Curlew Sandpiper	*Calidris ferruginea*	Critically Endangered; Migratory – wetland
	Great Knot	*Calidris tenuirostris*	Critically Endangered; Migratory – wetland
	Bar-tailed Godwit (menzbieri)	*Limosa lapponica menzbieri*	Critically Endangered; Migratory – wetland

Class	Common Name	Scientific Name	EPBC Act – Status
	Eastern Curlew	*Numenius madagascariensis*	Critically Endangered; Migratory – wetland
	Lesser Sand Plover	*Charadrius mongolus*	Endangered; Migratory – wetland
	Red Knot	*Calidris canutus*	Endangered; Migratory – wetland
	Southern giant-petrel	*Macronectes giganteus*	Endangered; Migratory – marine
	Australian painted snipe	*Rostratula australis*	Endangered; Migratory – wetland
	Soft-plumaged petrel	*Pterodroma mollis*	Vulnerable
	Australian fairy tern	*Sternula nereis nereis*	Vulnerable
	Bar-tailed Godwit (baueri)	*Limosa lapponica baueri*	Vulnerable; Migratory – wetland
	Greater Sand Plover	*Charadrius leschenaultii*	Vulnerable; Migratory – wetland
	Shy Albatross	*Thalassarche cauta cauta*	Vulnerable; Migratory – marine
	White-capped Albatross	*Thalassarche cauta steadi*	Vulnerable; Migratory – marine
	Campbell Albatross	*Thalassarche impavida*	Vulnerable; Migratory – marine
	Black-browed Albatross	*Thalassarche melanophris*	Vulnerable; Migratory – marine
	Common noddy	*Anous stolidus*	Migratory – marine
	Fork-tailed swift	*Apus pacificus*	Migratory – marine
	Streaked shearwater	*Calonectris leucomelas*	Migratory – marine
	Lesser frigatebird	*Fregata ariel*	Migratory – marine
	Great frigatebird	*Fregata minor*	Migratory – marine
	White-tailed tropicbird	*Phaethon lepturus*	Migratory – marine
	Red-tailed tropicbird	*Phaethon rubricauda*	Migratory – marine
	Flesh-footed Shearwater	*Puffinus carneipes*	Migratory – marine
	Wedge-tailed shearwater	*Puffinus pacificus*	Migratory – marine
	Little tern	*Sterna albifrons*	Migratory – marine
	Bridled tern	*Sterna anaethetus*	Migratory – marine
	Lesser crested tern	*Sterna bengalensis*	Migratory – marine
	Caspian tern	*Sterna caspia*	Migratory – marine
	Roseate tern	*Sterna dougallii*	Migratory – marine
	Masked booby	*Sula dactylatra*	Migratory – marine
	Brown booby	*Sula leucogaster*	Migratory – marine
	Red-footed booby	*Sula sula*	Migratory – marine
	Common sandpiper	*Actitis hypoleucos*	Migratory – wetland
	Ruddy turnstone	*Arenaria interpres*	Migratory – wetland
	Sharp-tailed sandpiper	*Calidris acuminata*	Migratory – wetland
	Sanderling	*Calidris alba*	Migratory – wetland
	Pectroral Sandpiper	*Calidris melanotos*	Migratory – wetland
	Red-necked Stint	*Calidris ruficollis*	Migratory – wetland
	Long-toed Stint	*Calidris subminuta*	Migratory – wetland

Class	Common Name	Scientific Name	EPBC Act – Status
	Double-banded Plover	*Charadrius bicinctus*	Migratory – wetland
	Oriental Plover	*Charadrius veredus*	Migratory – wetland
	Oriental Pratincole	*Glareola maldivarum*	Migratory – wetland
	Grey-tailed Tattler	*Heteroscelus brevipes*	Migratory – wetland
	Broad-billed Sandpiper	*Limicola falcinellus*	Migratory – wetland
	Asian Dowitcher	*Limnodromus semipalmatus*	Migratory – wetland
	Little Curlew	*Numenius minutus*	Migratory – wetland
	Whimbrel	*Numenius phaeopus*	Migratory – wetland
	Osprey	*Pandion haliaetus*	Migratory – wetland
	Ruff	*Philomachus pugnax*	Migratory – wetland
	Pacific Golden Plover	*Pluvialis fulva*	Migratory – wetland
	Grey Plover	*Pluvialis squatarola*	Migratory – wetland
	Crested Tern	*Thalasseus bergii*	Migratory – wetland
	Wood Sandpiper	*Tringa glareola*	Migratory – wetland
	Common Greenshank	*Tringa nebularia*	Migratory – wetland
	Marsh Sandpiper	*Tringa stagnatilis*	Migratory – wetland
	Common Redshank	*Tringa totanus*	Migratory – wetland
	Terek Sandpiper	*Xenus cinereus*	Migratory – wetland

3.7.1 Fish

Ten species of EPBC listed fish and rays have been identified as potentially occurring within the EMBA for the Stag Field. Of these, four species BIAs' also overlap with the EMBA including the; whale shark, green, dwarf and freshwater sawfishes (**Figure 3-5**).

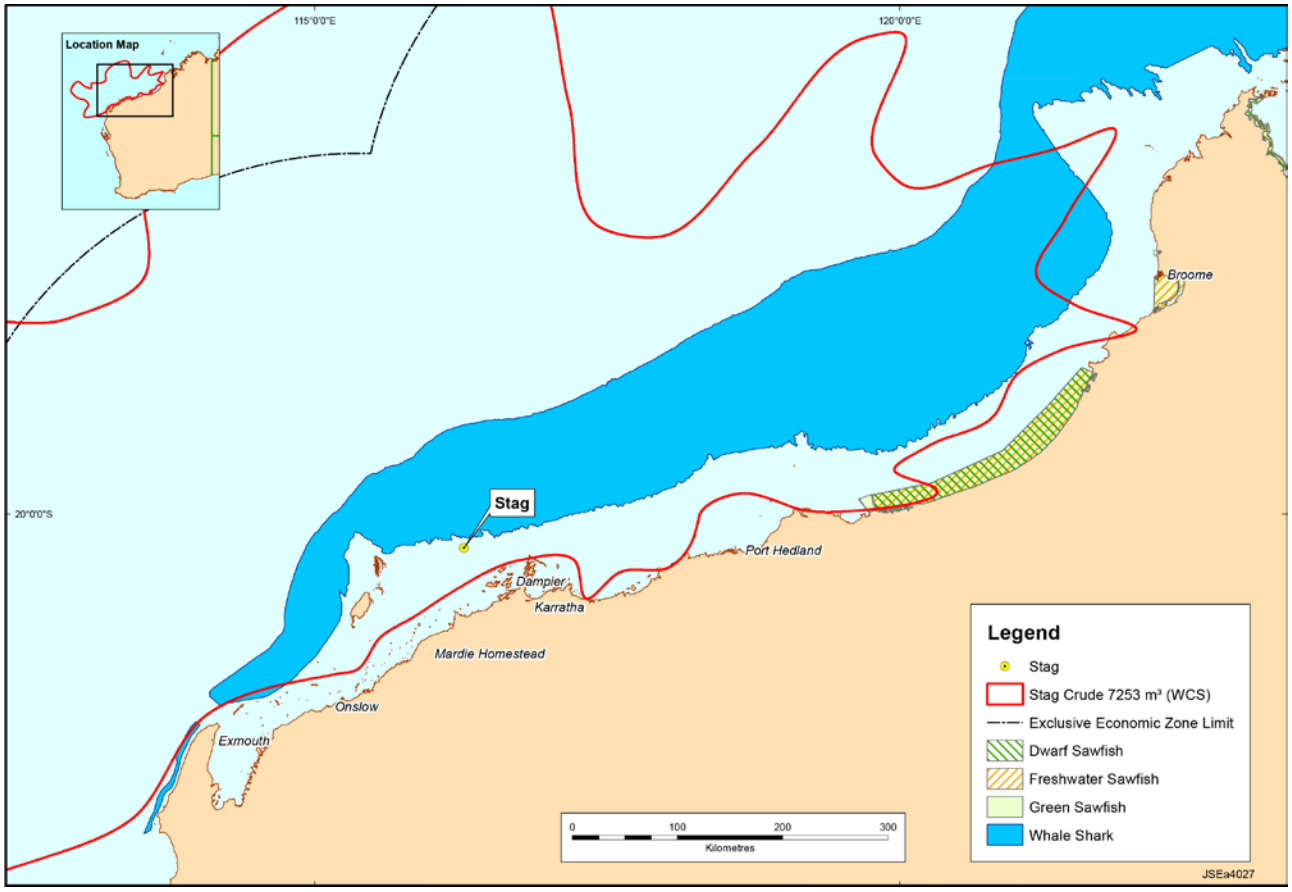

Figure 3-5: Biologically Important Areas for Shark and Fish

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. This location has been identified as a foraging BIA (Figure 3-5), 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.

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).

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. The range of the west coast population is not well known; however, records indicate that the species is widely distributed from the North-West Shelf (including coastal waters in Exmouth Gulf), south to the Great Australian Bight.

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 (CoA 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 drumlining.

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

Shortfin and Longfin Mako

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. 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.

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. 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.

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. Pupping is known and likely to occur along the Pilbara coastline, with main areas within the EMBA being along Eighty Mile Beach. Similarly, the Recovery Plan indicates that adults are known to occur along the coast north of Exmouth and within the EMBA and operational area.

Northern River shark

Northern river sharks have been recorded in rivers and estuaries, as well as the marine environment, within the west and east Kimberley, including King Sound, the Ord and King Rivers, the west arm of Cambridge Gulf and from Joseph Bonaparte Gulf and so outside the EMBA.

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). 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 (Peverell 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.

Pupping is known and likely to occur along the Pilbara coastline, with main areas within the EMBA being along Eighty Mile Beach. 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 is fishing activities (by-catch, traditional or illegal fishing) and habitat degradations or modification.

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.

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.

3.7.2 Marine Mammals

Marine mammals occur in the waters of the Stag Field, 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 revealed 32 cetaceans that may occur within the EMBA. The search identified five threatened marine mammal species that may occur within the Stag Field EMBA, including three species listed as vulnerable, the sei whale (Balaenoptera borealis), humpback whale (Megaptera novaeangliae) and fin whale (Balaenoptera physalus), and two species listed as endangered, the blue whale (Balaenoptera musculus) and southern right whale (Eubalaena australis). Further information on these species is provided in Figure 3-6. In addition, eight marine mammals were identified as migratory.

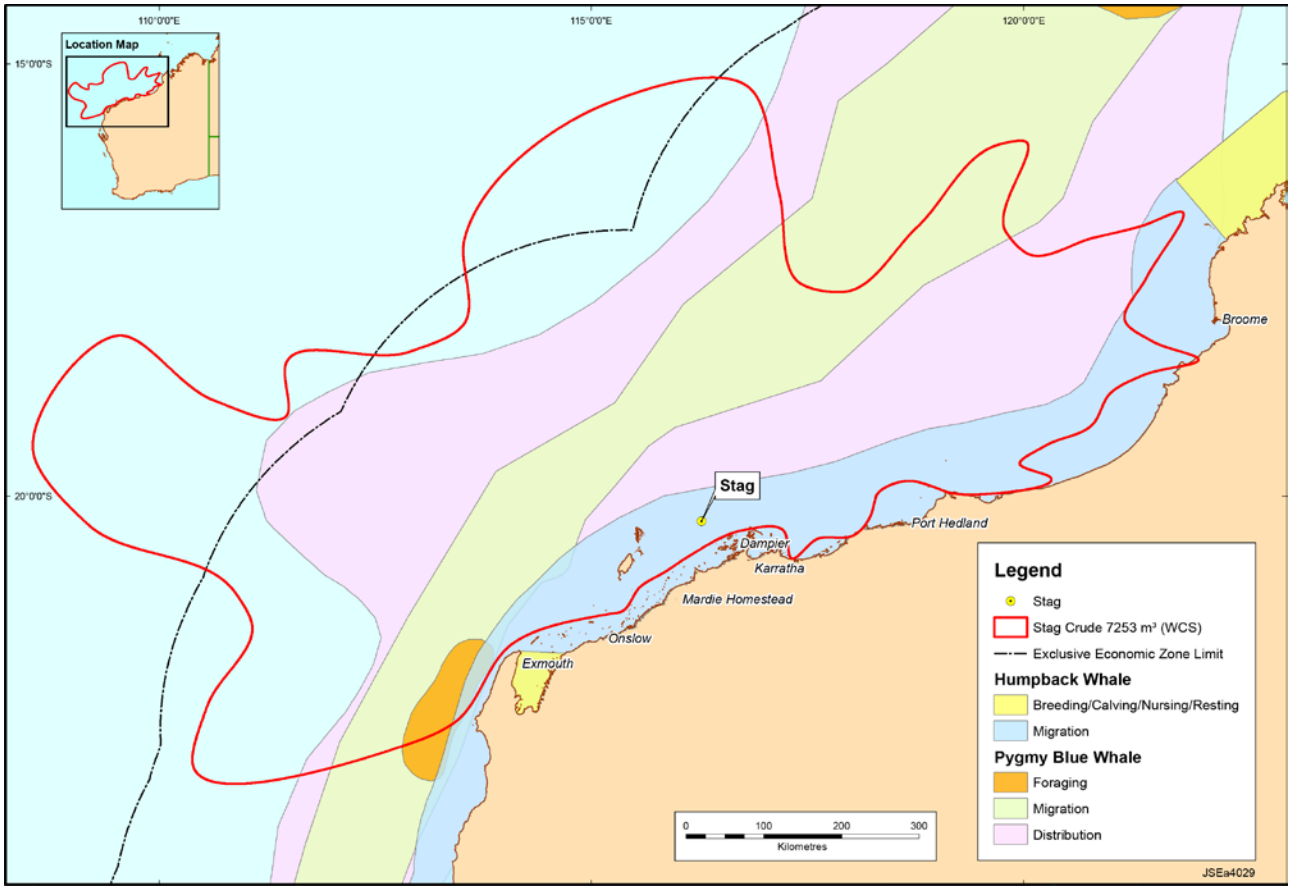

Figure 3-6: Biologically Important Areas for Marine Mammals

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.

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.

The Approved Conservation Advice for Megaptera novaeangliae (humpback whale) (DoE 2015) identifies that the humpback whale migration pathway is within the continental shelf boundary or 200 m bathymetry along the WA coastline. However actual sightings recorded by Jenner et al (2002) indicates 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., 2002) which are more than 900 km from the Stag Operational Area.

The Operational Area is within a region identified in the Conservation Advice (DoE 2015) as a ‘species core range’ (Figure 3-6) and whales may travel through this 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.

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 (DoE 1999). 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 blue whale BIA (migratory path) overlaps the operational area (Figure 3-6). 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.

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. 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 3-6).

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, and appear to occasionally venture into shallower waters in other areas. No BIA are in the waters surrounding the Stag Platform 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.

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 2012) 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 Stag Platform 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.

Other Whale Species

Other cetacean species whose broad distributions overlap with the 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.

Spotted Bottlenose

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.

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

Indo-Pacific Humpback

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. 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.

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

Irrawady Dolphin (Australian Snubfin)

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. Surveys have indicated that the species is typically found in protected shallow nearshore waters, generally less than 20m deep, adjacent to river and creek mouths close to seagrass beds. 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. Based on the extensive survey effort and amenable conditions within the James Price Point coastal area during survey, it is concluded that this species is seldom found outside of shallow and sheltered bays and inlets.

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 of Migratory Species (the CMS). 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 and

Lowendal Islands, and further north at Eighty Mile Beach and off the Kimberley Coast, particularly Roebuck Bay and Dampier Peninsula (DSEWPaC 2012).

A foraging and migration BIA is in Roebuck Bay (outside the EMBA) while the waters around Ningaloo Reef are a recognised breeding and nursery BIA.

3.7.3 Marine Reptiles

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 Field 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 (EA 2003) as well as the Draft Recovery Plan (CoA 2017).

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. **Error! Reference source not found.** outlines turtle activity within the Operational Area and EMBA.

A search of EPBC Act protected matters revealed 18 listed seasnakes that may occur within the EMBA. Of these species, one is considered threatened (critically endangered), the short-nosed sea snake (Aipysurus apraefrontalis).

The EPBC search also identified two species of crocodile, the saltwater crocodile (Crocodylus porosus) and the freshwater crocodile (Crocodylus johnstoni) as potentially occurring within the EMBA. The saltwater crocodile is listed as migratory marine species under the EPBC Act. These species are associated with riverine, estuarine and nearby coastal waters of the mainland and are most likely to be encountered along the northern mainland coastline of the EMBA. Given their habitat preferences they are unlikely to be encountered in the offshore waters of the Operational Area.

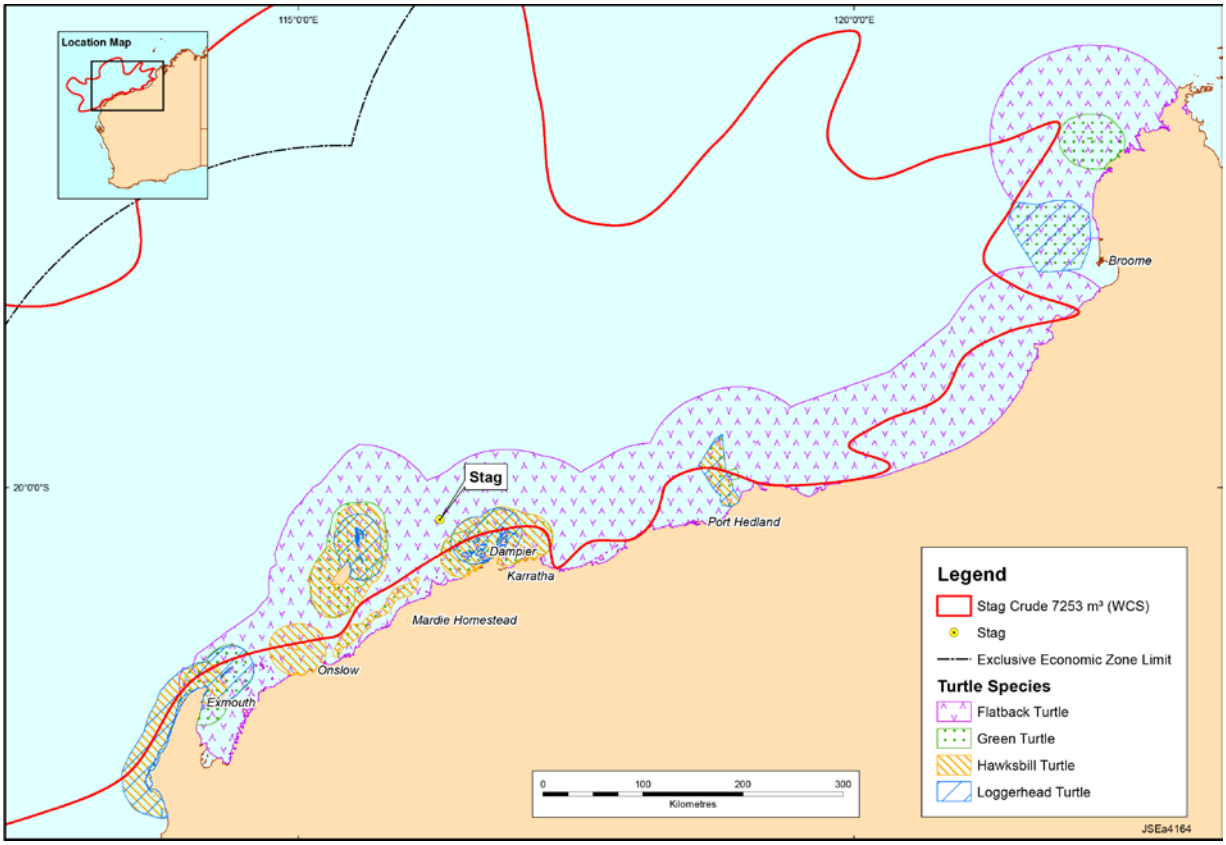

Figure 3-7: Biologically Important Areas for Turtles

Table 3-4: 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)

Species	Hawksbill turtle	Flatback turtle	Green turtle	Loggerhead turtle	Leatherback turtle
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	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

3.7.4 Birds

Marine waters and coastal habitat in the EMBA contains 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 November 2016 using a conservative EMBA for the Stag Field, revealed 75 listed bird species, 11 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.

A search of BIAs that overlap the EMBA was undertaken for the threatened species as well as migratory marine species and the results are summarised in Table 3-5.

Table 3-5: Seabird Biologically Important Areas that Overlap the EMBA

Species	BIA Location	Peak times
Wedgetail shearwater	Foraging and breeding with 100 km buffer along Pilbara coastline and islands including: Dampier Archipelago, Passage Island, Montebello Islands, Lowedall Islands off Barrow Island and islands off Onslow	Mid Aug to April
Roseate tern	Breeding: Islands off Pilbara coast including Dampier Archipelago, Lowendall Is, Frazer Is, Bedout Island and around Montebello Islands Resting: North Eighty Mile Beach	Mid-March to July
Lesser crested tern	Breeding: Bedout Island, Lowendal Islands, Thevenard Island	March to June
Lesser Frigatebird	Breeding and 100 km foraging buffer: Bedout Island	March to September
Fairy Tern	Breeding: Pilbara coast incl. Dampier Archipelago and Barrow Island.	July to late September

Species	BIA Location	Peak times
Brown booby	Breeding and foraging: Bedout Island	Feb to Oct, but mainly Autumn
Little tern	Breeding: Pilbara coastline along Eighty Mile Beach Resting: Rowley Shoals	June- July and Oct
White-tailed tropicbird	Breeding and foraging with 100 km buffer: Rowley Shoals	May to Oct
Red footed booby	In Australia, the distribution is apparently disjunct; birds are not known to travel far from breeding colonies. Unknown in Western Australia.	
Greater frigatebird	Pilbara coast – northern territory.	

The Eighty Mile Beach is particularly significant for migrating shorebird species and is considered one of the most significant sites in Australia for migratory shorebirds 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.

3.7.5 Environmental Sensitivities

Table 3-6: Environmental Sensitivities for Marine Fauna within the Operational area and EMBAs

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).
Invert-ebrates	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 Field 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.
	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

Marine fauna		Operational Area	EMBA
	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 favourable (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.
	Other shark/ ray species	Yes - Could transit through the operational area.	Yes - Could transit through the operational area.
	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.
Marine mammals	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.
	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.
	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 internesting 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.
	Crocodile	No- Not likely to be encountered given the water depth and distance from estuarine and coastal water of the mainland.	Yes - May be encountered in estuarine waters and nearby coastal waters. Most likely along more northerly stretches of coastline between Port Hedland and Broome

Marine fauna		Operational Area	EMBA
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 Field 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.

3.8 Protected Areas

3.8.1 EPBC Act Protected Matters

A search of the EPBC Act Protected Matters Database in November 2016 listed a number of areas that are considered matters of National Environmental Significance (NES) as well as other matters protected under the Act. These are outlined in Table 3-7 and discussed in more detail in Table 3-10.

Table 3-7: Summary of Protected Areas 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)	Carnarvon Canyon AMP
	Gascoyne AMP
	Ningaloo AMP
	Montebello AMP
	Dampier AMP
	Eighty Mile Beach AMP
	Argo-Rowley Terrace AMP
	Mermaid Reef AMP
	Kimberley AMP
Key Ecological Features	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

Area type	Title
	Mermaid Reef and Commonwealth Waters
Threatened Ecological Communities	None Identified
State Marine Reserves	Montebello Islands Marine Park
	Barrow Island Marine Park
	Barrow Island Marine Management Area
	Muiron Island Marine Management Area
	Ningaloo Marine Park
	Eighty Mile Beach Marine Park
	Rowley Shoals Marine Park

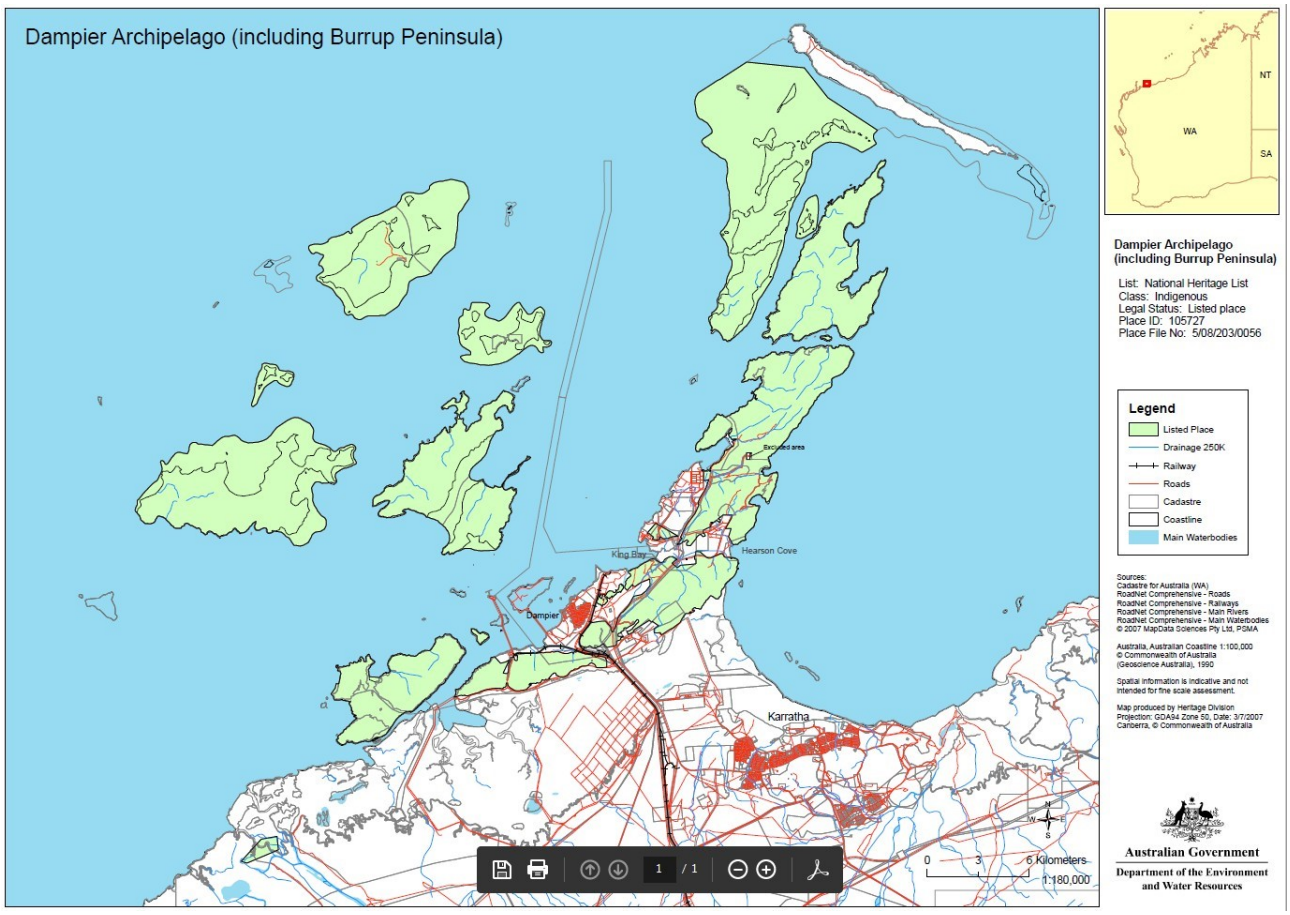

Figure 3-8: National Heritage Features of the Dampier Archipelago

3.8.2 Australian Marine Parks

Nine Australian Marine Parks (AMPs) overlap the EMBA (Figure 3-9) as outlined in Table 3-8.

Table 3-8: Australian Marine Parks within the EMBA

Australian Marine Parks	Distance from Stag Field	IUCN Categories overlapped
Carnarvon Canyon AMP	620 km	Habitat Protection Zone - IUCN Category IV
Gascoyne AMP	270 km	Multiple Use Zone (IUCN VI) Marine National Park Zone (IUCN II) Habitat Protection Zone (IUCN
Ningaloo AMP	260 km	Recreational Use Zone (IUCN IV)
Montebello AMP	30 km	Multiple Use Zone - IUCN Category VI
Dampier AMP	60 km	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)
Argo-Rowley Terrace AMP	290 km	Marine National Park Zone (IUCN II) Multiple Use Zone (IUCN VI)
Mermaid Reef AMP	80 km	Sanctuary Zone (IUCN 1a)
Kimberley AMP	620 km	Multiple Use Zone (IUCN VI)
Roebuck AMP	643 km	Multiple Use Zone (IUCN Category VI)

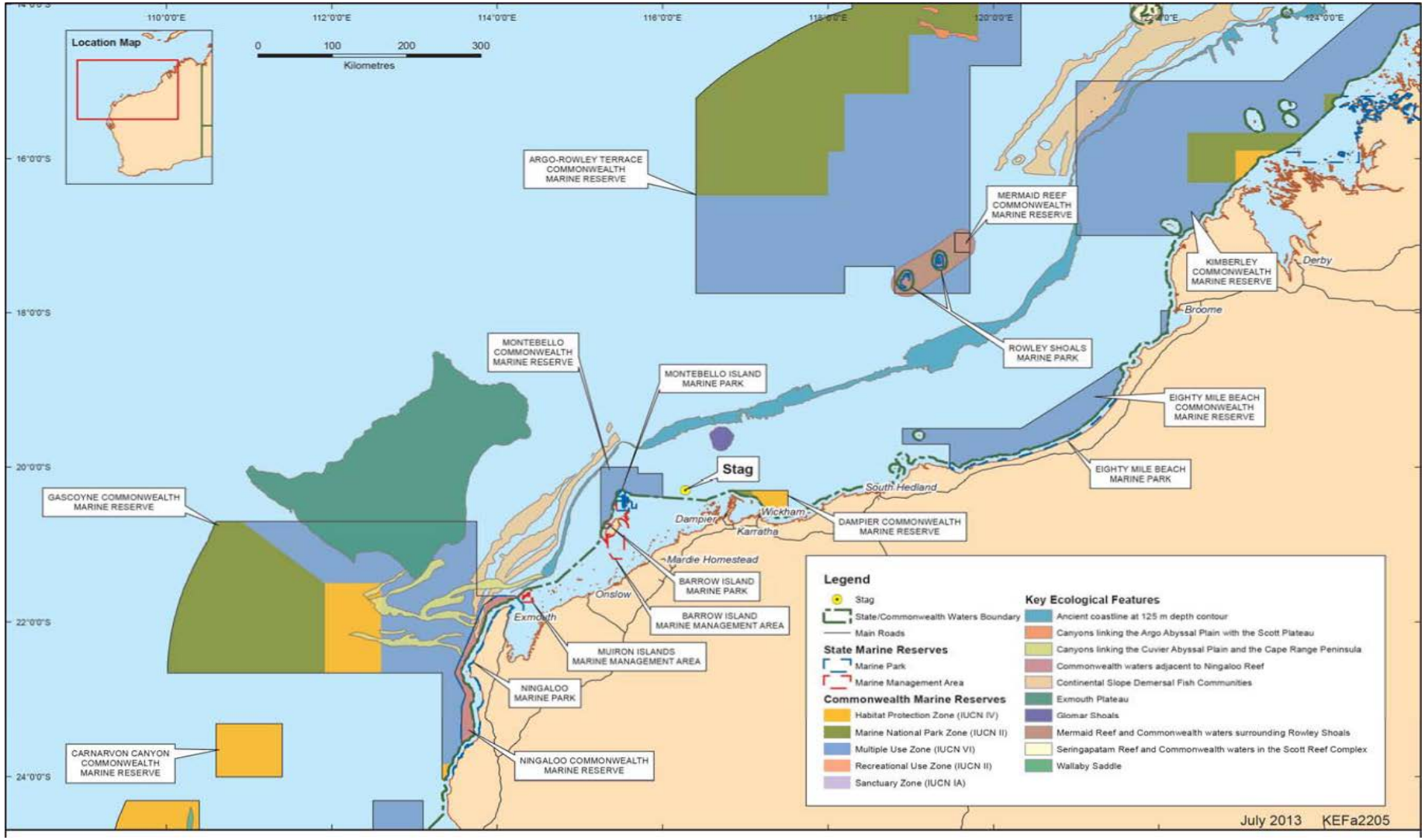

Figure 3-9: State Marine Reserves and Australian Marine Parks and Key Ecological Features

3.8.3 IUCN Principles

Existing and proposed Australian Marine Parks 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 the new proposed AMP in the NWMR, transitional arrangements apply, and there are no changes on the water for users of the new proposed reserves.

3.8.4 Key Ecological Features

Seven marine key ecological features (KEFs) of the NWMR overlap the EMBA (refer Figure 3-9). These KEFs are considered to be of regional importance for either the region's biodiversity or ecosystem function and integrity. Table 3-9 lists the KEFs together with their distance from the Stag Facility. Details on these KEFs are provided below.

Table 3-9: 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

3.8.5 EPBC Act Protected Matters within the Operational Area and EMBA

Table 3-10 summarises the habitats that may be affected by routine events at the Stag Field within the Operational Area as well as accidental events that may arise within a larger EMBA.

Table 3-10: 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			
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.

Protected matter	Environmental value	Sensitivities overlapped	
		Operational Area	EMBA
The Ningaloo Coast	See WHA	**No**	**Yes**
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**
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			
Canarvon Canyon AMP	Contains the whole of the Carnarvon Canyon and provides a wide range of habitats for benthic and demersal species.	**No**	**No** – values for this feature are related to benthic habitats and species. Given the depth) 1500- 5000 m) no oiling of these habitats or species could occur.
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 SW 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.
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.

Protected matter	Environmental value	Sensitivities overlapped	
		Operational Area	EMBA
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.
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 – s**ensitivity is for species (e.g. whales, turtles and whale sharks) that use surface waters within the reserve and therefore susceptible to oiling.
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 Western 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.
	Rowley Shoals Marine Park and the deeper waters of the region.		
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.

Protected matter	Environmental value	Sensitivities overlapped	
		Operational Area	EMBA
Kimberley AMP	Contains important foraging areas for migratory seabirds, migratory dugongs, dolphins and threatened and migratory marine turtles. Important migration pathway and nursery areas for the protected humpback whale and adjacent to important foraging and pupping areas for sawfish and important nesting sites for green turtles. The reserve provides protection for the communities and habitats of waters offshore of the Kimberley coastline ranging in depth from less than 15 metres to 800metres.	**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.
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.
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.

Protected matter	Environmental value	Sensitivities overlapped	
		Operational Area	EMBA
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

3.9 State Marine Reserves

3.9.1 State Marine Reserves within the EMBA

Seven State marine reserves have been identified within the EMBA as outlined in Figure 3-9 and Table 3-11.

Table 3-11: Distances from Stag Facility Location to State Marine Reserves within the EMBA

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

3.9.2 State Marine Reserves within the Operational Area and EMBA

Table 3-12 summarises the State marine reserves that may be affected by unplanned events that may arise within a larger EMBA.

Table 3-12: Summary of Environmental Values and Sensitivities for State Marine Reserves

State Marine Reserves	Environmental value	KPIs	Sensitivities within the Operational Area	Sensitivities within the EMBA
Montebello Island Marine Park	Comprise over 100 islands, with habitats including rocky shorelines, coral reefs, mangroves, intertidal flats, extensive sheltered lagoonal 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.	Coral reef communities Mangrove communities Macroalgae and seagrass Turtles Fin fish Water quality	No	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)
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 deep water 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.		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)
Muiron Island Marine Management Area	Adjacent to Ningaloo Marine Park around Muiron Island. Regionally significant loggerhead turtle nesting beaches. Contains coral reef and macroalgae habitat.	Coral reef communities Water quality Coastal biological communities Finfish	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) or aggregating/migrating offshore from these habitats (whale sharks and whales)

State Marine Reserves	Environmental value	KPIs	Sensitivities within the Operational Area	Sensitivities within the EMBA
		Mangrove communities 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)
Eighty-mile Beach Marine Park	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.	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	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, dugongs, dolphins and migratory shorebirds).

State Marine Reserves	Environmental value	KPIs	Sensitivities within the Operational Area	Sensitivities within the EMBA
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)

3.10 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 North-West Shelf (NWS).

3.10.1 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, 2012).

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 3-13).

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), refer Figure 3-11,

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 and State managed fisheries operating in the vicinity of the Stag Field is provided in Table 3-14.

State Fisheries

State fisheries are managed by the Department of Primary Industries and Regional Development (DPIRD) (previously Department of Fisheries) 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 Field Operational Area are listed below, and summarised in Table 3-14.

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;
- Pilbara Developing Crab Fishery.

Whole of State Fisheries

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

While some fisheries have permitted fishing zones that overlap the Operational Area (Figure 3-11), not all have significant fishing effort in this area Table 3-13. 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 Field 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;
- Pilbara Developing Crab Fishery.

Gascoyne Coast Bioregion

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

West Coast Bioregion

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

Whole of State Fisheries

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

Table 3-13: Fisheries Resources

North Coast Bioregion			
Fishery or resource	**Catch returns recorded in past 3 years (noting if any returns in North-West Shelf Bioregional province)**	**Are breeding stocks or effort for all target species in fishery considered acceptable?**	**Permitted fishing method**
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	Handline, dropline and 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 and 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

North Coast Bioregion			
Fishery or resource	**Catch returns recorded in past 3 years (noting if any returns in North-West Shelf Bioregional province)**	**Are breeding stocks or effort for all target species in fishery considered acceptable?**	**Permitted fishing method**
Western Tuna and Billfish Fishery (WTBF)	Yes	No (Stiped Marlin overfished)	Longline

Aquaculture

The only aquaculture activity within the EMBA is pearl farming of pearl oysters (Pinctada maxima) in protected waters (Fletcher and Santoro, 2012). Pearl farm locations within the EMBA are at the Montebello Islands.

3.10.2 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 (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 indicates that charter boat fishing effort in permit area WA-15-L has been recorded in the last five years. 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 off-shore mean 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.

3.10.3 Oil and Gas Industry

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

- Wandoo Production Platforms located in Exploration Permit WA-14-L, ~ 20 km northeast;
- 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 Field.

3.10.4 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 3-10. 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.

3.10.5 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;
- Recreational fishing.

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

3.10.6 Native Title

Within the SEMBA any sheen or impact on environmental values may impact the associated cultural values or use. Within the SEMBA 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.

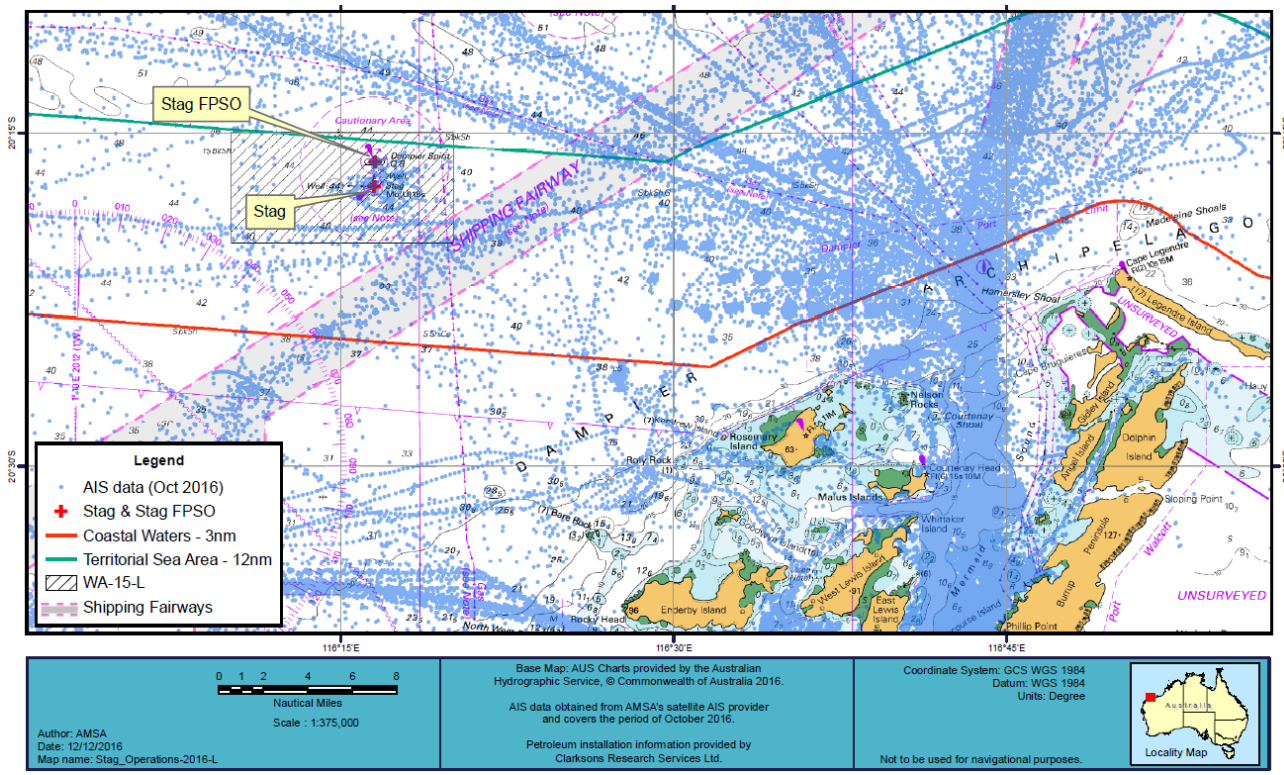

Figure 3-10: AMSA Designated Shipping Routes in the Vicinity of the Stag Field (2016)

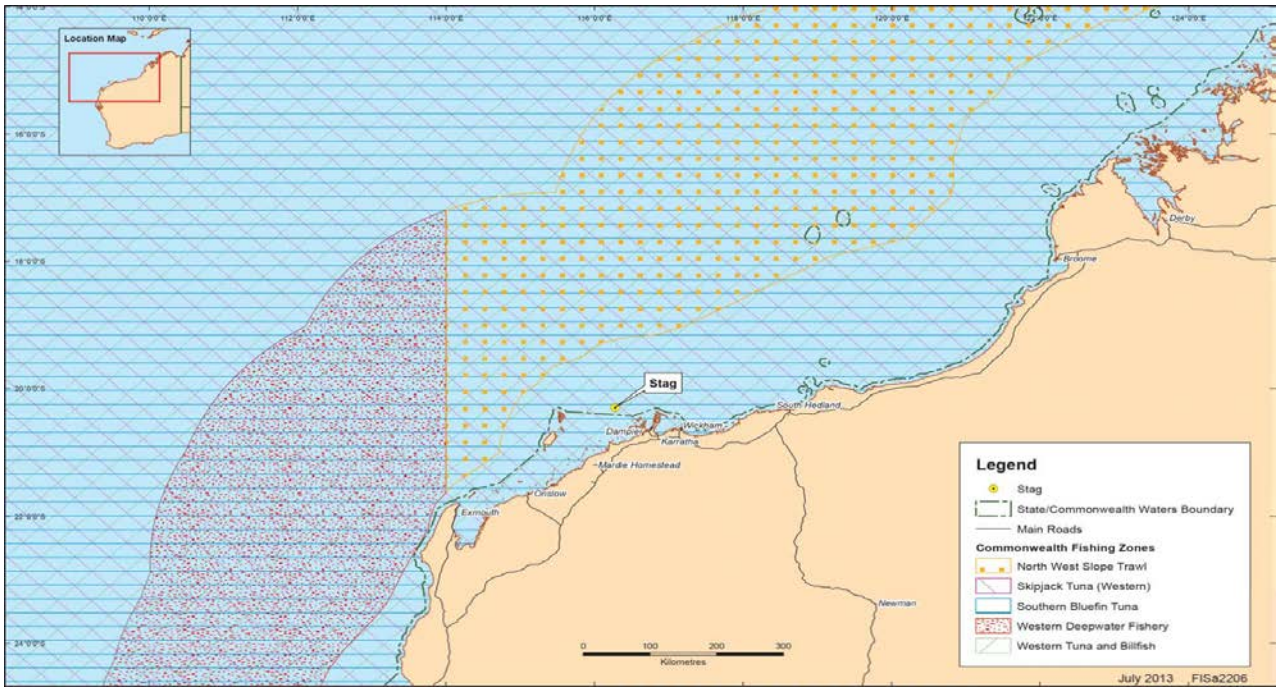

Figure 3-11: Commonwealth Commercial Fishing Zones in the Vicinity of the Stag Field

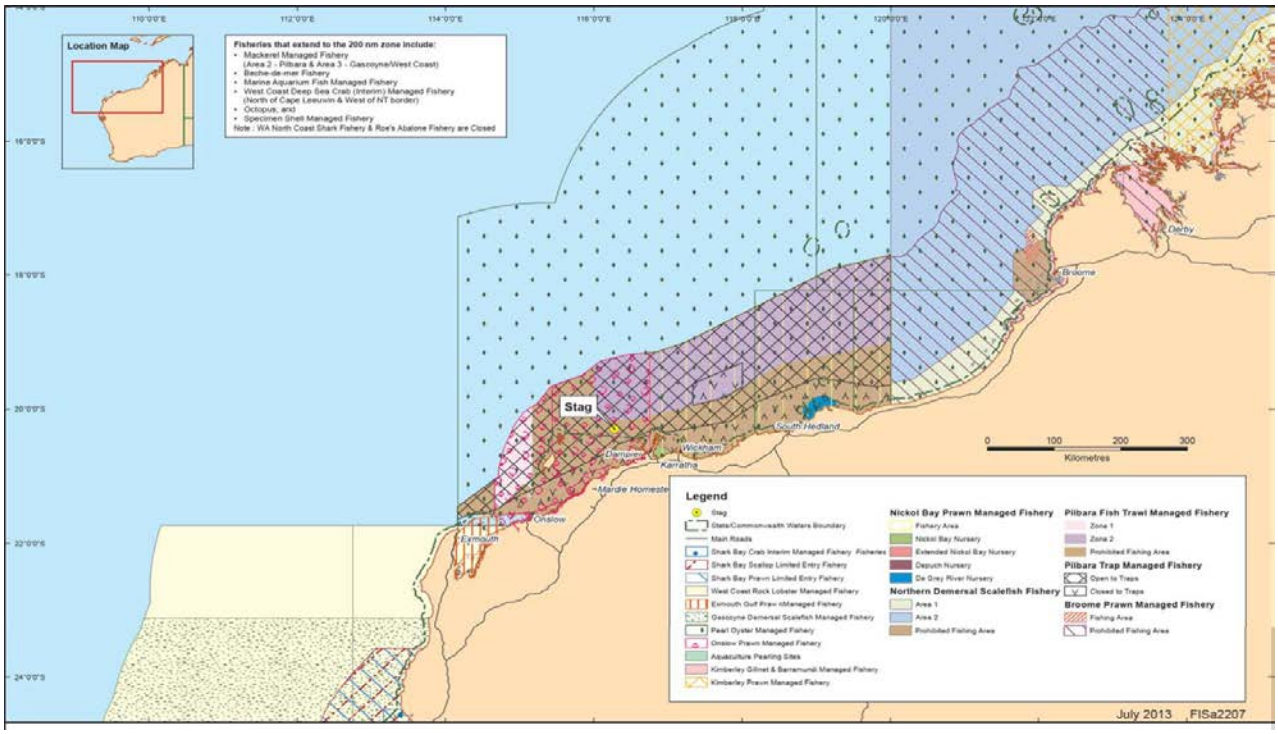

Figure 3-12: State Commercial Fishing Zones in the Vicinity of the Stag Field

Table 3-14: Summary of Commercial Fishery Licences in Vicinity of Stag Field and EMBA

Fishery	Target Species	Fishing Method and Area
Commonwealth-managed Fisheries		
North-West Slope Trawl	Scampi (crayfish): velvet scampi (*Metanephrops velutinus*) and boschmai scampi (*Metanephrops boschmai*). Deepwater prawns (penaeid and carid): pink prawn (*Parapenaeus longirostris*), red prawn (*Aristaeomorpha foliacea*), striped prawn (*Aristeus virilis*), giant scarlet prawn (*Aristaeopsis edwardsiana*), red carid prawn (*Heterocarpus woodmasoni*) and white carid prawn (*Heterocarpus sibogae*).	Demersal trawl seaward of the 200m isobath, but no current effort in vicinity of the operational area and limited effort within EMBA. Only 1 vessel active in 2014/15
Western Deepwater Trawl	Deepwater bugs and ruby snapper are the target species.	Demersal trawl seaward of the 200m isobath, and west of North-West Cape – does not overlap operational area, but small overlap of EMBA. 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.
Western Skipjack	Skipjack tuna (*Katsuwonus pelamis*) is the only target species. Landings of species other than skipjack (may include bigeye (*Thunnus obesus*), and yellowfin tuna (*T. albacares*), frigate mackerel (*Auxis thazard*), sharks, mahi mahi, rays and marlins are believed to be much less than 2% of the total landings.	Purse seine November to June. Historically fishing limited to waters off SA and not WA. No fishing effort since 2008-2009 (CoA 2016).

Fishery	Target Species	Fishing Method and Area
Western Tuna and Billfish	Broadbill swordfish (*Xiphias gladius*), yellowfin tuna, bigeye tuna, albacore tuna (*Thunnus alalunga*) and longtail tuna (*T. tonggol*).	Pelagic longline year-round. Historically effort has concentrated off south-west WA and SA (CoA 2016). No current effort on the NWS.
Southern Bluefin Tuna	Southern bluefin tuna (*Thunnus maccoyii*).	Most of the Australian catch is taken by purse-seine vessels in the Great Australian (CoA 2016). No current effort on the NWS.
State-managed Fisheries		
Onslow Prawn Managed Fishery	Western king prawn (*Penaeus latisulcatus*), brown tiger prawns (*Penaeus esculentus*) and endeavour prawns (*Metapenaeus* spp.)	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 east of 114º39.9' on the landward side of the 200m depth isobath. The 2014 season opened on 21 April and closed on 8 October, and only 1 vessel fished
Nickol Bay Prawn Managed Fishery	Primarily targets banana prawns (*Penaeus merguiensis*)	Otter trawls used within the boundaries of the NBPMF being 'all the waters of the Indian Ocean and Nickol Bay between 116°45' east longitude and 120° east longitude on the landward side of the 200m isobath. The 2014 season opened on 24 March and closed on 31 October. 7 vessels fished intermittently in 2014.
Broome Prawn Managed Fishery	Western king prawns (*Penaeus latisulcatus*) and coral prawns (a combined category of small penaeid species)	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. The Fishery opened on 1 June and officially closed on 8 Oct. Fishing effort limited to waters off Broome. No vessels fished in 2014
The Kimberley Gillnet and Barramundi Managed Fishery	Primarily Barramundi (*Lates calcarifer*), king threadfin (*Polydactylus macrochir*) and blue threadfin (*Eleutheronema tetradactylum*)	Operates in the nearshore and estuarine zones of the North Coast Bioregion from the WA/NT border (129ºE) to the top end of Eighty Mile Beach, south of Broome (19ºS). In late 2013, Roebuck Bay and the northern end of Eighty Mile Beach to 19ºS were closed to commercial fishing. Encompasses the taking of any fish by means of gillnet in inshore waters and and estuarine waters (0-20m) th e taking of barramundi (*Lates calcarifer*) by anymeans.
Northern Demersal Scalefish Managed Fishery (NDSF)	The main species landed by this fishery are red emperor and goldband 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. 8 Vessels fished in 2014.

Fishery	Target Species	Fishing Method and Area
Mackerel Managed Fishery	Spanish and grey mackerel	Trolling or handline year-round in all waters to the 200-nautical mile AFZ between 114º E to 121º. Fishing effort recorded within EMBA for Area 2 (Pilbara). 11 vessels operated in 2014.
Pilbara Demersal Scalefish Fishery (Line, Trawl and Trap)	Variety of demersal scalefish including goldband snapper (*Pristipomoides multidens*), red emperor (*Lutjanus sebae*) and bluespotted emperor (*Lethrinus punctulatus*).	Demersal trawl and trap in various zones and operates year-round. Trawl area is closed within operational area, but trap fishing is permitted. Northern portion of EMBA overlies both trawl and trap areas. In 2014 3 vessels used in the Pilbara Fish Trawl Fishery; 3 vessels in the Trap Fishery; and 7 vessels in the line fishery.
Pearl Oyster Managed Fishery	Silver-lipped pearl oyster (*Pinctada maxima*)	Drift diving restricted to shallow divable depths generally less than 35 m. In 2014 catch was taken from Zones 1 and 2/3. Main area though is zone 2/3.
WA North Coast Shark Fishery	Sandbar (*Carcharhinus plumbeus*), blacktip (*Carcharhinus* spp.), tiger (*Galeocerdo cuvier*) and lemon (*Negaprion acutidens*) 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 Developing Crab Fishery	Blue swimmer crab (*Portunus armatus*)	Hourglass traps used in inshore waters from Onslow through to Port Hedland with most commercial and activity occurring in and around Nickol Bay.
Exmouth Gulf Prawn Fishery	Target western king prawns (*Penaeus latisulcatus*), brown tiger prawns (*Penaeus esculentus*), endeavour prawns (*Metapenaeus* spp.) and banana prawns (*Penaeus merguiensis*).	Otter trawls used within Exmouth Gulf. In 2014, 6 boats trawled.
Gascoyne Demersal Scalefish Fishery	A range of demersal species including pink snapper (*Pagrus auratus*), goldband snapper (*Pristipomoides* spp., mainly *P. multidens*), red emperor (*Lutjanus sebae*), emperors (Lethrinidae, includes spangled emperor, *Lethrinus nebulosus*, and redthroat emperor, *L. miniatus*), cods (Serranidae), ruby snapper (*Etelis carbunculus*), pearl perch (*Glaucosoma burgeri*), mulloway (*Argyrosomus japonicus*), amberjack (*Seriola dumerili*) 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 2014, 17 vessels actively fished.
West Coast Rock Lobster Managed Fishery	Western rock lobster (*Panulirus cygnus*)	Baited pots fished along the west coast of Australia. between Latitudes 21°44´ to 34°24´ S
Beche-de-mer Managed Fishery	Sandfish (*Holothuria scabra*) and deepwater redfish (*Actinopyga echinites*).	Hand-harvest fishery, animals caught principally by diving (restricted to diving depths) and a smaller amount by wading.

Fishery	Target Species	Fishing Method and Area
Marine Aquarium Fish Managed Fishery	Fish, coral, algae, live rock	Dive based fishery operating all year throughout WA waters, but restricted by diving depths
Specimen Shell Managed Fishery	Shells (cowries, cones)	Dive based fishery operating all year throughout WA waters, but restricted by diving depths
West Coast Deep Sea Crustacean Managed Fishery	Crystal (Snow) crabs (*Chaceon albus*), Giant (King) crabs (*Pseudocarcinus gigas*) and Champagne (Spiny) crabs (*Hypothalassia acerba*)	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.

Source: CoA (2016); Fletcher and Santoro (2015)

3.10.7 Socio-Economic Values and Sensitivities within Operational Area and EMBA

Table 3-15 outlines those socioeconomic values that may be affected by routine events at the Stag Field within the Operational Area as well as unplanned events that may arise within a potentially larger area (EMBA).

Table 3-15: 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

Socio-economic value	Sensitivities within Operational Area	Sensitivities within EMBA
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.
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 dive- able 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.
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		

Socio-economic value	Sensitivities within Operational Area	Sensitivities within EMBA
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.
Other		
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.
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 *Tryal* shipwreck at Trial Rocks NW of the Montebello islands

4. CONSULTATION WITH RELEVANT PERSONS

Jadestone Energy has developed a Consultation Plan specific to the Stag EP, which outlines the process for:

- Identification and classification of stakeholders;
- Justification for sufficiency of information; and,
- Ongoing consultation.

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. There are no new risks or changes to operations due to Jadestone Energy becoming operator that have been identified. The scope of the Stakeholder Consultation Plan is limited to the ongoing consultation required to support the acceptance and duration of the EP, and covers ongoing Stag operations and planning for consultation in the event of any unplanned events as identified in the EP.

Relevant persons were classified according to criteria outlined in the consultation plan based on their interest/ activity/ function (Table 4-1).

As a result of applying the processes set out in the Stag EP Consultation Plan, no objections or claims about adverse impact were received in relation to the operation of the Stag Field.

Some feedback and clarification was received which is summarised in Table 4-2.

Ongoing consultation to ensure relevant persons are aware of activities includes:

- 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; and
- Charter operators will receive a mail-out advising on operations of the Stag Facility within two months of acceptance of this EP.

Table 4-1: Relevant Persons Identified for the Stag Field Operations

Relevant persons	Classification	Level of engagement
Department of Defence (ADF Airspace, Australian Hydrographic Service (AHS) and Australian Navy)	Government	Involve
Department of Environment and Energy	Government	Consult
Department of Industry and Science	Government	Inform
NOPSEMA	Government	Involve
Western Australian Department of Transport	Government/Response organisation	Consult
Australian Maritime Safety Authority	Government/Response organisation	Collaborate
Australian Marine Oil Spill Centre (AMOSC)	Government/Response organisation	Collaborate
Hon Josh Frydenberg Minister for Environment & Energy	Government	Inform
Senator the Hon Matt Canavan Minister for Resources and Northern Australia	Government	Inform
Hon Greg Hunt Minister for Industry, Innovation & Science	Government	Inform
Melissa Price Member for Durack	Government	Inform
WA Department of Mines and Petroleum	Government	Consult
WA Department of Fisheries (now Department of Primary Industries and Regional Development)	Government	Consult
Department Parks and Wildlife	Government	Inform
Hon Sean L'Estrange MLA Minister for Mines & Petroleum	Government	Inform
Hon Joe Francis MLA Minister for Fisheries	Government	Inform
Hon Albert Jacob MLA Minister for Environment	Government	Inform
Hon Bill Marmion MLA Minister for State Development; Transport	Government	Inform
Bill Johnston Shadow Minister for State Development; Energy; Mines and Petroleum; Ports	Government	Inform
Chris Tallentire MLA Member for Gosnells Shadow Minister for Environment	Government	Inform
Hon Brendon Grylls MLA Member for Pilbara	Government	Inform
Hon Ken Baston MLC Member for Mining and Pastoral	Government	Inform
Hon Jacqui Boydell MLC Member for Mining and Pastoral	Government	Inform

Relevant persons	Classification	Level of engagement
Hon Stephen Dawson MLC Member for Mining and Pastoral	Government	Inform
Hon Mark Lewis MLC Member for Mining and Pastoral	Government	Inform
Hon Robin Chapple MLC Member for Mining and Pastoral	Government	Inform
Hon Dave Grills MLC Member for Mining and Pastoral	Government	Inform
Australian Fisheries Management Authority (AFMA)	Government	Inform
BHP	Interested party	Inform
Chevron Australia	Interested party	Inform
Eni Australia	Interested party	Inform
Quadrant Energy	Interested party	Inform
Vermillion Engergy Inc	Interested party	Inform
A Raptis and Sons	Potentially affected party – unplanned event	Consult
Austral Fisheries	Potentially affected party – unplanned event	Consult
Australian South Bluefin Tuna Industry Association (ASBTIA)	Interested party	Consult
Commonwealth Fisheries Association (CFA)	Interested party	Consult
Marine Tourism WA	Interested party	Inform
MG Kailis Group	Potentially affected party – unplanned event	Consult
Ocean Wild Tuna	Potentially affected party – unplanned event	Consult
Pearl Producers Association	Potentially affected party – unplanned event	Consult
Recfishwest	Interested party	Consult
W.A. Seafoods Direct	Potentially affected party – unplanned event	Consult
Western Australian Fishing Industry Council (WAFIC)	Interested party	Consult
WestMore Seafoods & Shark Bay Seafoods	Potentially affected party – unplanned event	Consult
Pilbara Port Authority	Government	Inform
Dampier Port Authority	Government	Inform
City of Karratha	Interested parties	Inform
Karratha Chamber of Commerce and Industry	Interested parties	Inform
Mackerel Managed Fishery (State)	Potentially affected parties - operations	Consult
Pearl Oyster Fishery (State)	Potentially affected parties – operations	Consult
Onslow Prawn Managed Fishery (State)	Potentially affected parties – operations	Consult
Beche-de-mer Fishery (State)	Potentially affected parties – operations	Consult

Relevant persons	Classification	Level of engagement
Marine Aquarium Managed Fishery (State)	Potentially affected parties – operations	Consult
Specimen Shell Managed Fishery (State)	Potentially affected parties – operations	Consult
Pilbara Trawl Managed Fishery (State)	Potentially affected parties – operations	Consult
Pilbara Trap Managed Fishery (State)	Potentially affected parties – operations	Consult
Pilbara Line Fishery (State)	Potentially affected parties – operations	Consult
Pilbara Developing Crab Fishery (State)	Potentially affected parties – operations	Consult
Karajarri People	Potentially affected party – unplanned event	Inform
Ngarluma/Yindjibarndi	Potentially affected party – unplanned event	Inform
Rubibi Community	Potentially affected party – unplanned event	Inform
Ngarla	Potentially affected party – unplanned event	Inform
Yaburara & Mardudhunera People	Potentially affected party – unplanned event	Inform
Gnulli	Potentially affected party – unplanned event	Inform
Jabirr Jabirr	Potentially affected party – unplanned event	Inform
Goolarabooloo People	Potentially affected party – unplanned event	Inform
Bindunbur	Potentially affected party – unplanned event	Inform
Kimberley Land Council Aboriginal Corporation	Potentially affected party – unplanned event	Inform
Yamatji Marlpa Aboriginal Corporation	Potentially affected party – unplanned event	Inform
Australian Specimen Collectors Associated of WA	Interested party	Inform
Professional Specimen Shell Fishermen Association	Potentially affected party – unplanned event	Inform
North-West Slope Trawl (Commonwealth)	Potentially affected party – unplanned event	Inform
Western Deepwater Trawl Fishery (Commonwealth)	Potentially affected party – unplanned event	Inform
Exmouth Game Fishing Club	Potentially affected party – unplanned event	Inform
Nickol Bay Sport Fishing Club	Potentially affected party – unplanned event	Inform
Onslow Visitor Centre	Potentially affected party – unplanned event	Inform

Relevant persons	Classification	Level of engagement
Port Hedland Game Fishing Club	Potentially affected party – unplanned event	Inform
Conservation Council of Western Australia	Interested party	Inform

Table 4-2: Assessment of Merit of Concerns, Objections and Claims

Stakeholder	Stakeholder Concern, Objection or Claim	Jadestone Energy Assessment of merit	Jadestone Energy's Response
WA Department of Fisheries (now Department of Primary Industries and Regional Development) Carli Telfer (Policy officer) 1 Dec 2017	DPIRD acknowledged that the procedures and plans referenced in the EP including the Scientific Monitoring Plan would be Jadestone Energy's responsibility, however DPIRD confirmed it was happy to provide advice during the development of these documents if desired.	*No objection, concern or claim.* *Request only:* DPIRD is the key regulatory agency for the management of State fisheries and provides significant input for EP consideration. Jadestone Energy considers these comments and DPIRD input into the SMPs have merit.	DPIRD is listed as relevant person and will be advised of updates to the project, in addition to ongoing requests for advice as requested. DPIRD would be consulted during the implementation of any relevant SMP.
WA Department of Fisheries Victoria Aitken (Director Policy and Strategic Services) 19 Jul 2017	Key items raised by DPIRD regarding the Stag operational area were:	DPIRD is the key regulatory agency for the management of State fisheries and provides significant input for EP consideration.	
	Consultation Request for Jadestone Energy to consult with: • WAFIC, PPA, Recfishwest, and TOs • Individual commercial fishers and charter operators with entitlement to fish in the affected area	• Jadestone Energy agrees with DPIRD comments and has undertaken consultation with the representative bodies requested. Consultation with TO's will be triggered in event of spill. This is consistent with the approach applied to other stakeholders in the larger EMBA area. • Consultation with individual commercial operators has been undertaken. Charter operators were omitted from the original consultation in error and an additional mail-out to these operators will be undertaken.	Additional triggered consultation included in traditional owners in the event of a spill. **Trigger** – Oil spill event **Action** - Notification of DPIRD via environment@fish.wa.gov.au within 24 hours of incident report. Notification of traditional owners and all other stakeholders identified in Table 4 within 72 hours of event. Attempt to electronically notify all relevant persons listed in Stag EP Consultation plan within 72 hours of spill. Jadestone Energy will implement consultation with Charter operators.

Stakeholder	Stakeholder Concern, Objection or Claim	Jadestone Energy Assessment of merit	Jadestone Energy's Response
	Timeframes • Advice provided valid for duration of activity commencing within six months of the date this letter is signed. • Request to be advised of actual commencement date and any changes to this proposal a minimum of three months prior to the commencement of any activity. • Response to any updated advice provided at this time required.	Jadestone Energy considers these comments have merit and have incorporated these into the EP.	• Timeline for validity of advice noted. • Item included in implementation section of EP to ensure notification within three months of commencement.
	Pollution Emergency Plans • Request for notification of any oil spill or discharge of any other pollutant within 24 hours. • Request that when developing Oil Pollution Emergency Plan (OPEP) Jadestone Energy collects baseline marine data to compare against post spill monitoring. Baseline data should be made available to the Department. • Consideration of spawning grounds and nursery areas should be included in OPEP.	Jadestone Energy considers these comments have merit and have incorporated these into the EP.	• Item included in implementation section of EP to ensure notification within 24 hrs of spill or discharge. • Pollution emergency plans and spill contingency plans Baseline sampling was undertaken by Apache (Kinhill 1997, 1998) and as part a more contemporary work by Oceanica (2015). These reports can be made available to the DPIRD. • Fish spawning and nursery areas have been considered in the EP and in selection of spill response strategies: Fish spawning is described in the EP in identifies the Spawning Dates for Key Fish Species which are likely to spawn in the EMBA. **T**he EP identifies the spill response strategies that have been considered (and either adopted or rejected) and the environmental benefits, of which fish life cycles are a part of. Specific strategies for mitigation of risks to spawning grounds and nursery areas include: source control, operational monitoring, containment and recovery,

Stakeholder	Stakeholder Concern, Objection or Claim	Jadestone Energy Assessment of merit	Jadestone Energy's Response
			shoreline clean-up and scientific monitoring. **T**he EP identifies the rationale for the determination of Fish spawning and identifies the Spawning Dates for Key Fish Species which are likely to spawn in the EMBA. The EP identifies the spill response strategies that have Protection Priorities for Spill Response allowing for the varying types of contact that an oil spill can have on the marine environment: floating oil, entrained oil, dissolved oil. Entrained and dissolved oil can have an impact on fish spawning and nursery areas via direct contact, although duration and concentration of contact is highly variable and intermittent. '
	Biosecurity • Jadestone Energy must take reasonable measures to minimise the biosecurity risk. Two ways to demonstrate commitment: 1. Utilise the Departments Vessel Check tool and complete actions to manage any activity related to vessels to a low/acceptable risk rating. 2. Actively use a biofouling management plan and record book that meets requirements under International Organisation's Guidelines for the Control and Management of Ships' biofouling to minimise the Transfer of Invasive Aquatic Species. • Recommendation that residual risk after using above measures is managed. Recommended this could be achieved by follow-up marine pest inspection around 75 days after arrival if the vessel is still in WA waters.	Jadestone Energy considers these comments have merit and have incorporated these into the EP. The residual risk is considered low and follow-up inspections of vessels is not considered practical or required. The FSO is moored at the Stag Field and consequently ballast water is ordinarily taken up and discharged from the Stag location. It is unlikely that any invasive marine pests 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	ALARP assessment of biosecurity risk included, including management of residual risks. This includes a performance standard that all vessels sourced from outside WA must use the DPIRD Vessel check process and for this assessment to indicate low/acceptable risk rating. Vessels mobilised from international waters will have DAWR approval and Ballast Management Plans and Ballast Record Books. Item included in implementation section of EP to ensure notification within 24 hrs of biosecurity incident. **Trigger** - Biosecurity incident: suspected marine pest or disease

Stakeholder	Stakeholder Concern, Objection or Claim	Jadestone Energy Assessment of merit	Jadestone Energy's Response
	• Request that any suspected marine pest or disease be reported within 24 hours.	and shallow coastal areas which have historically been colonised by invasive marine pests.	**Action** - Notification of DPIRD via biosecurity@fish.wa.gov.au or 1800 815 507 within 24 hours.
Department of Mines and Petroleum (State) Stan Bowes 29 Nov 2016	Request notification when EP accepted by the regulator and Jadestone Energy is the operator of the asset.	*No objection, concern or claim.* *Request only:* Key State government agency.	Jadestone Energy notes the Department's request to be notified when EP accepted by NOPSEMA and action included in implementation section of EP to ensure this is done within three months of approval.
Australian Maritime Safety Authority (AMSA) Luke Pugsley (Senior Advisor Nautical and Hydrographic System Safety) 12 Dec 2016	Noted Stag Facilities long history in the area. Noted 3 nm cautionary zone and shipping fairway 5.7km to the South of the facility, which is predominantly support vessel traffic for the oil and gas industry.	*No objection, concern or claim.* *Request only:* AMSA is the key regulatory agency for the management of shipping and maritime safety in Australia.	Shipping traffic advice from AMSA is noted and referenced in the EP.
David Imhoff 22 Nov 2017	Arrangements need to be in place regarding access to national plan resources including chemical dispersants and the FWADC.	*No objection, concern or claim.* *Request only:* MOU needs to be in place to ensure access to logistical support	MOU in place with AMSA outlining access arrangements to national plan resources.
WAFIC Mannie Shae (Executive Officer) 1 Dec 2016	WAFIC accepts 500m restricted zone around the facility for safety reasons, with additional cautionary zone as charted where vessels should 'avoid navigating, anchoring or fishing' however are not excluded from the area.	*No objection, concern or claim.* *Request only:* Peak industry body for commercial fishing in Western Australia.	Jadestone Energy notes acceptance of restricted zone.
Australian Marine Oil Spill Centre (AMOSC) Phil Starkins (D/GM) 22 Nov 2016	AMOSC advised they are able to support the response requirements identified for the activity however membership will not be finalised until first board meeting of 2017. Noted requirement for Jadestone Energy to have a service arrangement with AMOSC as an interim measure.	*No objection, concern or claim.* *Request only:* AMOSC is a key and respected source of input in the EP in relation to response to unplanned events.	MSA agreement in place 1 July 2017.

Stakeholder	Stakeholder Concern, Objection or Claim	Jadestone Energy Assessment of merit	Jadestone Energy's Response
Phil Starkins (D/GM) 5 Dec 2016	AMOSC response to Jadestone Energy specific questions on capability assessment support as requested. Technical and editorial advice on OPEP including suggestions to improve implementation of OPEP, reference material and technical corrections.	*No objection, concern or claim.* *Response only* AMOSC is the key agency for the coordination of spill response and provides significant input for OPEP consideration. Jadestone Energy considers these comments and editorial corrections have merit.	Jadestone Energy has noted AMOSC response and incorporated advice where appropriate in developing the OPEP capability assessment support. Jadestone Energy incorporated all comments on OPEP from AMOSC.
Department of Transport Jade Herwig (cc Matt Verney and Emily Gifford) 29 June 2017	DoT noted separate IMT arrangements for cross jurisdiction spills.	DoT is a key regulatory agency and response agency in an unplanned event.	Jadestone Energy will continue to work with DoT regarding spill response arrangements, as outlined in the activity OPEP.
	Comments on OPEP and supporting documents provided 8 June 2017, including:	Jadestone Energy considers these comments and editorial corrections have merit and have incorporated them as outlined below:	A written response to comments was provided to DoT.
	There are a number of references throughout the OPEP and supporting documentation that appear to rely on Department of Transport (DoT) resources and decision making as part of the primary response capabilities. In accordance with the DoT Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (January 2017) (IGN), while DoT may opt to deploy members of the State Response Team, request deployment of members of the National Response Team and use DoT resources during a cross-jurisdictional spill event, it is an expectation that Jadestone Energy is suitably prepared independent of DoT resources. This includes Jadestone Energy providing an appropriate number of qualified persons and having sufficient contracts/arrangements in place for resourcing, as required for their given activity.	Jadestone Energy acknowledges the expectation that capability independent of DoT and AMSA is in place. Jadestone Energy has identified SRT and NRT resources as potential capability however the primary capability for personnel rests within arrangements held with AMOSC (core group and mutual aid) and labour hire providers.	MSA agreement in place with AMOSC 1 July 2017. Arrangements in place with various logistics companies as outlined in stakeholder log.
	There is insufficient clarification of the minimum number of personnel required to be provided by Jadestone Energy to the DoT Incident	The OPEP has been developed for a worst-case spill scenario of an instantaneous spill	Information updated.

Stakeholder	Stakeholder Concern, Objection or Claim	Jadestone Energy Assessment of merit	Jadestone Energy's Response
	Management Team (IMT) and Forward Operations Base in the event of a cross-jurisdictional spill event as outlined in the IGN. In addition, please show references as to the roles required to be filled, the number of personnel required and the time and locations that they are to be deployed to. It is not clear that Jadestone Energy have sufficient personnel, contracts and resources in place to deal with a spill event and to resource DoT's IMT and response.	of Stag Crude. Operationally, once the spill moves from Commonwealth waters into State Waters, the majority of the Jadestone Energy IMT will be working on response activities in conjunction with DoT meaning that a skeleton IMT for Commonwealth issues will only be required to be populated by Jadestone Energy. Forward Operating Bases will be managed by AMOSC on behalf of Jadestone Energy. AMOSC core group and mutual aid arrangements will be used to supplement Jadestone Energy IMT functions.	
	Ensure that Table 4-1 of the Oil Spill Response Arrangements document (OSRA) correctly aligns with Western Australian State Hazard Plan for Marine Oil Pollution: WestPlan – Marine Oil Pollution regarding the responsible Jurisdictional Authorities and Controlling Agencies.	Comment of merit	Correction made.
	Include some diagrams to illustrate the Control and Coordination structure and IMT structure for a cross-jurisdictional spill event. DoT is happy to meet with Jadestone Energy to discuss IMT arrangements and ensure there is clarity around cross jurisdictional arrangements.	Comment of merit	Updated diagrams included.
	Will assessment of dispersant use applicable to the location and conditions at the time of a spill be undertaken prior to initial dispersant application? Or is it just assumed that chemical dispersant will be used as a response in all relevant scenarios and then a NEBA will be done after application to determine whether continuing with this option is viable?	A NEBA is conducted before the application of dispersant as part of the IAP process.	No update to document required.
	If dispersant is to be used in Commonwealth waters, but is likely to enter State waters, DoT request to be notified prior to dispersant application.	DoT is listed on the notification list in the OSRA document and will be kept appraised through SITREPS.	No update to document required.

Stakeholder	Stakeholder Concern, Objection or Claim	Jadestone Energy Assessment of merit	Jadestone Energy's Response
	There is very little detail in the way of communication equipment available for use or what communication equipment can be sourced in the event of a spill.	Comment of merit and clarification provided.	Communication support for radios, mobile phones, satellite phones, computers and tablets will be provided by existing arrangements with Telstra and if required additional service providers at the time. Additional support for communications equipment and operators can be accessed through groups such as the Pilbara District Emergency Management Committee.
	Is there an Incident Management System in place to help with the document and records part of managing an incident? For example, a way to manage standardised notification and reporting procedures, tracking and logging of communications, decision making, record keeping etc?	Jadestone Energy uses systems in accordance with the incident management plan.	No change required
	There are a number of references in the OPEP back to the OSRA, particularly in the initial response part of the document. Jadestone Energy is reviewing structure and ergonomics of the OPEP and OSRA documents to ensure ease of use. However, it is not clear which sections of the OSR they are referring to which would make it time consuming and possibly confusing in a spill event. Consider cross-referencing specific sections for both documents to make it easy to use in a spill event.	Comment of merit.	Jadestone Energy is reviewing structure and ergonomics of the OPEP and OSRA documents to ensure ease of use.
	The OSR states that the Stag Field Environment Plan Permit WA-15-L – Framework for Scientific Monitoring Plan is attached; however, this appears to be missing from the document. Does this document detail the termination criteria for ongoing scientific monitoring?	This was an omission and has now been corrected.	Determining end points for scientific monitoring is addressed in this document.
	Are there any media plans in place in the event of a spill incident?	Media arrangements for all emergencies sit within the Jadestone Energy Incident Management Response Plan document	No change required
	There is very little detail regarding any insurance measures in place to deal with cost recovery in a spill event.	Jadestone Energy's insurance for oil spill response activities is aligned with the	No change required.

Stakeholder	Stakeholder Concern, Objection or Claim	Jadestone Energy Assessment of merit	Jadestone Energy's Response
		financial assessment method developed by APPEA. NOPSEMA considers the method developed by APPEA to be generally suitable for determining the level of financial assurance for most circumstances in Australia's offshore areas. The APPEA method considers reasonably estimable costs, expenses and liabilities associated with responding to an incident, cleaning up and monitoring.	

5. EVALUATION OF ENVIRONMENTAL IMPACTS AND RISKS

5.1 Methodology

The environmental impacts and risks associated with operational activities of Stag Field operations have been assessed using the Jadestone Energy Risk Management Framework and methods consistent with HB 203:2012 and AS/NZS ISO 31000:2009.

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.

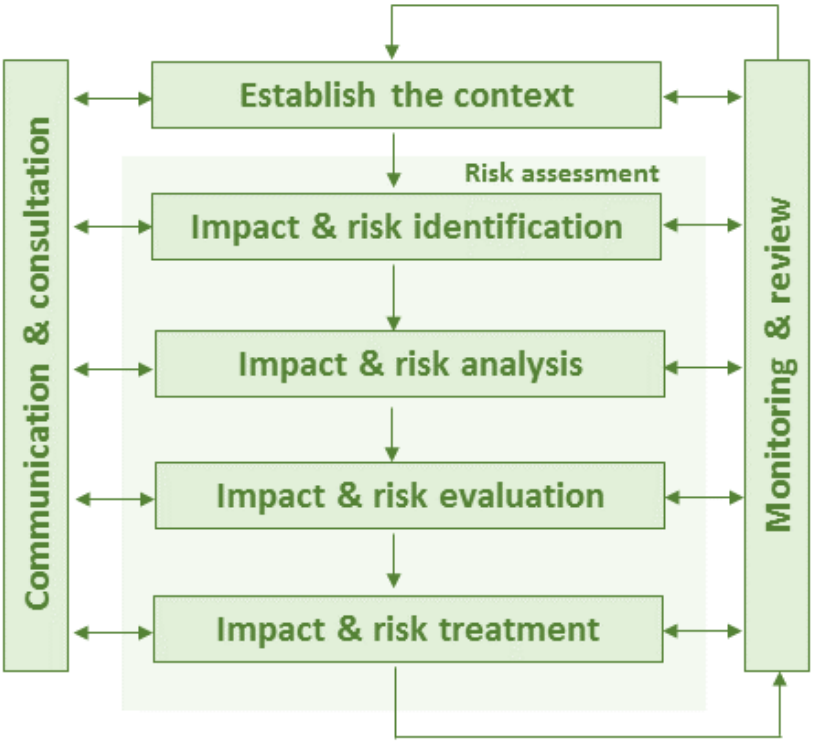

Image source: NOPSEMA (N4700-GN1074 Rev 1 2013)

Figure 5-1: Impact and Risk Evaluation Process

5.2 Risk Ranking Process

5.2.1 Risk Matrix

Impacts and risks are ranked using the Jadestone Energy Qualitative Risk Matrix (Table 5-1). Environmental ranking of a measure between Low to Extreme is determined by combining the expected severity of the impact (consequence level) with the likelihood of the impact occurring after implementation of control measures. In the case of planned events or impacts, the likelihood level is not considered as the event is intended to occur, and so a consequence level is assigned to determine the nature and scale of the impact.

Table 5-1: Jadestone Energy 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 events are assigned on the basis of the expected extent of area that will or may be affected, the duration of effect and the severity of the effect. A consequence level of Negligible to Critical may be assigned (Table 5-2).

Table 5-2: Definition of Consequence Levels

Consequence	
5. Critical	Massive effect; recovery in decades; ecosystem collapse
4. Major	Major effect; recovery in 1 to 2 years; impact to population
3. Moderate	Local effect; recovery in months to a year; impact to localised community
2. Minor	Minor effect; recovery in weeks to months; death of individuals
1. Negligible	Slight effect; recovery in days to weeks; injury to organism

Likelihood levels for accidental or unplanned events are assigned on the basis of preceding performance in relation to the 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 5-3). A likelihood level is not assigned to planned events.

Table 5-3: 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 (ALARP and acceptable. The processes for determining if risks and impacts have been reduced to ALARP and acceptable levels are described below.

5.2.2 Demonstration of ALARP

Regulation 10A(b) of the Environment Regulations requires a demonstration that environmental impacts and risks are reduced to ALARP.

The ALARP principle states that it must be possible to demonstrate that the cost involved in reducing the impact or risk further would be grossly disproportionate to the benefit gained. The ALARP principal arises from the fact that infinite time, effort and money could be spent attempting to reduce a risk or impact 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. Impacts and risks are reduced to ALARP where:

- The residual rank is LOW:
  - Good industry practice or comparable standards have been applied to control the impact or risk, because any further effort towards reduction is not reasonably practicable without sacrifices grossly disproportionate to the benefit gained.
- The residual rank is MEDIUM or HIGH:
  - Good industry practice is applied for the situation/ impact/ risk; or
  - Alternatives have been identified and the control measures selected to reduce the impacts and risks to ALARP. This may require assessment of Company and industry benchmarking, review of local and international codes and standards, consultation with stakeholders, etc.
- The residual rank is EXTREME:
  - The impact/ risk is unacceptable and the activity cannot continue as described. Further control measures must be applied such that acceptable impact/ risk is demonstrated and the residual risk is reduced. Final business sign off is required affirming the acceptability of the revised residual risk prior to proceeding.

The process of evaluating the reduction of impacts and risks to ALARP is illustrated in Figure 5-2.

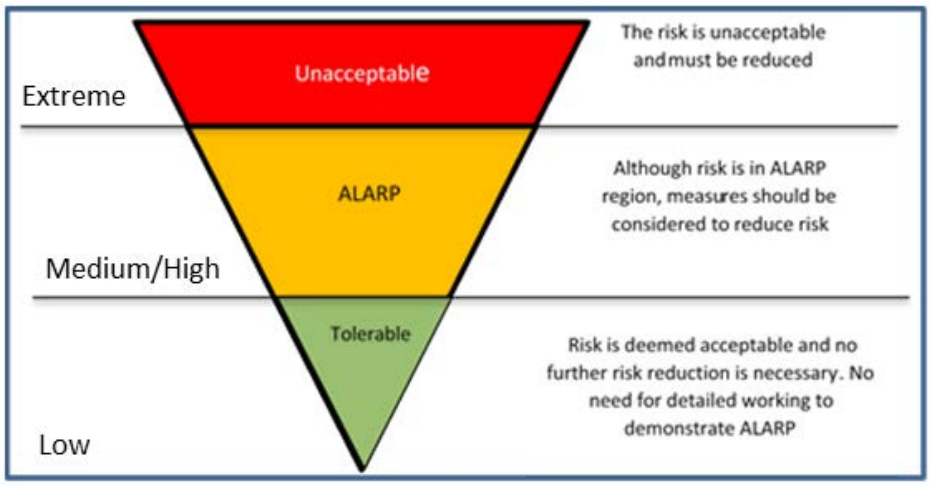

Figure 5-2: ALARP Triangle

5.2.3 Demonstration of Acceptability

Regulation 10A(c) of the Environment Regulations require a demonstration that environmental impacts and risks are of an acceptable level.

Environmental impacts and risks cover a wider range of issues, multiple species, persistence, reversibility, resilience, cumulative effects and variability in severity. The degree of environmental impact/ risk and the corresponding threshold for acceptability has been adapted to include principles of ecological sustainability (given as an objective in the Environment Regulations and defined in the EPBC Act), the Precautionary Principle and the corresponding environmental threshold decision-making principles used to determine acceptability.

The following process has been applied to demonstrate acceptability in the reduction of impacts and risks:

- LOW residual impacts and risks are Tolerable, if they meet legislative requirements, industry codes and standards, regulator expectations, the Jadestone Energy Environmental Policy and industry guidelines;
- MEDIUM/ HIGH residual impacts and risks are Broadly Acceptable if ALARP can be demonstrated using good industry practice, risk based analysis, if societal concerns are accounted for and the alternative control measures are disproportionate to the benefit gained; and
- EXTREME residual impacts and risks are Intolerable and therefore Unacceptable. Impacts and risks will require further investigation and mitigation to reduce them to a lower and more acceptable level. If after further investigation the impact or risk remains in the severe category, the risk requires appropriate business sign-off to accept the impact or risk.

The process for evaluating the reduction of impacts and risks to an acceptable level is detailed in Table 5-4.

Table 5-4: Acceptability Assessment Criteria

Criteria	Question	Acceptability demonstrated
Policy compliance	Is the proposed management of the impact or risk aligned with the Jadestone Energy Environmental Policy?	The impact or risk must be compliant with the objectives of the company policies.
Management System compliance	Is the proposed management of the impact or risk aligned with the Jadestone Energy Management System?	Where specific Jadestone Energy procedures and work instructions are in place for management of the impact or risk in question, acceptability is demonstrated.
Social acceptability	Have stakeholders raised any concerns about activity impacts or risks, and if so, are measures in place to manage those concerns?	Stakeholder concerns must have been adequately addressed and closed out.
Laws and standards	Is the impact or risk being managed in accordance with existing Australian or international laws or standards, such as EPBC Policy Statements, MARPOL, AMSA Marine Orders, Marine Notices etc.?	Compliance with specific laws or standards is demonstrated.
Industry best practice	Is the impact or risk being managed in line with industry best practice, such as APPEA Code of Environmental Practice, IAGC guidelines etc.?	Management of the impact or risk complies with relevant industry best practice.
Environmental context	Is the impact or risk being managed pursuant to the nature of the receiving environment (e.g. sensitive or unique environmental features generally require more management measures to protect them than environments widely represented in a region)?	The proposed impact or risk controls, EPO and EPS must be consistent with the nature of the receiving environment.
ALARP	Are there any further reasonable and practicable controls that can be implemented to further reduce the impact or risk?	There is a consensus that residual risk has been demonstrated to be ALARP.

5.3 Impact and Risk Assessment for Hydrocarbon Spills Response

5.3.1 Approach

The impact and risk assessment approach for the worst-case hydrocarbon spill response follows the 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:

1. Determine threshold concentrations to be used in oil spill modelling;
2. Determine the EMBA;
3. Identify sensitive receptors;
4. Determine Protection Priorities; and
5. ALARP and Acceptability evaluation for spill response.

5.3.2 ALARP and Acceptability Evaluation

Jadestone Energy 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 Protection Priorities, and, to ensure that effective control measures exist to mitigate environmental risks and impacts to a level that is ALARP.

6. ENVIRONMENTAL HAZARDS AND CONTROLS

6.1 Risk Evaluation Summary

The assessment process undertaken by Jadestone Energy in November 2016 for operational activities at the Stag Field identified nine planned hazards and seven unplanned hazards and their associated environmental impacts and risks that will or may occur during operation of the Stag Field.

Table 6-1: Summary of Environmental Impact and Risk Assessment Rankings

Hazard	Pre-treatment Ranking	Residual Ranking
Planned events		
1. Light	1	1
2. Noise	1	1
3. Atmospheric emissions	1	1
4. Discharge of produced water	2	1
5. Discharge of liquid wastes	2	1
6. Interaction with other users	1	1
7. Interaction with fauna	2	1
8. Physical footprint	1	1
9. Spill response activities	5	3
Unplanned events		
1. Marine pest introduction	M	L
2. Non-hazardous and hazardous solid waste	M	M
3. Non-hydrocarbon liquid hazardous materials	M	L
4. Unplanned release of hydrocarbons (Stag crude oil, diesel)	M	L
5. Dropped Objects	L	L

6.2 Environmental Impacts, Risks and Control Measures

A summary of environmental impacts and risks and their control measures for planned (Table 6-1) and unplanned (Table 6-2) events are provided below.

6.2.1 Planned Events

Table 6-2: Summary of Environmental Impacts, Risks and Controls for Planned Events

Event	Potential Impacts	Consequence	Management Controls	Effectiveness of Controls
1. Light emissions	Light is emitted from the central platform facility, the FSO, support vessels, and flaring. Continuous lighting for extended periods may create a disruption in natural behavioural patterns and cycles in marine fauna.	Negligible	Lighting will be maintained to meet safety, navigational and operational requirements.	Emissions of light from the facility are managed to levels as low as reasonably practicable to minimise light impacts to marine fauna
2. Noise emissions	Noise is generated by vessels (including the FSO and support vessels), helicopters and equipment such as generators and pumps. Noise emissions may result in physiological or behavioural impacts to marine fauna.	Negligible	Support vessels and helicopters comply with relevant parts of Part 8 of EPBC Regulations. Planned maintenance, routine inspections and surveys of machinery and equipment.	Noise emissions from the facility are managed to levels as low as reasonably practicable to reduce impacts to marine fauna.
3. Atmospheric emissions	Atmospheric gases are emitted from engine exhausts, production gas and flaring, venting and fugitive emissions and from power generation and process heating. Atmospheric emissions will reduce air quality in the immediate vicinity of the facility.	Negligible	Continuous metering of flare emissions. International air pollution prevention certificates and planned maintenance.	No unplanned emissions to the atmosphere
4. Produced water discharge	Water produced during the recovery of hydrocarbon from the reservoir and during the oil/ water separation process, is discharged to the marine environment. Produced water from the Stag field contains a mixture of dissolved hydrocarbons and suspended oil droplets, naturally occurring radioactive materials (NORMs), dissolved inorganic salts, dissolved metals, dissolved gases as well as low residual concentrations of a small	Negligible	Monitoring of the discharge volume, oil in water concentration, and discharged oil loads, of produced water with planned contingency and adaptive control measures to manage excursions from planned operations / performance. Holding times on the FSO prior to commencement of discharge Characterisation of contaminants, Whole Effluent Toxicity (WET) testing and microtox	PFW discharges from the facility are managed to levels as low as reasonably practicable. No persistent environmental impacts will occur due to the discharge of produced water.

Event	Potential Impacts	Consequence	Management Controls	Effectiveness of Controls
	number of chemical additives that are introduced during the production process such as corrosion and scale inhibitors, and biocides. A continuous produced water stream is discharged overboard at the CPF at an average rate of approximately 3,816 kL per day. Produced water is also occasionally discharged from the FSO. Produced water discharges are intermittent and short term (over a matter of hours), with volume of discharge to be maximum 66 kL per day. Numerical modelling of the produced water discharge stream predicts water quality impacts may occur within an area of up to 70m from the facility discharge point (or up to 20m from the FSO discharge point), within the top metre of the water column. There is the possibility that fine particles (smaller than a sand grain) within the discharge stream may fall to the sediments 50m below sea surface and any contaminants associated with these particles will become incorporated into the local sediments. The area over which sediments may be affected by this process is up to 250m from the facility and FSO discharge points. The discharge footprint of the produced water overlaps with the BIAs for the humpback whale, blue pygmy whale, wedge tailed shearwater and flatback turtle.		testing, verification study of numerical modelling Calibration of monitoring equipment and third party quality control checks. Chemical Selection Evaluation and Approval Procedure Measurement of chemicals in water samples from production equipment Management of change procedure	

Event	Potential Impacts	Consequence	Management Controls	Effectiveness of Controls
5. Discharge of liquid wastes	A localised reduction in water quality, including a temporary increase in nutrient concentrations, temperature and salinity will be associated with the discharge of liquid wastes including sewage, deck drainage and bilge water, cooling water and desalination brine.	Negligible	International pollution prevention certificates MARPOL requirements Planned maintenance of systems and equipment	Liquid discharges from the facility are managed to levels as low as reasonably practicable. No unplanned discharges of liquid wastes
6. Interaction with other users	The presence of the 500 m radius Restricted Zone (the Operational Area) and 3 nm Cautionary Zone creates a localised disturbance for other users of the area including commercial and recreational fishers, and shipping traffic.	Negligible	Navigational aids and communication Consultation of relevant persons maintained during the activity	Recreational and commercial fishers and shipping traffic are aware of the facility and activities to minimise any potential disturbance/ impacts to them.
7. Interaction with fauna	The physical presence of infrastructure and the movement of vessels and helicopters may result in physical and behavioural impacts to marine fauna. The Operational Area overlaps the humpback whale 'species core range', is adjacent to the whale shark BIA and overlaps the flatback turtle internesting BIA.	Negligible	Vessels operating within the restricted zone must not exceed a speed of five (5) knots. Online inductions Incident reporting procedure	As vessels will travel at <5 knots risk to megafaua is considered low and acceptable; with minimal vessel activity in the area, the risk of mortality from a low-speed vessel strike is low.
8. Physical footprint	Disturbance to marine habitats and the seabed may occur in the event subsea infrastructure needs to be modified or repaired. The presence of infrastructure may result in localised physical damage to, or loss of, soft sediment benthic habitats and associated biota. In addition, infrastructure provides an artificial habitat for benthic and pelagic organisms.	Negligible	Visual seabed survey using ROV/ AUV prior to commencement of integrity, maintenance, repair works No well fluids are recovered to surface during well workover or intervention activities	Disturbance will be localised to immediately under or near to the footprint of Stag Facility subsea infrastructure within the Operational Area.

Event	Potential Impacts	Consequence	Management Controls	Effectiveness of Controls
	The Operational Area overlaps the flatback turtle internesting area.			
9. Spill response activities	There is the potential for spill response activities to exacerbate or create additional environmental impacts. Impacts to the environment from implementing source control, monitoring and evaluation, oiled wildlife response and scientific monitoring include those operational impacts from vessels and aircraft. In addition, implementing oiled wildlife response may cause additional distress, habitat disturbance, physical and behavioural impacts, separation and increased predation to wildlife if not undertaken correctly.	Moderate	Oil pollution emergency plan include: Light spill onto shorelines and coastal waters is reduced to ALARP during spill response Noise emissions reduced to ALARP during spill response Spill response vessel emissions meet MARPOL requirements Impacts from spill response operational discharges are reduced to ALARP Prevention of secondary contamination of oily waste and litter during spill response Disturbance to habitats, fauna and culturally sensitive areas during spill response is reduced to ALARP Additional impacts from dispersant application are reduced to ALARP Reduce disruption to other users of marine and coastal areas and townships during spill response is reduced to ALARP	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

6.2.2 Unplanned Events

Table 6-3: Summary of Environmental Impacts, Risks and Controls for Unplanned Events

Event	Potential Impacts	Risk	Management Controls	Effectiveness of Controls
1. Introduction of marine pests	The introduction and establishment of marine pests can result in a localised impact on native marine fauna and flora.	Low	DAWR/ WA DPIRD approvals including: Vessel Contractors are required to conduct an IMS risk assessment for support vessel(s) that have been sourced from outside Western Australia. Where applicable, the Contractor will use the WA Department of Fisheries 'Vessel Check' process. All vessels from international waters have a valid DAWR certificate In accordance with marine pest management guidelines (as enforced under the WA Fish Resources Management Act 1994; and Fish Resources Management Regulations 1995): • Vessels must be clean before entering WA waters; and • Any suspected or confirmed marine pests are reported to DPIRD. Prior to arrival in Australia Ballast management plan All ballast transfers and exchanges made during the voyage need to be recorded.	Reduce risk of introduced marine species from vessels and equipment used in water.
2. Release of solid wastes	Non-hydrocarbon solids such as plastics have the potential to smother benthic environments and harm marine fauna through entanglement or ingestion. Release of hazardous solids (e.g. wastes) may result in the pollution of the immediate receiving environment.	Medium	Facility waste management procedures including; Waste Management Plan which directs: • All food waste is disposed of ashore • 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. • Produced Sands will be double-bagged (bulki bags).	Reduce the risk of release of solid waste to the marine environment to minimise any potential disturbance/impacts from them.

Event	Potential Impacts	Risk	Management Controls	Effectiveness of Controls
			• 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 Regulations (controlled waste) • FSO: Garbage Management Guidelines when Stationed at Stag Oilfield Competency and training system	
3. Release of liquid wastes	An accidental release of non-hydrocarbon liquids to the marine environment may occur due to the transfer and use of liquids during operating activities. 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.	Low	Dropped object prevention procedures Bulk liquid transfer procedures Hazardous substances and dangerous goods standards Chemical selection procedure Vessel SOPEP	Minimises drop object risk during lifting operations that may cause secondary spill (discharges) resulting in reduction in water quality Reduces risk of accidental discharge to sea Reduces the risk of spills and leaks (discharges) to the sea by controlling the storage, handling and clean up.
4. Hydrocarbon spill	Accidental loss of fuel and other hydrocarbons (used or stored onboard the Stag facility and support vessels) to the marine environment may result in a reduction of water quality and potential impacts to local marine fauna and flora including; chemical (e.g. toxic) and physical (e.g. coating of emergent	Low	Diesel Fuel Bunkering Procedure Crude oil import procedures Competency and training system Subsea inspection procedure Stag Facility Operating procedure SOPEP	Management controls implemented to reduce the risk of accidental hydrocarbon spill to the marine environment. OPEP environmental benefit see section 8.

Event	Potential Impacts	Risk	Management Controls	Effectiveness of Controls
	habitats, oiling of wildlife at sea surface and ingestion). The environmental consequences of a hydrocarbon spill are highly variable, dependant on the characteristics of the hydrocarbon released, the dynamics of the receiving environment and the proximity of the release point to sensitive environmental receptors.		OPEP Facility Safety Cases	Vessels have and implement a Shipboard Oil Pollution Emergency Plan (SOPEP), or Shipboard Marine Pollution Emergency Plan (SMPEP), pursuant to MARPOL Annex I to ensure Jadestone Energy is prepared.
5. Dropped objects	Damage or loss to marine habitats may occur due to objects dropped from the CPF, FSO and support vessels. The Operational Area is within a habitat critical to survival for flatback turtles	Low	Competent personnel Lifting Operations Procedure Facility Safety Cases	Management controls implemented to reduce the risk of dropped objects to the marine environment, and thereby damage to the benthos.

7. HYDROCARBON SPILL RESPONSE ARRANGEMENTS

7.1 Credible Worst Case Hydrocarbon Spill

The credible worst case hydrocarbon spill scenarios for the Stag Field identified in Table 7-1.

Table 7-1: Credible Worst Case Oil Spill Scenarios for the Stag Field

Hydrocarbon	Release point	Credible Worst Case
Diesel	At surface	Short term (5 hours) with total release = 350 m^3
Stag crude oil	At surface	Short-term release (5 hours) with total release volume = 7,253 m^3
	Subsea	Short-term release (12 hours) with total release volume = 546 m^3

7.2 Net Environmental Benefit Analysis

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.

7.3 Evaluation of Spill Response Strategies

The evaluation of the suitable response strategies was conducted based on the credible spill scenarios. Key considerations evaluated were:

- 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.

Spill response strategies considered for the mitigation of hydrocarbon, including summary of benefits and decision to adopt or reject are outlined in Table 7-2.

Table 7-2: Spill Response Strategies Considered for the Mitigation of Hydrocarbon Spills

Strategy	Description	Environmental Benefits	Decision
Source control	Implementation of the FSO SOPEP	Reduce the volume of oil entering the marine environment	**Adopt**
	Implementation of Emergency Pipeline Repair Plan	Cease loss of containment event as soon as practicable.	**Adopt**

Strategy	Description	Environmental Benefits	Decision
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.	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. 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.	**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.	Surface chemical dispersant may be viable, either by vessel or plane. 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). 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). The OSTM output comparing dispersant and non-dispersant models indicated oil loading at the closest onshore receptors, may be reduced through the surface application of chemical dispersants particularly in the summer months, however, does show a localised increase in entrained oil (refer Section 7.9.2). 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 Energy 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. 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.	**Adopt**
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**

Strategy	Description	Environmental Benefits	Decision
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 Montebellos) this strategy is considered important to the overall spill response.	**Adopt**
Protection and deflection	Protection and deflection activities involve the use of booms to: 1. Protect sensitive receptors; 2. Deflect spills away from sensitive receptors or shorelines; or 3. 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 beneficial to the environment based on the NEBA performed on the affected areas based on actual site conditions.	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 reconnaissance, shoreline assessments and NEBA in the shoreline clean-up assessment.	**Adopt**
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.	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. Options for wildlife management are considered and a strategy determined guided by the Western Australian Oiled Wildlife Response Plan (WAOWRP).	**Adopt**
In-situ burning	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. When conditions are favourable and conducted properly, in situ burning will reduce the amount of oil on the water.	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. Due to operational constraints and the expected hydrocarbon not being suitable for in-situ burning, this response strategy is deemed inapplicable for Stag Operations.	**Reject**
Scientific Monitoring	This is the main tool for determining the extent, severity and persistence of environmental impacts from an oil spill	Scientific monitoring is especially beneficial for monitoring entrained and dissolved oil impacts as	**Adopt**

Strategy	Description	Environmental Benefits	Decision
	and allows operators to determine whether their environmental protection outcomes have been met (via scientific monitoring activities). This strategy also evaluates the recovery from the spill.	response strategies are generally targeted to manage the surface oil impacts.	

7.4 Oil Spill Response Arrangements and Capability

Jadestone Energy has adequate arrangements and capability in place to implement the oil spill control measures proposed to manage a significant oil pollution emergency in a timely manner. In the event of a spill, initial actions will be undertaken by the OIM/Vessel Master in line with the vessel's Shipboard Oil Pollution Emergency Plan (SOPEP) and/or Stage Incident Response Plan. Should the spill require further action, the IMT in Jadestone Energy (Perth) will mobilise, in accordance with the Oil Pollution Emergency Plan (OPEP).

Oil spill response equipment and resources are a combination of Jadestone Energy, AMOSC, AMSA, DoT, National Plan (NatPlan), and other operator resources available through the AMOSPlan mutual aid arrangements. Under the MOU between AMSA and Jadestone Energy, AMSA will provide all resources available through NatPlan to support a Jadestone Energy spill response. The DoT coordinates the State Response Team (SRT) oil spill response personnel and equipment resources. The DoT will work with Jadestone Energy in an oil spill response and will lead the response where the spill is within State waters. Where oil contacts shorelines managed by the Commonwealth government, Jadestone Energy will work with the Department of the Environment to establish shoreline clean-up priorities, activities and termination criteria.

In the event of an oiled wildlife response, Jadestone Energy will activate the West Australian Oiled Wildlife Response Plan (WAOWRP) and work with Department of Biodiversity, Conservation and Attractions (DBCA) in determining resources and capability requirements. DBCA and Industry (AMOSC) Oiled Wildlife Advisors (OWAs) ensure minimum standards for oiled wildlife response, as outlined within the WAOWRP, are met and ensure timely mobilisation of appropriate resources (equipment and personnel) through communication with the wildlife logistics team. Jadestone Energy has access to:

- AMOSC core group responders;
- DBCA staff and approved volunteers/SMEs;
- Additional local resources under current contracts and suppliers; and

During and post-spill scientific response monitoring activities require resources external to Jadestone Energy and include specialist technical capabilities. Jadestone Energy has contracts in place for obtaining primary control support agency for scientific response monitoring activities. If additional support is required, the primary contractor has MOUs with other service providers to support scientific response monitoring activities.

Response planning and preparedness undertaken in accordance with:

- NatPlan (AMSA, 2014)
- AMOSCPlan (AMOSC, 2014)
- WestPlan MOP (2010)

A summary of the management controls and performance standards in place to maintain preparedness to implement response arrangements in the event of an oil pollution emergency is provided in Table 7-3.

Table 7-3: Spill Response Preparedness

Management Control	Performance Standards
Contracts valid and maintained in accordance with Jadestone Energy Contractor Management Framework to ensure access to competent personnel and appropriate equipment to support spill response	Contracts for the supply of personnel and materials meeting the minimum requirements of spill response planning in place and current with competent service providers and suppliers
AMOSC Master Services Contract (MSC) and AMSA Memorandum of Understanding (MOU) maintained and 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)
Response personnel competent and trained in accordance with Jadestone Energy Training and Competency Management System and OPEP	Assessment of proposed / rostered response personnel as being competent and trained according to the requirements of response roles
Jadestone Energy Audit Manual includes emergency response and spill preparedness	Scheduled audit of Jadestone Energy's emergency response and spill preparedness
Spill response exercise and training completed in accordance with Jadestone Energy Incident Management Team Response Plan to maintain spill preparedness	Training and exercising current and completed as required by the Incident Management Team Response Plan
OPEP risk register 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
Teekay Shipboard Oil Pollution Emergency Plan valid and tested to ensure ability to respond to spills	In line with MARPOL Annex 1, support 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
	FSO spill exercises are conducted monthly
Oil Spill Response Arrangements maintained to ensure ability to respond to spills	Provides current information for Jadestone Energy spill response resources and matches risk
Personnel aware of roles and responsibilities in the event of a response in accordance with Stag Incident Response Plan	Instructs offshore response roles and responsibilities and training requirements.
Quadrant Energy MOU for support for emergency and oil spill response for life of the EP	Quadrant Energy MOU allowing access to personnel and resources for emergency and oil spill response via an MOU for life of the EP

8. MANAGEMENT APPROACH

8.1 Overview

The Stag Field will be managed in compliance with all measures and controls detailed within the EP accepted by NOPSEMA under the OPGGS (E) Regulations, other relevant environmental legislation and Jadestone Energy's Business Management System.

The objective of the EP is to ensure that potential adverse environmental impacts associated with unplanned events and planned events associated with the survey, are identified and assessed, and to stipulate mitigation measures to avoid and/or reduce any adverse impacts to the environment to ALARP.

The EP details specific performance outcomes, standards and procedures, and identifies the range of controls to be implemented (consistent with the standards) to achieve the performance outcomes. The controls for the activities are summarised in Sections 6 and 7. The EP also identifies the specific measurement criteria and records to be kept, to demonstrate the achievement of each performance outcomes.

8.2 Implementation Strategy

To meet the requirements of Regulation 14(1) of the OPGGS (E) Regulations the implementation strategy includes the following:

- Details on the systems, practices and procedures to be implemented;
- Key roles and responsibilities;
- Training, competencies and ongoing awareness;
- Monitoring, auditing, management of non-conformance and review;
- Incident response including Oil Pollution Emergency Plan;
- Reporting and Record keeping; and
- Stakeholder consultation.

8.2.1 Environmental Performance Monitoring

As required under subregulation 14(6), Jadestone provides 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.

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.

Quantitative records are maintained for 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.

Audits are Jadestone Energy's primary tool for:

- Determining whether management systems are suitable, available where required, implemented and effective in accomplishing the documented policies and objectives of the organisation;
- Verifying conformance with legal and contractual requirements;
- Obtaining and maintaining confidence in the capability of suppliers; and
- Contributing to the improvement of the Business Management System (BMS).

8.2.2 Management of Change

Jadestone Energy's Change Management Procedure (MoC) provides the means for identifying, tracking, responding, progressing and closing out any change requests or queries raised by any party involved in Jadestone Energy operations. In particular, the MoC procedure provides for Regulation 17 of the Offshore Petroleum Greenhouse Gas Storage (Environment) Regulations 2009, i.e. revision because of a change, or proposed change, of circumstances or operations. This includes consideration of new activities, changes to existing activities, or and new or increased environment impact and risk. The 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.

8.2.3 Management of Non-conformance

Non-conformances from audits, inspections, regular monitoring or response testing are communicated immediately to the OIM and tracked and monitored by the General Manager until closed.

The findings, opportunities for improvement and corrective actions from audits are formally documented in the inspection or audit report which is distributed to responsible roles and are entered into Jadestone Energy's online Hazard and Incident reporting program (Bassnet).

8.2.4 Roles, responsibilities, training and competency

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 Field, is provided in the EP as well as detail on what measures are in place to ensure personnel are aware of their role requirements and how Jadestone Energy evaluates their competency and training needs in these roles.

8.3 Incident Notification and Reporting

Incident notification and reporting to NOPSEMA and other regulators will be conducted as per Regulations 26, 26A, 26AA and 26B.

8.4 Annual Performance Review

The annual performance review process contributes directly to the annual performance reporting activity of the EP including the implementation strategy. 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.

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.

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