BHP

Crosby-3H1 Light Well Intervention Environment Plan

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REVISION RECORD					
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Environment Plan Summary

This Environment Plan (EP) Summary has been prepared from material provided in this EP. This summarises the items as required by Regulation 11(4) of the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009.

EP Summary Material Requirement	Relevant Section of EP
Details of the titleholder's nominated liaison person for the activity	Section 1.6
The location of the activity	Section 3.2
A description of the activity	Section 3
A description of the receiving environment	Section 4
Consultation already undertaken and plans for ongoing consultation	Section 5
Details of the environmental impacts and risks	Section 7 Section 8 Section 9
The control measures for the activity	Section 7 Section 8 Section 9
The arrangements for ongoing monitoring of the titleholder's environmental performance	Section 10
Response arrangements in the oil pollution emergency plan	Section 9 and Appendix G

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Acronyms and Glossary

Term	Description
"	inch
µ	Micron
AMFA	Australian Fisheries Management Authority
AHO	Australian Hydrographic Office
AHS	Australian Hydrographic Service
AIS	Automatic identification system
ALARP	As low as reasonably practicable
AMOSC	Australian Maritime Oil Spill Centre
AMSA	Australian Maritime Safety Associations
ANZECC	Australian & New Zealand Environment and Conservation Council
APPEA	Australian Petroleum Production and Exploration Association
APU	Australian Production Unit
AS	Australian Standard
ASBTIA	Australian Southern Bluefin Tuna Industry Association
AUV	Autonomous underwater vehicle
bbl/day	Barrels per day
bpm	Barrel per minute
BACI	Before-After-Control-Impact
BHP	BHP Petroleum Pty Ltd
BIA	Biologically important area
BOP	Blowout preventer
BTEX	Benzene, Toluene, Ethyl benzene, Xylene
CAMBA	Agreement between the Government of Australia and the Government of the People's Republic of China for the protection of Migratory Birds and their Environment. (China Australia Migratory Birds Agreement)
CBTA	Competency based training and assessment
CEM	Crisis and emergency management
CHARM	Chemical hazard and risk management
CRG	Community Reference Group
Cwlth	Commonwealth
CWTS	Controlled waste tracking system
DAWE	Department of Agriculture, Water and the Environment
DBCA	Department of Biodiversity, Attractions and Conservation
DFES	Department of Fire and Emergency Services
DIIS	Department of Industry Innovation and Science
DMIRS	Department of Mines, Industry Regulation and Safety (formerly the Department of Mines and Petroleum [DMP])
DMP	WA Department of Mines and Petroleum
DNP	Director of National Parks
DoEE	Department of Environment and Energy
DoT	Department of Transport
DP	Dynamic positioning
DPIRD	WA Department of Primary Industries and Regional Development
EAG	Executive Advisory Group
ECC	Emergency and Crisis Centre
EES	Exclusive economic zone
EFL	Electrical flying lead
EMBA	Environment that may be affected
EMT	Emergency Management Team
ENVID	Environment Impact (and risk) Identification
EP	Environment Plan, prepared in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPG	Environment Protection Group
EPO	Environmental Performance Outcome
EPS	Environmental Performance Standard
ERP	Emergency Response Plan
ESD	Ecologically Sustainable Development
FPSO	Floating storage and offloading (facility)
FR	Flush return
FRT	Field Response Team
GHG	Greenhouse gas
GIH	Grease injection head
HBJ	Hydraulic bridging jumper
HFL	Hydraulic flying lead
HMA	Hazard Management Agency
IAP	Incident Action Plan
IAPP	International air pollution prevention
IBC	International bulk carriers
ICS	Incident Command Structure
IEG	Industry Guidance Note
IMO	International Maritime Organisation
IMS	Introduced marine species
IMT	Incident Management Team
IOPP	International oil pollution prevention
ISPP	International sewage prevention pollution
ITC	Internal tree cap
ITOPF	International Tank Owners Federation

JAMBA	Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment. (Japan Australia Migratory Birds Agreement)
JRCC	AMSA's Joint Rescue Coordination Centre
KEF	Key ecological feature
km	kilometre
L	Litre
LPG	Liquid petroleum gas
LSID	Lower subsea intervention device
LWI	Light well intervention
m	Metre
mm	Millimetre
m^3	Cubic metre
m/s	Metres per second
MC	Measurement Criteria
MEE	Maritime environment emergency
MARPOL	The Convention for the Prevention of Pollution from Ships (MARPOL Convention)
MDO	Marine diesel oil
MEG	Mono-ethylene glycol
MNES	Matters of National Environmental Significance, according to the EPBC Act
MOP	Marine oil pollution
MoU	Memorandum of Understanding
nm	Nautical mile
NAT-DET	National Plan dispersant effectiveness field test kit
NEBA	Net environmental benefit analysis
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOPTA	National Petroleum Titles Administrator
NSW	New South Wales
NT	Northern Territory
NTM	Notice to Mariners
NWMR	North West Marine Region
NWS	North West Shelf
OCNS	Offshore Chemical Notification Scheme
ODS	Ozone-depleting substance
OIM	Offshore Installation Manager
OIW	Oil-in-water
OPGGS Act	*Offshore Petroleum and Greenhouse Gas Storage Act 2006*
OPEP	Oil Pollution Emergency Plan
OSPAR	*Offshore Petroleum and Greenhouse Gas Storage Act 2006*
OSRA	Oil Spill Response Agency
OSRC	Oil spill response coordination
OSRL	Oil Spill Response Limited
OSTB	Oil spill tracking buoys
OSTM	Oil spill trajectory modelling
ppb	Parts per billion
ppm	Parts per million
ppt	Parts per thousand
PAH	Polycyclic aromatic hydrocarbons
PIC	Person in charge
PLONOR	OSPAR definition of a substance that Poses Little Or No Risk to the environment
PMS	Preventative maintenance system
PPA	Pearl Producers Association
PPE	Personal protective equipment
PROWRP	Pilbara Region Oiled Wildlife Respnse Plan
QET	Quick-effectiveness test
ROV	Remotely operated vehicle
SA	South Australia
SCAT	Shoreline clean-up assessment technique
SCSSV	Surface controlled subsurface safety valve
SCU	Subsea control unit
SEL	Sound exposure level
SEM	Subsea electronic module
SID	Subsea intervention device
SINTEF	The Foundation for Scientific Research at the Norwegian Institute of Technology
SLDMB	Self-locating datum marker buoys
SMPEP	Shipboard Marine Pollution Emergency Plan
SOPEP	Shipboard Oil Pollution Emergency Plan
SSDI	Subsea dispersant injection
TCT	Tree cap test
TH	Tubing hanger
TPH	Total petroleum hydrocarbons
TRP	Tactical Response Plan
USID	Upper subsea intervention device
UTA	Umbilical termination assembly
WA	Western Australia
WAFIC	Western Australian Fishing Industry Council
WAOWRP	WA Oiled Wildlife Response Plan
WMP	Waste Management Plan
WOMP	Well Operations Management Plan
XT	Xmas tree

1 Introduction

1.1 Overview of Proposed Activity

BHP Petroleum (Australia) Pty Ltd (BHP) proposes to undertake riserless light well intervention (LWI) activities in relation to the Crosby-3H1 well located in production licence area WA-42-L in Commonwealth waters, which forms part of the Pyrenees Development. The Pyrenees Development covers crude production from fields located in both WA-42-L and neighbouring WA-43-L.

Crosby-3H1 is a dual-lateral well originally drilled in 2010 with a second lateral drilled in November 2015. In order to reduce excessive water production from the dual-lateral well, BHP proposes to isolate the water producing lower lateral to enable the remaining upper lateral to increase the oil production performance. The common term given to this technique applied to solve excessive unwanted water production is water shut-off. The LWI activities will be undertaken using a light well intervention vessel to establish on the well and conduct the intervention activities utilising riserless subsea intervention equipment and wireline technology. The LWI activities will be short in duration, with the LWI vessel expected to be on location in the production licence area for up to 14 days, contingent on weather conditions and unforeseen circumstances. To account for potential delays or schedule changes, the environmental assessment encompasses the petroleum activity occurring at any time of year. The earliest expected start time is September 2020, pending vessel/equipment availability and environmental approval. The LWI activities from here on will be referred to as the petroleum activity and form the scope of this EP. A detailed description of the activity is provided in Section 3.

BHP is acting as the operator on behalf of the Pyrenees Joint Venture Partners for the Crosby reservoir within production permit WA-42-L:

- BHP Petroleum (Australia) Pty Ltd; and
- Santos WA Energy Ltd.

1.2 Defining the Petroleum Activity

The petroleum activity to be undertaken in Petroleum Production Licence WA-42-L comprises conducting subsea LWI on the Crosby-3H1 well, which are petroleum activities as defined in Regulation 4 of the Environment Regulations. As such an EP is required under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (referred to as the Environment Regulations), administered by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).

1.3 Purpose of this Environment Plan

In accordance with the objectives of the Environment Regulations, the purpose of this EP is to demonstrate that:

- the potential environmental impacts and risks from planned (routine and non-routine) activities and unplanned events (including emergency situations) of the petroleum activity are identified and described;
- appropriate management controls are implemented to reduce impacts and risks to a level that is ‘as low as reasonable practicable’ (ALARP) and acceptable;
- the petroleum activity is carried out in a manner consistent with the principles of ecologically sustainable development (as defined in Section 3A of the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act)).

The EP describes the process used by BHP to identify and evaluate potential environmental impacts and risks arising from the petroleum activity, and defines environmental performance outcomes, performance standards and measurement criteria to be applied to manage the impacts and risks to ALARP and acceptable levels. This EP includes an implementation strategy for the monitoring, audit, and management of the petroleum activity to be performed by BHP and its contractors. The EP documents and considers consultation with relevant authorities, persons and organisations.

1.4 Scope of this Environment Plan

The scope of this EP covers the activities described in Section 3. The spatial boundary of the petroleum activity has been described and assessed using the operational area that encompasses a radius of 500 m from the Crosby-3H1 well centre while the LWI vessel is on location at the well. The extent of the Operational area has been defined based on the physical footprint of the LWI activities detailed in this EP.

The scope of this EP does not include the movement of the LWI vessel outside of the operational area (e.g. travel to and from Permit Area WA-42-L). These activities will be undertaken in accordance with other relevant maritime and aviation legislation, most notably, the *Navigation Act 2012* (Cwlth) and *Civil Aviation Act 1988* (Cwlth).

1.5 Overview of HSE Management System

All BHP controlled activities associated with the petroleum activity will be conducted in line with:

- BHP Charter (Appendix A);
- BHP Environment and Climate Change – Our Requirements;
- BHP Health, Safety, Environment and Community (HSEC) Management Standards;
- BHP Wells and Seismic Delivery (W&SD) Management System;
- BHP Australian Production Unit (APU) Management System; and
- Any specific commitments laid out in this EP.

All Petroleum sites must maintain up-to-date practices that adhere to the requirements contained in the Petroleum HSE Management System Framework and HSE Standards. Activity-specific environmental Management Measures specific to the LWI activities are implemented through this EP.

1.6 Titleholder Details

The nominated Titleholder for this activity is BHP Billiton Petroleum (Australia) Pty Ltd, on behalf of the Pyrenees Joint Venture Partners for the Crosby reservoir within production permit WA-42-L:

- BHP Billiton Petroleum (Australia) Pty Ltd; and
- Santos WA Energy Ltd.

BHP has exploration, development, and production activities in more than a dozen countries around the globe, including a significant deep water position in the Gulf of Mexico, as well as operations in Australia, the United Kingdom, Trinidad and Tobago, Algeria and Pakistan. BHP's Australian assets include:

- Macedon Gas Plant – Natural gas and Condensate (Operator);
- Bass Strait – Crude oil, condensate, LPG and natural gas (Non-operator); and
- North West Shelf – Crude oil, condensate and LNG (Non-operator).

In accordance with Regulation 15(1) of the Environment Regulations, details of the titleholder are provided in Table 1-1.

Table 1-1: Titleholder details

Name	BHP Billiton Petroleum (Australia) Pty Ltd
Business address	125 St Georges Terrace, Perth, Western Australia 6000
Telephone number	+61 8 6321 0000 or 1300 554 757 (Switchboard)
Email address	Reception.Perth@bhp.com
ACN	39 006 923 879

In accordance with Regulation 15(2) of the Environment Regulations, details of the titleholder's nominated liaison person are provided in Table 1-2.

Table 1-2: Titleholder nominated liaison person

Name	Francis Bolzan
Position	Operations Manager APU
Business address	125 St Georges Terrace, Perth, Western Australia 6000
Telephone number	+61 8 6321 0000 or 1300 554 757 (Switchboard)
Email address	Reception.Perth@bhp.com

In the event of any change in the titleholder, a change in the titleholder's nominated liaison person or a change in the contact details for either the titleholder or the liaison person, BHP will notify the regulator in writing in accordance with Regulation 15(3) of the Environment Regulations.

2 Legislative Framework

2.1 Commonwealth Legislation

Environmental aspects of petroleum activities in Australian Commonwealth waters are controlled by two main statutes, the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGS Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Each of these, as applicable to the Crosby-3H1 LWI activities, is described in the following sections. There are also a number of applicable Commonwealth and West Australian statutes and regulations, International Agreements and Conventions and other applicable standards, guidelines and codes under which the activities are implemented. These are listed in Appendix B of this EP.

2.1.1 Offshore Petroleum and Greenhouse Gas Storage Act (2006)

The OPGGS Act provides the regulatory framework for all offshore exploration and production activities in Commonwealth waters (those areas beyond three nautical miles from the Territorial sea baseline and with the Commonwealth Petroleum Jurisdiction Boundary). The Offshore Petroleum and greenhouse Gas Storage (Environment) Regulations (referred to as the Environment Regulations) have been made under the auspices of the OPGGS Act for the purposes of ensuring (as described in section 3) *"....that any petroleum activity or greenhouse gas activity carried out in an offshore area is:*

- *carried out in a manner consistent with the principles of ecologically sustainable development set out in section 3A of the EPBC Act; and*
- *carried out in a manner by which the environmental impacts and risks of the activity will be reduced to as low as reasonably practicable; and*
- *carried out in a manner by which the environmental impacts and risks of the activity will be of an acceptable level".*

This EP meets the requirements of the Environment Regulations by providing a plan that:

- Is appropriate for the nature and scale of the activity;
- Demonstrates that the environmental impacts and risks of the activity will be reduced to as low as reasonably practicable (ALARP);
- Demonstrates that the environmental impacts and risks of the activity will be of an acceptable level;
- Provides for appropriate environmental performance outcomes, environmental performance standards and measurement criteria;
- Includes an appropriate implementation strategy and monitoring, recording and reporting arrangements;
- Does not involve the activity or part of the activity, other than arrangements for environmental monitoring or for responding to an emergency, being undertaken in any part of a declared World Heritage property with the meaning of the EPBC Act; and
- Demonstrates that:
    - an appropriate level of consultation, as required by Division 2.2A, has been carried out;
    - the measures (if any) adopted, or proposed to adopt, because of consultations are appropriate; and
    - complies with the OPGGS Act and the Environment Regulations.

2.1.2 Environment Protection and Biodiversity Conservation Act 1999

Under the Commonwealth government streamlining arrangements, the National Offshore Petroleum Safety and Environmental Management Authority's assessment of this EP provides an appropriate level of consideration of the impacts to matters of national environmental significance (MNES) protected under Part 3 of the EPBC Act.

2.2 State Legislation

In the event of a hydrocarbon release from a loss of well control or a tank rupture from a vessel collision, there is the potential for the spill to impact on State waters and/ or shorelines. Relevant state legislation in listed in Appendix B.

2.3 Environmental Guidelines, Standards and Codes of Practice

A number of international codes of practice and guidelines are relevant to environmental management of the petroleum activity. Those considered most relevant are listed in Appendix B.

3 Description of Activity

3.1 Overview

This section has been prepared in accordance with Regulation 13(1) of the Environment Regulations, and describes the petroleum activity to be performed under this EP.

BHP proposes to undertake riserless light well intervention (LWI) activities in relation to the Crosby-3H1 well located in Permit Area WA-42-L in Commonwealth waters, which forms part of the Pyrenees Development. The Pyrenees Development covers crude production from fields located in both WA-42-L and neighbouring WA-43-L. Crosby-3H1 is a dual-lateral oil well. The well was originally drilled in 2010 and was re-entered in November 2015 to convert to the current dual-lateral configuration. The well requires artificial gas lift operation in order to produce from the well. In order to reduce excessive water production from the dual-lateral well, BHP proposes to isolate the water producing lower lateral to advantage the upper lateral and increase oil production performance. The common term given to this technique applied to solve excessive unwanted water production is water shut-off. The LWI activities will be undertaken utilising a riserless light well intervention vessel to establish on the well and undertake the intervention activities utilising subsea intervention equipment and wireline technology.

3.2 Location

The proposed activities will occur in Petroleum Production Licence WA-42-L located in Commonwealth waters on the North West Shelf of Western Australia (WA) (Figure 3-1). The location coordinates of the Crosby-3H1 well are provided in Table 3-1. The closest landfall is the North West Cape peninsula, Exmouth, approximately 27 km to the south-east. The water depth in the operational area is approximately 200 m, with the Crosby-3H1 well located in 197 m.

Table 3-1: Location coordinates for petroleum activity

Well	Approx. Water Depth (m)	Latitude	Longitude	Production Licence
Crosby-3H1	197 m	21º 32' 43.063" S	114º 05' 42.504" E	WA-42-L

3.3 Operational Area

The operational area for the petroleum activity is a 500-m radius around the Crosby-3H1 well. The operational area sets the spatial boundary within which activities described in this EP will occur, as shown in Figure 3-3.

3.4 Pyrenees Development Infrastructure

The location of subsea infrastructure for the Pyrenees Development is shown on Figure 3-2. The subsea infrastructure that falls within the operational area is listed in Table 3-2.

The Pyrenees Development was referred to the Department of the Environment and Energy (DoEE) (formerly the Department of Environment) under the EPBC Act in March 2005 (referral number 2005/2034). A Draft Environmental Impact Statement (EIS) was prepared and released for public consultation in September 2005. The scope of the EIS included development of the Pyrenees oil fields for oil production and associated infrastructure, as well as future infill drilling and installation of infrastructure to link known fields and other unknown fields within the notional Pyrenees Development Area. The final EIS was submitted to the Commonwealth Minister for the Environment and Heritage for assessment in February 2006 together with an EIS Supplement to address the issues raised by stakeholders. Approval of the Pyrenees Development, subject to conditions, was granted by the Minister on 26 April 2006 (Environment Minister, 2006). A list of the conditions for the Pyrenees Development, with those relevant to the petroleum activity covered under this EP is provided in Appendix C.

Table 3-2: Location of subsea infrastructure in the operational area and the Pyrenees Facility

Facility/ Well/ Infrastructure	Description	Coordinates
Pyrenees facility	Pyrenees Venture Floating Storage and Offloading (FPSO) facility	E: 201 298 m N: 7 615 199 m
Crosby-3H1 6" production jumper	Jumper runs from the NE side of the XT to Crosby manifold-2 Length: 103 m; Volume 1.88 m^3	N/A
Cro-3H1 2.5" gas lift jumper	Jumper to Crosby manifold-2 Length: 115 m; Volume: 0.36 m^3	N/A
Electrical flying lead (EFL) and Hydraulic flying lead (HFL)	Electro/ hydraulic control leads No hydrocarbons	N/A
Crosby manifold-2	Crosby manifold-2 (Crosby south)	E: 199 085 N: 7 614 742
Crosby-4H2 well	Subsea tree	E: 199 058 N: 7 614 699
Cro-4H2 6" production jumper	Jumper to Crosby manifold-2 Length: 90 m; Volume: 1.64 m^3	N/A
Cro-4H2 2.5" gas lift jumper	Jumper to Crosby manifold-2 Length: 65 m; Volume: 0.21 m^3	N/A
4" gas lift flowline (K)	FPSO to Ravensworth manifold-2 Length: 3,595 m; Volume: 29.1 m^3	N/A
8" Ravensworth production/test flowline (G)	Ravensworth manifold-2 to FPSO Length: 3,547 m; Volume:115 m^3	N/A
10" Ravensworth production flowline (A)	Ravensworth manifold-2 to FPSO Length: 3,490 m; Volume: 176.8 m^3	N/A
EHU-02b & 03	Electro/ hydraulic control umbilical No hydrocarbons	N/A
4" gas lift flowline (N)	Crosby manifold-2 to manifold-1 Length: 2,156 m; Volume: 17.5 m^3	N/A
8" Crosby production/test flowline (E)	Crosby manifold-2 to manifold-1 Length: 2,178 m; Volume: 70.6 m^3	N/A
8" Crosby production flowline (D)	Crosby manifold-2 to manifold-1 Length: 2,266 m; Volume: 72.2 m^3	N/A
UTA 3-1	Umbilical termination assembly No hydrocarbons	E: 199 053 m N: 7 614 624 m
C-SDU2	Umbilical termination assembly No hydrocarbons	E: 199 087 m N: 7 614 623 m
CM2-HBJ	Hydraulic bridging jumper No hydrocarbons	E: 199 109 m N: 7 614 633 m

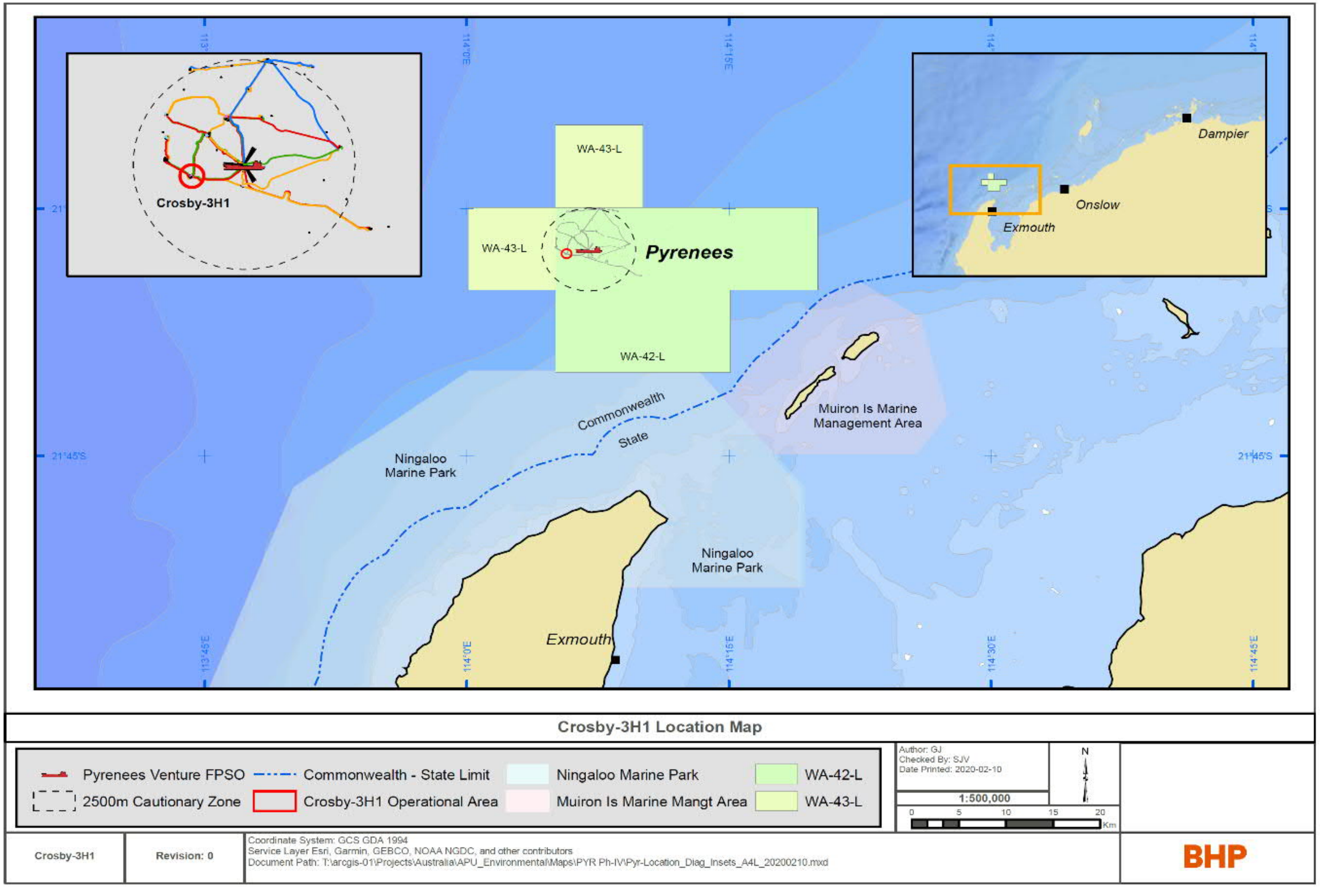


Figure 3-1: Production licence WA-42-L and Crosby-3H1 operational area

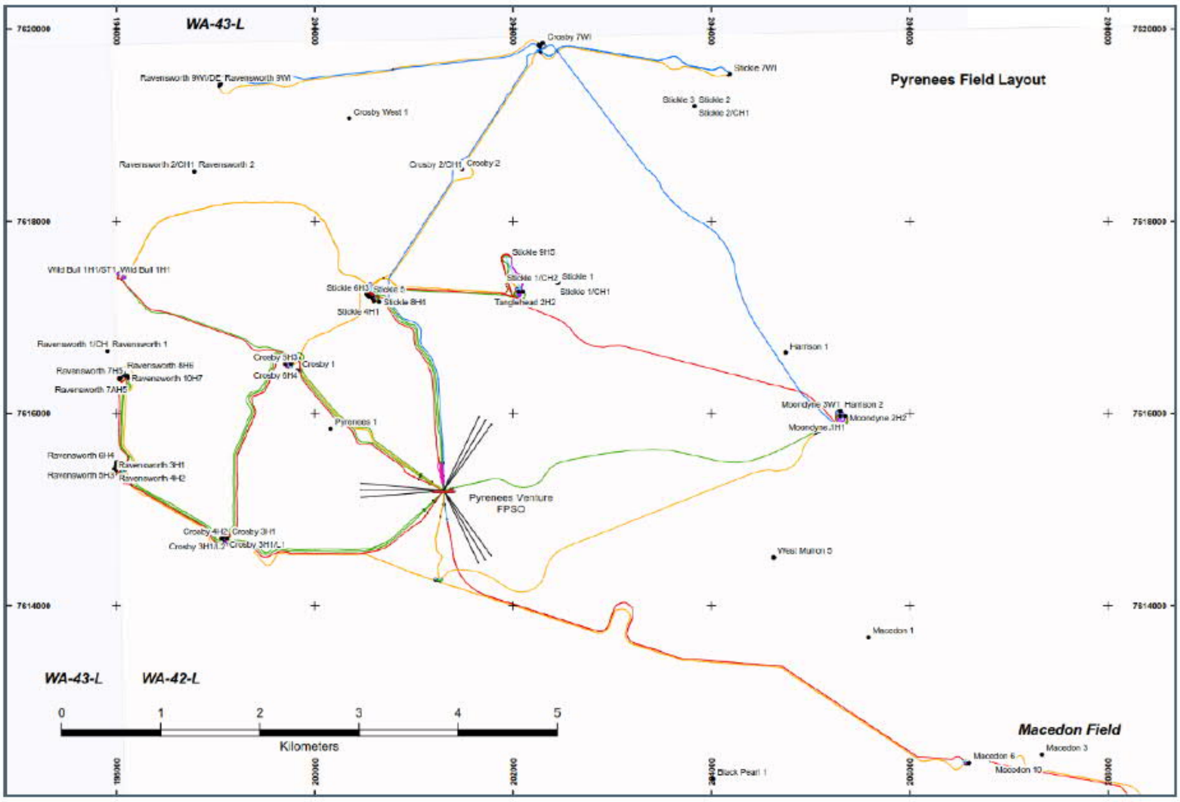


Figure 3-2: Pyrenees Development subsea infrastructure

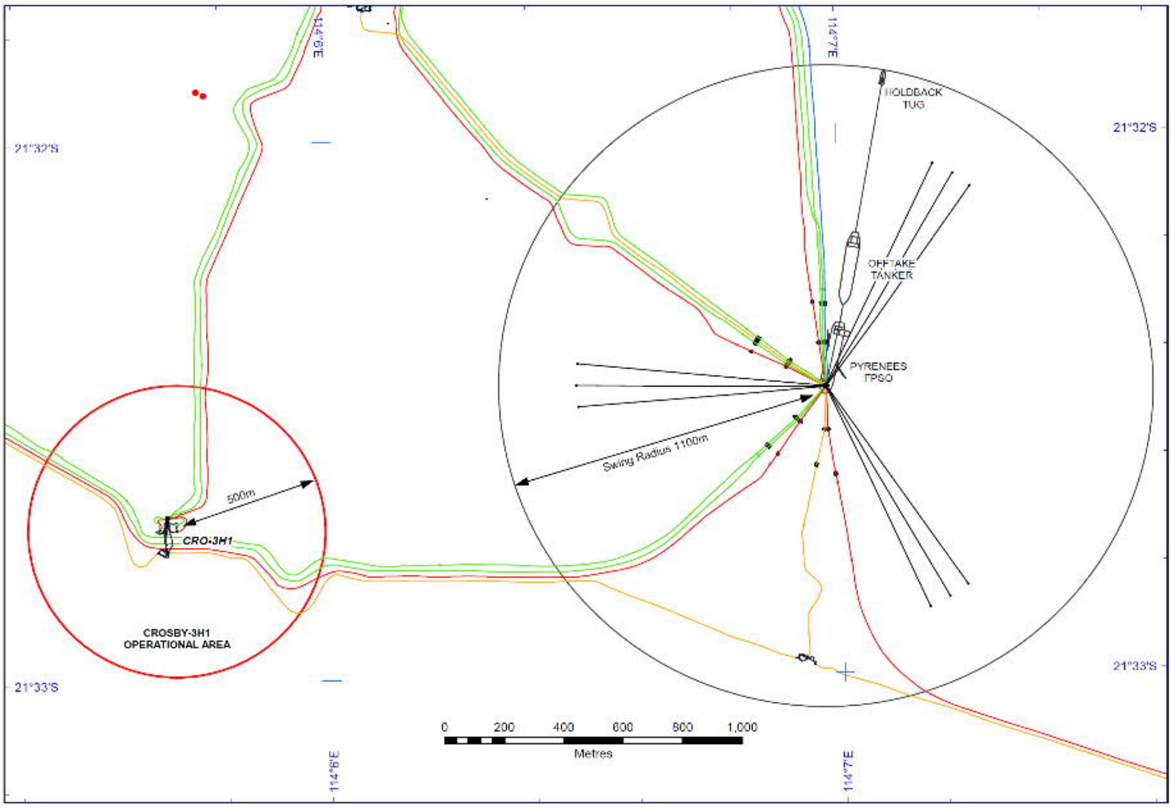


Figure 3-3: Crosby-3H1 LWI operational area in relation to Pyrenees FPSO

3.5 Timing and Duration

The earliest expected commencement date for the Crosby-3HI LWI activities is September 2020, although for contingency purposes due to vessel availability and weather constraints, this EP allows for the petroleum activity to occur any time of year.

The LWI activities will be short in duration, with the LWI vessel expected to be on location in the production licence area for up to 14 days, contingent on weather conditions and unforeseen circumstances. The activities will take place 24 hours a day, 7 days a week.

3.6 Project Vessel

3.6.1 Vessel Details

The LWI activities will be completed from a subsea operational support vessel. Specifications of the vessel are provided in Table 3-3.

Table 3-3: Vessel specifications

Vessel Specifications	
Owner	Sapura Energy Offshore
Vessel Name	*SapuraKencana Constructor*
Vessel Type	MP Subsea Operational Support Vessel
IMO Number	9392705
DWT (tonnes)	6,200
Length (m)	117.30
Breadth (m)	22.00
Maximum Draft (m)	7.5
Accommodation	120 persons

3.6.2 General Vessel Operations

The vessel will be subject to BHP's Marine Management Procedure. All required audits and inspections will assess compliance with the laws of the international shipping industry, which includes safety and environmental management requirements, and maritime legislation including *International Convention for the Prevention of Pollution from Ships 1973* as modified by the Protocol of 1987 (MARPOL) and other International Maritime Organisation (IMO) standards.

The vessel will display navigational lighting and external lighting, as required for safe operations. Lighting levels will be determined primarily by operational safety and navigational requirements under relevant legislation, specifically the *Navigation Act 2012*. The vessel will be lit to maintain operational safety on a 24-hour basis.

The vessel will be equipped with two Work Class remotely operated vehicles (ROVs), well intervention equipment, a helideck, moon pool and accommodation for 120 persons. The vessel will not anchor in the operational area, instead using dynamic positioning (DP) to maintain position near the well centre. DP uses satellite navigation and radio transponders in conjunction with thrusters to maintain the position.

3.6.3 Vessel Mobilisation

The LWI vessel will mobilise to the operational area from Dampier, in accordance with biosecurity and marine assurance requirements.

3.6.4 Vessel Refuelling

Owing to the short duration of the activity (up to 14 days, dependent on weather conditions and unforeseen circumstances), vessel refuelling is not planned to occur during the petroleum activity.

3.6.5 Helicopter Crew Change

Helicopters will be used for medevac. Due to the short duration of the petroleum activity, crew change is not planned. However, if necessary crew changes will be performed using helicopters. Helicopter operations within the operational area are limited to helicopter take-off and landing on the helideck.

3.6.6 Remotely Operated Vehicles

The LWI vessel will be equipped with two Work Class remotely operated vehicles (ROVs) deployed by an integrated launch and recovery system (LARS). The ROVs are linked to the vessel by a neutrally buoyant tether and a load carrying umbilical cable along with their management systems. The ROV systems will be maintained and operated by a specialised contractor on-board the vessel.

The ROVs are equipped with lights and can be fitted with various tools and camera systems to capture and record live (via video feed) and still (photographic) imagery of the subsea equipment and immediate surrounding environment.

3.7 Well Intervention

3.7.1 Light Well Intervention Device

The subsea intervention device (SID) (Figure 3-4) selected for operations is designed to be deployed in two sections. It provides two pressure containing lubricator sections that allow the deployment of wireline / electric line or slickline tool strings subsea without the requirement of running a rigid riser system back to the surface. The SID interfaces to the subsea Xmas Tree (XT) by means of a standard XT connector incorporating an inner sleeve that seals into the XT internal tree cap. The system is designed to ensure that there are a minimum of two well barriers available during well intervention. The system is also designed to secure the well by shutting in additional barriers through manual or autonomous emergency shutdown.

3.7.2 Upper SID

The upper SID system including the slickline and electric line mandrels have the following components and features:

- Slickline mandrel – latches and seals into the upper SID latch providing the primary external seal between wellbore and the environment whilst providing a wire entry point into the well. A pressure controlled packer assembly contains internal well pressure against the wire.
- Electric line mandrel (grease injection head) – like the slickline mandrel, latches and seals into the upper SID latch providing a primary external seal. A series of internal grease tubes and injection points maintain a dynamic seal against wellbore pressure for the deployments of more sophisticated toolstrings requiring electrical communication to surface.
- Both electric line and slickline mandrels contain the following features:
    - Dual pack-off – provides a dual elastomeric seal with an additional high pressure injected grease seal to control wellbore pressure.
    - Integral tool catcher prevents the toolstring from falling downhole by retaining the rope socket attached to the upper end. The tool catcher fails to the ‘catch’ position.
    - Integral chemical injection – ability to inject chemical directly onto the wire for hydrate management.
- Ball safety check – prevents hydrocarbon pressure release in the event of a wire failure.

- Head-latch connector – provides subsea entry to the lubricator for wireline tooling by permitting subsea release of the mandrels. A safety pressure lock prevents release of the head-latch connector assembly when well bore pressure is present.
- Shear seal ram blowout preventer – wire cutting and sealing capability.
- Upper lubricator – tubular sections that provide pressure-containing envelope for housing the toolstring in conjunction with lower lubricator. The lower lubricator is part of the lower SID.

3.7.3 Lower SID

The lower SID system provides a connection point for the upper SID and a means of connection to the XT assembly via purpose built interface. The main features are as follows:

- Mid-latch connector – interface to the upper SID for mechanical and hydraulic communication, fitted with a pressure lock.
- Lower lubricator – same as upper lubricator section.
- Tool trap – hydraulically opened flapper trap to prevent wireline tools from running in hole until required. The tool trap is also used as a reference point for downhole toolstrings.
- Isolation gate valve – a hydraulically operated fail as is gate valve to provide a working wellbore barrier during well intervention operations, used to allow change-out of toolstrings.
- Dual ram blowout out preventer (BOP) – a dual ram BOP trimmed with a variety of wireline and a bi-directional sealing ram to provide pressure control during wire in hole operations.
- XT connector – provides mechanical dual barrier connection between the SID and the XT.
- Subsea control unit (SCU) – oil-filled pressure compensated control cabinet containing all the solenoid valves and solenoids required to function the SID and well equipment.
- Subsea electronics module (SEM) – oil-filled pressure compensated control cabinet containing all the electronics that control the solenoids required to function the SID and well equipment; also controls battery charger and pressure transducer interface.
- Umbilical interface – connection point for the control umbilical providing electrohydraulic feed to the SID and client equipment. The connection has a release mechanism that relies on a bolt that breaks under tension. This release is automatically activated in the event of a specific level emergency shut-down.
- ROV panel – providing override of the critical well control barriers within the SID system; also houses test lines for critical seals.
- Subsea accumulators – providing sufficient stored hydraulic pressure to close all well control barriers in the event of emergency shut down or disconnection.
- Grease pump box subsea grease pump to allow for large, rapid adjustments to the flow and pressure supplied to the dynamic grease seal in the electric line mandrel.
- Protection frame – providing protection, guidance and mounting for the SID system components during deployment and recovery.

3.7.4 Flush Return System

The flush return (FR) system provides a means of flushing the lubricator contents back to the hydrocarbon-handling package on deck of the vessel. This is done before returning the wireline mandrel to surface to ensure that no wellbore fluid is released to the environment from hydrocarbon-contaminated toolstrings or lubricator bores. An additional function of the FR system allows for the use of the pumps on the vessel to pressure test barriers, equalise pressure across valves and kill the well if required. The system also includes an optional 2" kill line, which would be run should well kill capability be required. The main components of the FR system are as follows:

- FR umbilical – four-line umbilical back to surface to provide circulation and well kill facility connected to the choke manifold and hydrocarbon handling equipment on deck.

- FR umbilical termination – connection point for the umbilical. This connection point is for both the controls umbilical and the FR umbilical. A manual disconnect and reconnect facility also exists.
- FR valves – fail closed valves and pipe work within the SID system to allow circulation operations.
- The system is configured to have dual barriers for additional safety and environmental protection. This is complimented by an additional pressure rated choke manifold system on the surface that is part of the hydrocarbon handling system.
- Pumping spread – capable of pumping fluids for flushing and well kill at a rate of up to 6-8 barrels per minute (bpm);
- Kill line – single 2" downline to allow higher flow of fluid into the wellbore through tree connector crossover.
- Kill line termination – connection point for the kill line, kill fail closed valves and pipe work within the SID system to allow well kill operations.
- The system is configured to have dual barriers for additional safety and environmental protection.

The FR system in conjunction with the hydrocarbon handling system on the vessel provides well barrier and pressure control redundancy for surface and subsea systems combined and in isolation ensuring that all operational and emergency shut-down scenarios have a minimum of two independent verified, available barriers between pressure source and environment. This is further enhanced by strictly controlled operating procedures conducted by competent and qualified personnel. Some of the components within the flush, return and kill system and the well service pump are hired from specialist vendors on a project-by-project basis. Some of this equipment has been deemed a safety critical element. Accordingly, the hired equipment must meet agreed standards.

3.7.5 Lubricator Flushing of System to Surface

Hydrocarbons, in the form of hydrocarbon-contaminated flushing returns, are handled on the vessel by a dedicated system consisting of a choke manifold, deck connection piping, separator and cold vent boom. The flushed lubricator fluids are transferred to surface through the FR umbilical to the FR reeler with the outlets connected directly to the choke manifold on deck.

The flushing, return and kill umbilicals have subsea and surface isolation valves which will be closed when the BOP valves or other well barriers are opened on the well and conversely the BOP valves or other well barriers will be closed when any of these outlet isolation valves are opened to bleed the lubricator back to surface. The volume flushed at any one time is limited to the volume of the SID lubricator.

During a lubricator flushing operation where the well is completely isolated and barriers tested from the direction of pressure before displacement of fluid, controlled circulation within the lubricator with a known quantity of water-glycol mix is carried out. The volume of the lubricator is 0.384 m^3 hence with the worst-case of total lubricator volume stored as gas then bled back to surface at well pressure, the volume of stored gas brought to the surface and fed through the separator would be less than 0.4 m^3.

The equipment used for hydrocarbon handling is rated for full working pressure of the system; however, the operating procedures limit the lubricator flushing operations to controlled pressures by means of well isolation and choke manifold.

During lubricator flushing operations if an emergency shut-down situation occurs then isolation barriers are automatically effected using accumulated pressure stored subsea after activation of the relevant emergency shut-down button.

Typically, international bulk carriers (IBC) or tote tanks stored on the vessel deck are used to contain the flushed lubricator fluids returned to surface from the separator.

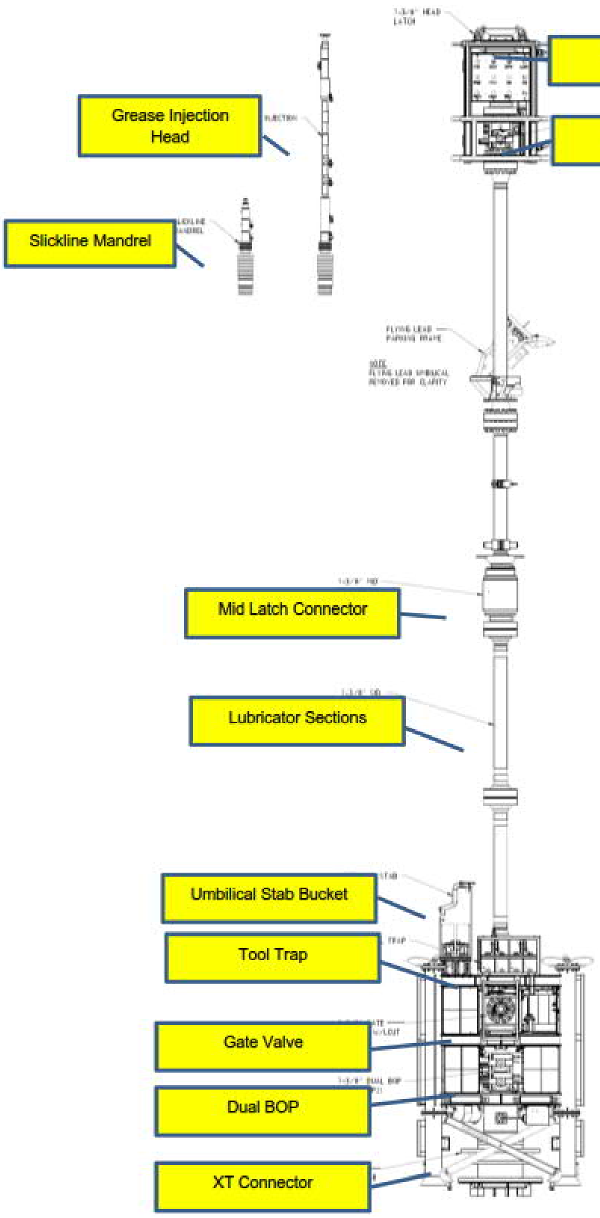


Figure 3-4: Typical subsea intervention device

3.7.6 Well Intervention Operations

Well intervention is a collective expression for the deployment of tools, chemical fluids, and equipment in completed wells. Well intervention activities are expected to include the following sequence of operations:

Prior to Mobilisation:

As recommended by industry standards the planned LWI package will be used in conjunction with BHP owned equipment to perform a full Extended Factory Acceptance Test (EFAT) where all critical interfaces will be made up and tested to verify system compatibility.

Mobilise LWI Vessel to Operational Area

- The LWI system will be installed onto the vessel in Dampier Port and a full integration test of equipment completed. Once compliant with BHP and required standards a ready to sail certificate will be issued to the

Vessel contractor allowing departure to the Crosby-3H1 well within the Pyrenees field. As required DP and similar vessel requirement testing will be performed at a suitable position prior to field entry.

Handover of Well from FPSO; and Site Survey

- Flowline and gas lift line depressurisation, and establishment of barriers to production systems will have been completed prior to vessel arrival at Crosby-3H1, allowing permit issue and well handover to vessel to be completed.
- Once in position ROVs will be launched to conduct scopes including:
  1. Perform an as found survey and identify any issues or hazards
  2. Remove non-sealing debris cap from the top of the XT.
  3. Clean XT gasket seal face using ROV tooling.

Marine Growth Removal

- To achieve step 3 above and prior to undertaking the well intervention activities, it will be necessary to remove excess marine growth (biofouling) on the subsea XT at the SID connector interface and production controls umbilical interfaces. Marine growth is removed using an ROV to undertake high-pressure cleaning (water jetting), brushing, chemical washing or a combination of these:
  - Water-jetting – water under high-pressure is used to remove marine growth.
  - Brushing – typically using a coarse brush or similar device.
  - Calcium wash removal – typical chemical wash fluid BHP utilise is calcium wash manufactured by McDermid Offshore Solutions.

  Upon completion and acceptance of cleaning, the well will be ready for SID installation.

Establish lower and upper SID onto Well

The following steps will be executed to establish the full upper and lower SID assemblies onto the well ready for wireline entry into the well.

- Production controls umbilical and electrical flying lead will be removed from tree and placed on a previously positioned parking frame.
- Using safe lift zone, the vessel AHC crane will run the lower SID to depth, move over well.
- Lower SID will be lowered to land, lock connector and pressure test barriers.
- Run and establish upper SID and pressure test barriers.
- Run hydraulic and electrical flying leads from SID to XT and establish control of the XT.

In Well Operations:

- Via TCT (tree cap test) line, pressure will be checked below the ITC plug, and if found, vented to vessel.
- Run wireline/pulling tool and pull internal tree cap (ITC) crown plug.
- Retrieve and re-run stuffing box/grease injection head (GIH) – per standard operating procedures.
- Run wireline/pulling tool and pull tubing hanger crown plug.
- Retrieve and re-run stuffing box/GIH – per standard operating procedures.
- Install tubing hanger bore protection sleeve.
- Retrieve and re-run stuffing box/GIH – per standard operating procedures.
- ‘Perform full OD equivalent drift run.
- Retrieve and re-run stuffing box/GIH – per standard operating procedures.
- Run and set mechanical wireline plug into lateral 1.

- Retrieve and re-run stuffing box/GIH – per standard operating procedures.

Close well and demobilise LWI vessel

- Run pulling tool and recover tubing hanger bore protection sleeve.
- Retrieve and re-run stuffing box/GIH – per standard operating procedures.
- Run wireline/pulling tool and install/test tubing hanger crown plug.
- Retrieve and re-run stuffing box/GIH – per standard operating procedures.
- Run wireline/running tool and install/test internal tree cap crown plug.
- Perform pressure testing confirming both TH and ITC plugs as well barriers as per BHP Standards.
- Retrieve stuffing box/GIH – per standard operating procedures.
- Recover upper and lower SID, install debris cap.
- Return well ready for production by installing production controls umbilical and EFL.
- Perform as left site survey, sign off permit and hand well back to FPSO.
- Demobilise LWI vessel to Dampier for removal of LWI equipment.

3.8 Chemical Selection and Assessment

The chemicals required for the well intervention activities will be stored on-board the LWI vessel. All chemicals that may be operational released or discharged to the marine environment from either planned activities or unplanned events are accompanied with relevant Safety Data Sheets (SDS). On-board the LWI vessel, chemical and hydrocarbon containers are stored in dedicated areas. Hazardous chemicals are stored within bunds or in secure areas to prevent accidental overboard discharges.

The management, approval and control of SDSs must also comply with the requirements outlined in the APU Hazardous Materials Acquisition Environmental Supplement (AO-HSE-S-0002) and Environmental Supplement Form (AO-HSE-S-0002-0001), which provides guidance on environmental standards, assessment process and authorisation for material selection and use. Hazardous chemical proposed for use intended to be directly or indirectly discharged to the marine environment must be assessed by this process to reduce the impacts to ALARP. Four steps are followed to determine the acceptability:

1. New material request;
2. Designated Low Ecotoxicity Materials - Offshore Chemical Notification Scheme (OCNS) Gold or Group E or D (lowest environmental hazard);
3. Material Specific Ecotoxicity Assessment:
   - Acute ecotoxicity;
   - Biodegradability; and/or
   - Bioaccumulation potential.
4. ALARP Assessment
   - Frequency of use, dose concentration and dilution factor of material potentially discharged to the environment;
   - Estimated fate of the material;
   - Environmental receptors;
   - Assessment of less harmful alternative materials demonstrates, alternatives unavailable;
   - Requirement for the material use can be technically justified (cannot be eliminated or redesigned);

- Define risk mitigation measures to limit discharge to the environment (i.e. Maximum dose rate or volume); and
- Measures to ensure risk is monitored and controlled.

Table 3-4 lists the indicative chemicals used on the LWI vessel, their indicative storage inventories on-board and potential discharge volume.

Table 3-4: Indicative chemical types, storage quantities and discharge volumes

Chemical	Purpose/ Uses	Anticipated Inventory	Indicative Discharge Volume
Mono ethylene glycol (MEG)	Hydrate control for lubricator flushing fluid	2,000 L	No planned release
Calcium wash (scale dissolver)	Removal of marine growth and carbonate scale; wellhead/ connector cleaning	5,000 L	100 L
Biocide	Treatment of water/seawater that may enter wellbore and reservoir	100 L	No planned release
Transaqua HT2	Control fluid (water-based)	5,000 L	100 L
Imperial – Bio-wireline grease	Bio-degradeable wireline grease	1,000 L	400 L
Shell Tellus 32 hydraulic oil	ROV control fluid (oil-based)	5,000 L	No planned release

3.9 Contingent Activities

The following subsections present contingency activities that are not planned activities, but which may be required in the event of operational issues or unforeseen circumstances.

3.9.1 Emergency Disconnect

An Emergency Disconnect Sequence (EDS) may be implemented if the LWIV is required to rapidly disengage from the well. This can be initiated manually, or autonomously, on loss of power or communications. Examples of when this system may be initiated include the movement of the LWI vessel outside of its operating circle (e.g. due to a failure of DP) or the movement of the LWI vessel to avoid a vessel collision (e.g. third-party vessel on collision course).

EDS aims to leave the XT and SID in a secure condition but may result in a release of small volume of fluids during the enactment of the disconnect sequence. If required, the valves on the BOP will automatically shear the wire and shut-in the well upon enactment of the EDS, providing well integrity and sufficient barriers while the event is rectified. Should the ESD sequence be activated once the cause of the shutdown has been eliminated (e.g. DP integrity restored, errant vessel has departed location) the LWIV will return to the well and attempt to recommence operations. Integrity of barriers would be confirmed prior to activity recommencement. Should the wireline have been sheared or released during the EDS, there will be a need to insert a fishing tool to recover the sheared wire and recover any lost tooling, prior to the normal work sequence recommencing.

Should vessel move off be unplanned not allowing the EDS to be undertaken and retrieval of umbilical, or other lines connected to the SID, then breakaway points have been designed into the system so no excessive loading is applied to the well, wire would be cut or released and removed from the well allowing the ball check valve at the top of the SID to activate and seal the well.

4 Description of Environment

The purpose of this section is to address the requirements of Regulation 13(2) and 13(3) through describing the environment that may be affected (the EMBA), including relevant values and sensitivities, by both routine/ planned activities and non-routine/ unplanned events. The information contained in this section has been used to inform the evaluation and assessment of the environmental impacts and risks presented in Section 7 and 8. The level of detail is appropriate to the nature and scale of the impacts and risks to the particular values and sensitivities.

4.1 Determination of the Environment that May Be Affected

To describe the EMBA, it is necessary to consider the spatial extent of all planned activities (impacts) and unplanned events (risks). The description of the environment is based on two spatial areas:

- The operational area. The operational area for the petroleum activity is a 500-m radius around the Crosby-3H1 well. The operational area sets the spatial boundary within which activities described in this EP will occur (Figure 3-3).
- The wider EMBA. This is the environment that may be affected by worst-case hydrocarbon spills (Figure 4-1).

The spatial extent of the wider EMBA has been defined using stochastic hydrocarbon fate and transport modelling of the worst-case hydrocarbon spills, based on the hydrocarbon exposure values (concentrations) for a subsea release of crude oil from a loss of well containment (Section 8.3) and a marine diesel oil (MDO) spill arising from a vessel-to-vessel collision (Section 8.5). Stochastic oil spill modelling was undertaken for each spill scenario simulating a spill at the Crosby-3H1 well. To account for a spill occurring at any time of year, and therefore variables in environmental conditions, each scenario consisted of 120 individual oil spill simulations staggered across five years of hydrodynamic and wind data.

The oil spill modelling considered four key hydrocarbons phases that pose differing environmental and socio-economic risks: surface (floating) oil, total submerged hydrocarbons (entrained oil droplets in the water column), dissolved oil in the water column, and shoreline accumulated oil. The modelling used defined oil exposure values (concentrations) to aid interpretation of the modelling, to identify when and where areas might be contacted by oil, and inform the subsequent environmental risk evaluation and spill response planning. The oil exposure values used to define the EMBA were guided by NOPSEMA's *Environment Bulletin – Oil Spill Modelling Guideline* (NOPSEMA, 2019) are provided in Table 4-1. Section 8.2.5 provides information on the selection of the oil spill modelling exposure values.

Table 4-1: Hydrocarbon exposure values

Hydrocarbon phase	Exposure Value		
	Low	Moderate	High
Surface (floating) oil	1 g/m^2	10 g/m^2	50 g/m^2
Shoreline (accumulated) oil	10 g/m^2	100 g/m^2	1,000 g/m^2
Total submerged oil in the water column (a combination of entrained and dissolved oil components)	10 ppb	100 ppb	-
Dissolved oil in the water column	10 ppb	50 ppb	400 ppb

The EMBA presented in Figure 4-1, shows the combined stochastic modelling outputs for the worst-case crude spill and marine diesel oil (MDO) spills, based on 120 individual spills for each spill scenario. By overlaying all of the individual spills onto a single figure, the stochastic modelling shows all the potential areas that could be affected in the event of a spill. While the EMBAs represents the area that could be contacted in the event of a spill, a single spill event would be have a much smaller spatial extent (refer to Figure 8-3 in Section 8.3).

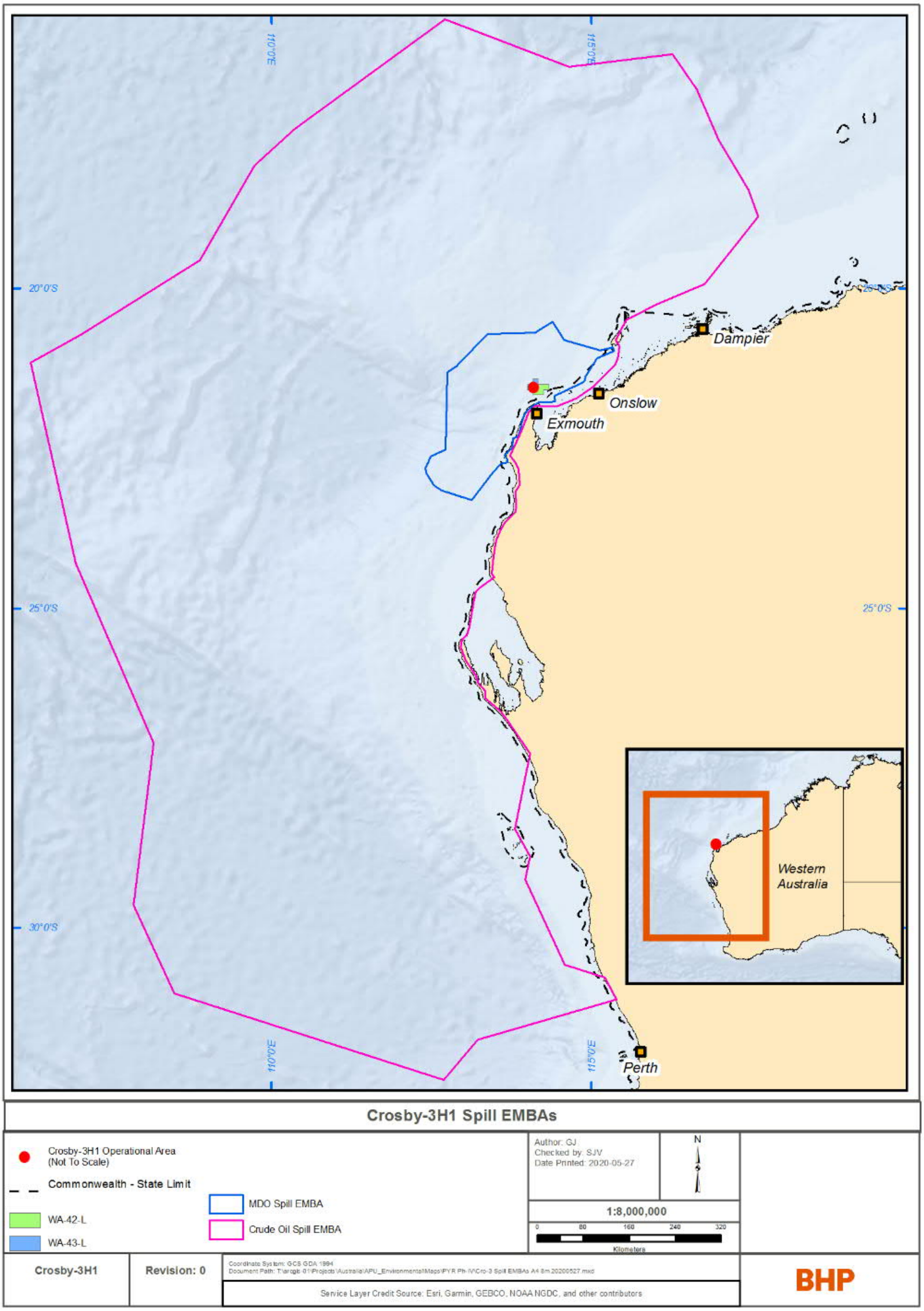


Figure 4-1: Crosby-3H1 spill EMBAs based on low hydrocarbon exposure values

4.2 Regional Setting

Australia's offshore waters have been divided into six marine regions in order to facilitate their management by the Australian Government under the EPBC Act. The Crosby-3H1 operational area is located in Commonwealth waters within the North West Province, in water depths of approximately 197-200 m (Figure 4-2). The North West Province falls within the North West Marine Region (NWMR), as defined under the Integrated Marine and Coastal Regionalisation of Australia (IMCRA v4.0).

The NWMR encompasses Commonwealth waters from the WA/NT border in the north, to Kalbarri in the south (Director of National Parks, 2018). The NWMR consists entirely of continental slope and is characterised by muddy sediments and water depths that predominantly range between 1,000-3,000 m (DEWHA, 2008a). The Exmouth Plateau is the dominant topographical feature within the North West Province and is an important feature as it modifies the flow of deep waters and contributes to uplifting of deeper, more nutrient-rich waters.

The inner shelf component of the North West Province with water depth ranges from 30-60 m is virtually flat and overlain by sparse sandy substrata. Relict sediments are also present and rhodolith beds of coralline red algae growing on rocks occur between 30-90 m (DEWHA, 2007). In the deeper waters of the mid shelf (60-100 m), sediments are comprised of sands and gravels on cemented hard grounds. It is reasonably barren substratum with 50% comprising relict reworked material (e.g. ooid old shoal) and hence there is little recent organic material and the substrata support a generally low biota (DEWHA, 2007). The sediments of the outer shelf (100-200 m) comprise sands and gravels, transitioning to muds with increasing distance offshore. Detrital rain transports some organic material to the seafloor however there is believed to be very few benthic living organisms at on this outer shelf (DEWHA, 2007).

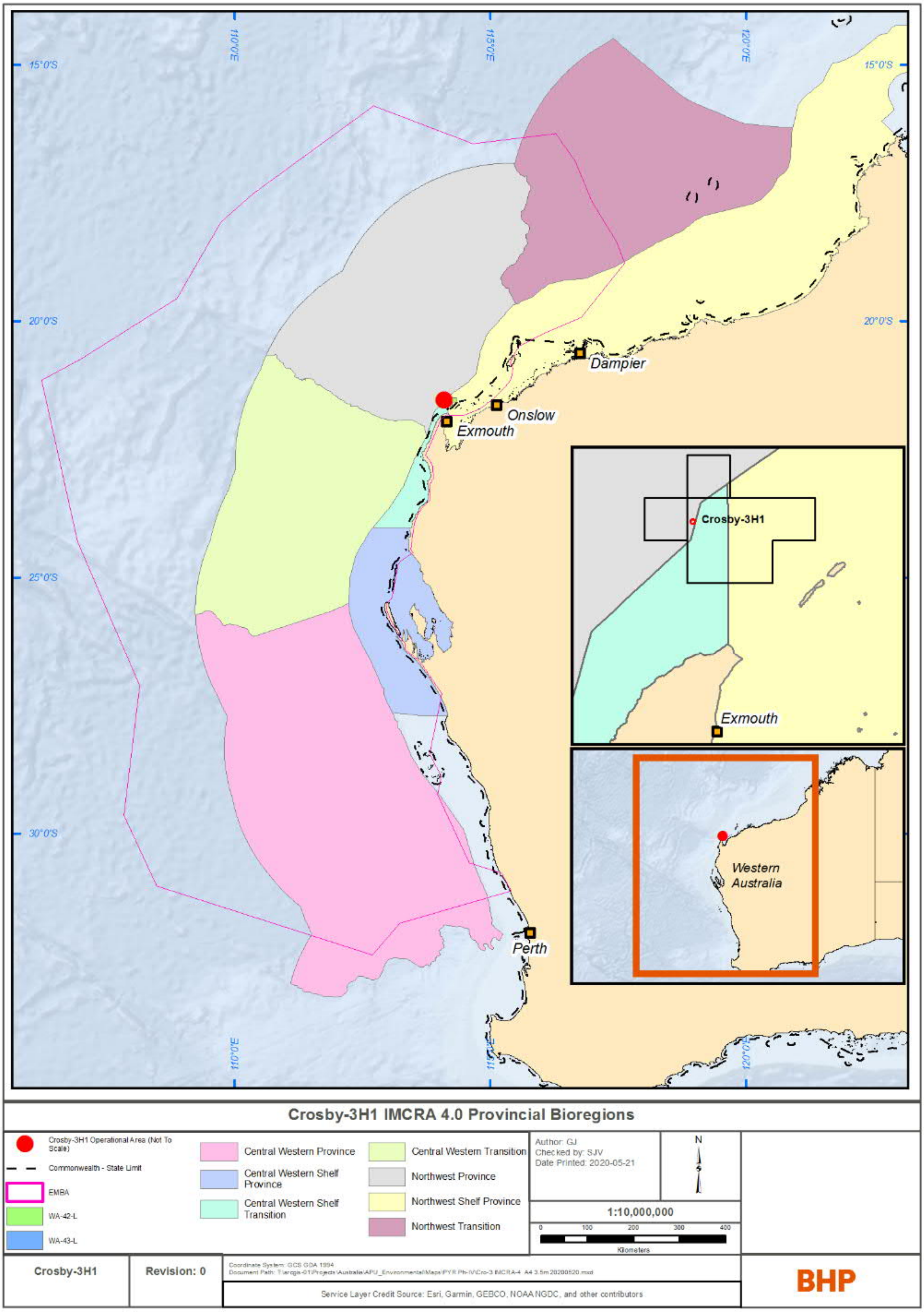


Figure 4-2: IMCRA provincial bioregions within the EMBA

4.3 Physical Environment

4.3.1 Climate and Meteorology

The region experiences an arid sub-tropical climate and a distinct summer monsoonal “wet” season from November to February followed by a typically cooler winter “dry” season (ANRA, 2013). The climate is controlled by two major atmospheric pressure systems: Indian Tropical Maritime air moving in from the west or north-west, and the tropical continental air from the inland (ANRA, 2013). The northwest coast between Broome and Exmouth experiences on average about five tropical cyclones between November to April each year (BOM, 2012a). Cyclones can bring vast amounts of rain to the area, with strong swell and rough seas common during these meteorological events. Most cyclones approach the region from the east-northeast, veering to a southerly track the further south they go (BOM, 2012a). Observations from the Learmonth weather station are summarised in Table 4-2.

Table 4-2: Meteorological conditions (for Learmonth) presentative of the operational area

Month	Mean Maximum Monthly Temperature (ºC)	Mean Minimum Monthly Temperature (ºC)	Mean Rainfall (mm)
January	37.9	23.0	31.2
February	37.5	24.1	41.1
March	36.4	22.9	41.4
April	33.2	20.4	17.8
May	28.5	16.1	43.3
June	24.8	13.1	42.5
July	24.2	11.4	22.3
August	26.4	12.1	11.7
September	29.4	13.8	1.9
October	32.8	16.4	1.6
November	34.6	18.5	1.8
December	36.9	20.8	6.2
Annual Average	31.9	17.7	259.6

Sea surface wind data was sourced by GHD (2020) from the National Centre’s for Environmental Predictions (NCEP) / National Centre for Atmospheric Research (NCAR) global re-analysis dataset. Average monthly wind direction and monthly wind roses for the NCEP/NCAR node nearest to the operational area provided in Figure 4-3 and Figure 4-4. Wind data shows May to August inclusive are characterised by predominately southerly to easterly average winds. Southwesterly average winds prevail from October to March. April and September are transitional periods with predominantly southerly average winds.

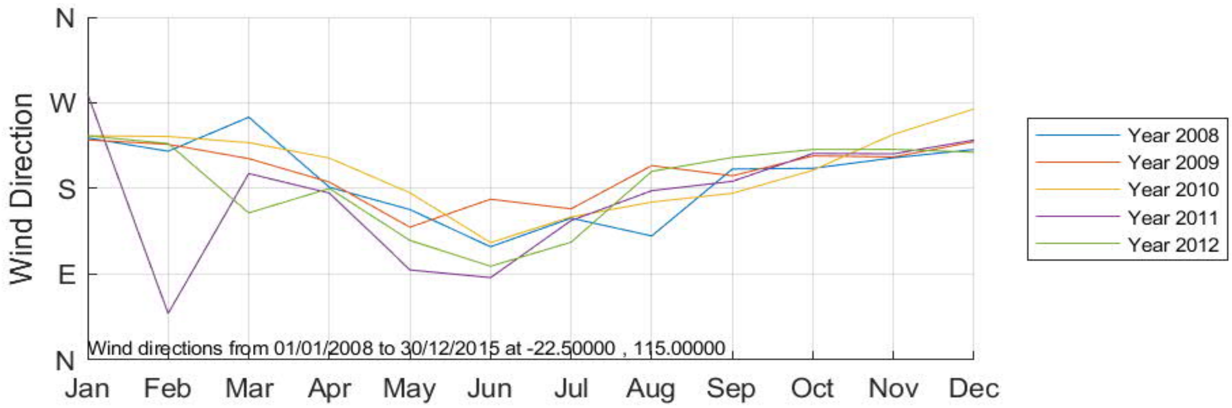


Figure 4-3: Average monthly wind direction

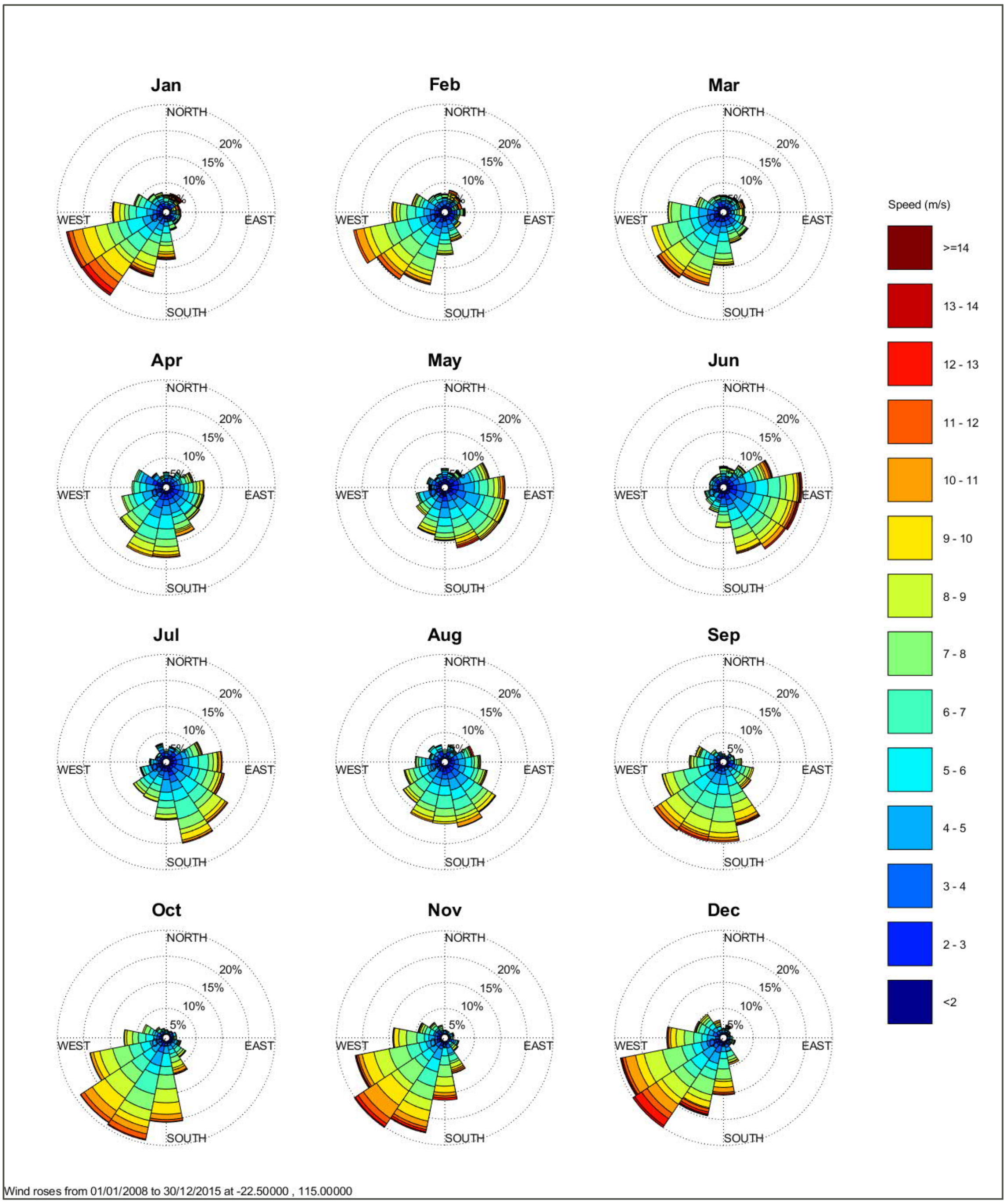


Figure 4-4: Average monthly wind roses

4.3.2 Oceanography

Currents and Tides

The oceanography of the region is strongly influenced by the warm, low salinity waters of the Indonesian Through Flow (ITF), which influences the upper 1,250 m of the water column (DEHWA, 2007b). While the origin and movement of shelf waters such as those in the permit area are not well understood, it is believed that ITF waters flood the shelf via the Eastern Gyral Current and the Leeuwin Current (Table 4-3).

Surface currents are subject to strong seasonal variations; the Eastern Gyral Current intensifies during July-September and the Leeuwin Current is strongest in autumn, and weakens during from December to March.

Below the main thermocline the water column is influenced by Banda Intermediate Water from the north, and Sub-Antarctic Mode Water and Antarctic Intermediate Water from the south (DEHWA, 2007). In addition to the major surface and subsurface currents, a number of smaller, localised currents also occur nearshore such as the Capes Current, the Ningaloo Current and the Shark Bay Current (Figure 4-5). In addition to seasonal variability, the oceanography of the region exhibits inter-annual variability, with winds driving the thermocline to shallower depths reducing sea level and sea surface temperature resulting in a weakening of the ITF and Leeuwin Current during El Niño/Southern Oscillation and reversing in La Niña years (DEHWA, 2007). There is evidence of a strong northward current between 200 m and 500 m in this area which may be an off shoot of the Eastern Gyre (DEHWA, 2007).

Table 4-3 presents the average and maximum combined current speeds (ocean plus tides) in the vicinity of the operational area. Data shows monthly average ranges from between 1.9 m/s and 0.35 m/s, with currents predominantly flowing towards the south-southwest.

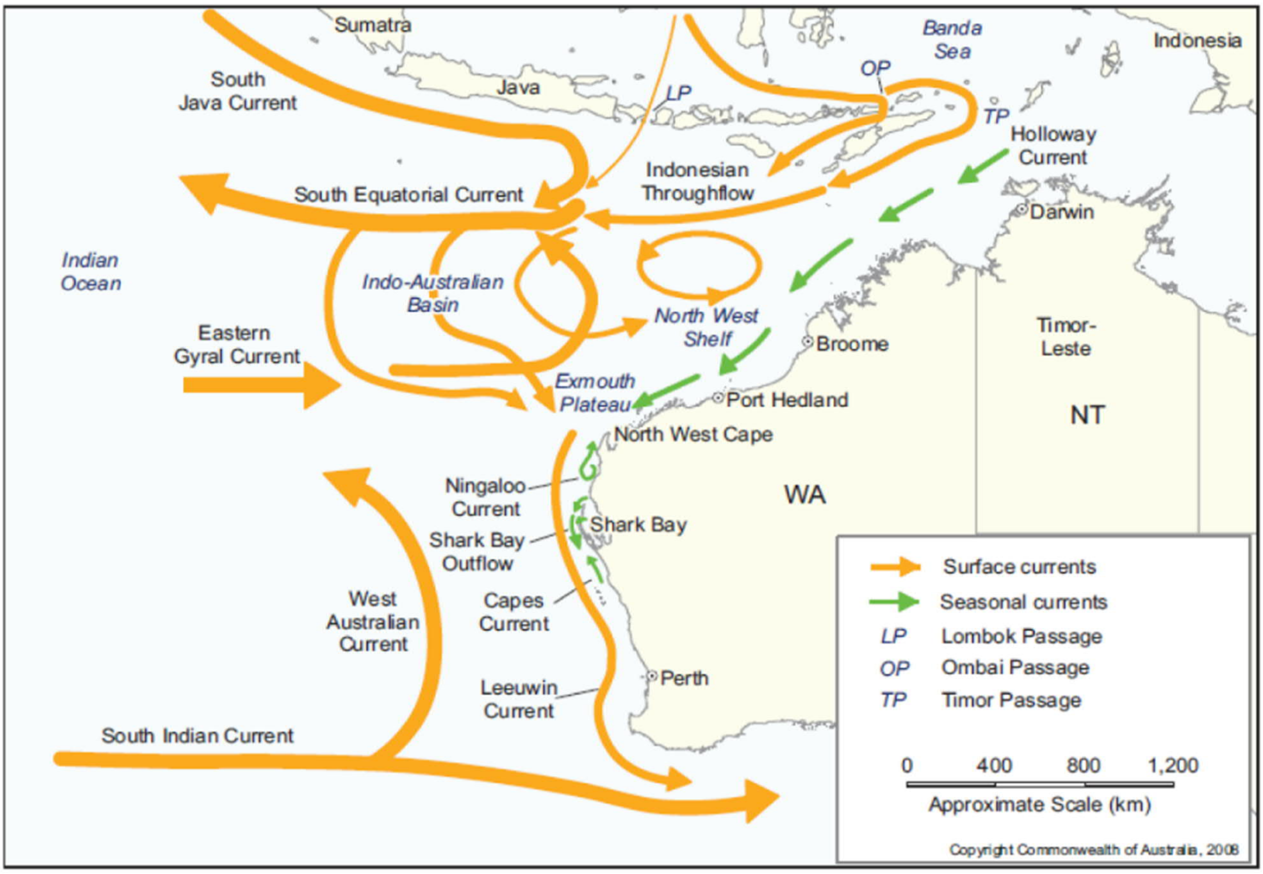


Figure 4-5: Major ocean currents influencing Western Australia (DEWHA, 2008a)

Table 4-3: Predicted average and maximum surface current speeds at the closest station to the operational area

Month	Average Current Speed (m/s)	Maximum Current Speed (m/s)	General Direction (towards)
January	0.31	1.08	West-southwest
February	0.30	1.13	West
March	0.35	1.14	West-southwest
April	0.23	0.51	West-southwest
May	0.26	0.66	West-southwest
June	0.27	0.63	West-southwest
July	0.21	0.51	West-southwest
August	0.19	0.49	West-southwest
September	0.20	0.50	West-southwest
October	0.21	0.52	West
November	0.24	0.73	West
December	0.23	0.81	West
Minimum	0.19	0.49	
Maximum	0.35	1.14	
Annual Average	0.25	0.73	

Tides in the region are semi-diurnal (i.e. there are two high tides and two low tides each day). Spring tides (the highest tidal range each month) are about 1.6 m, while neap tides (the lowest tidal range) are about 0.6 m. The tides run on a northeast and south-west axis, and the maximum speed of the tidal streams is about 0.5 m/sec. Wind driven surface currents reflect the prevailing seasonal wind directions, which are predominantly from the southwest during summer and from the east, southeast and south during winter. These prevailing winds generate surface currents of about 0.2 to 0.3 m/sec in the direction of the prevailing wind (Woodside, 2002).

Waves

The wave regimes in the region are caused by the combination of sea waves and swells. Sea waves occur predominantly from the south-west throughout the year, while the largest swells generally occur from June to October (Woodside, 2002). Therefore, the largest total waves (sea waves combined with swell) occur from June to September, with April and May the calmest months. Tropical cyclones can generate extreme swells, generally from the northeast.

Water Temperature and Salinity

The average sea surface temperature within the area ranges from 20°C to 24°C during winter and 24°C to 28°C during summer (BOM, 2012b). There is likely to be a distinct thermocline in deep offshore waters, associated with the warming influence of the Leeuwin current, which overlays colder, more saline, deeper ocean waters that vary seasonally (DEWHA, 2008a). Salinity is relatively uniform at 35 parts per thousand (ppt).

Bathymetry and Geomorphology

The seafloor of the region consists of four general feature types: continental shelf; continental slope; continental rise; and abyssal plain (or deep ocean floor). The majority of the region consists of either continental slope or continental shelf.

The two main elements of the continental shelf in this region are the Dirk Hartog Shelf to the west of North West Cape and Rowley Shelf to the northeast. The Dirk Hartog Shelf varies in width from 40 km wide to the south of North West Cape, to only 9 to 15 km wide on a direct line between the Pyrenees area and the cape. It is relatively gently sloping and underlain by Pleistocene limestone or mudstone, occasionally exposed but mostly covered by a veneer of sediments of varying thickness. Where the sediment forms a thin layer over the base, the sediment veneer typically consists of coarser sands. Medium and fine sands interspersed with patches of coarser sands usually characterise the deeper sediments.

Approaching the coastline, the Dirk Hartog Shelf rises abruptly to the outer barrier reef, which consists of limestone and coral. The Ningaloo Reef comprises a partially dissected basement of Pleistocene marine or Aeolian sediments, or Tertiary limestone covered by dead or living coral. The reef flat is on average several hundred metres wide (CALM/MRPA, 2005a) and separated from the coastline by a lagoonal area. Sediments in the lagoon are generally coarse calcareous sand with finer calcareous sand or silt in deeper basins and gutters (CALM/MRPA, 2005a). These longshore drainage channels skirt the shoreward edge of the reef and may be up to 12 m deep (CALM/MRPA, 2005a). The underlying limestone may occasionally be exposed as bare pavement where the sand veneer has been swept away.

Continuing on from North West Cape, the Muiron Islands are low dome-shaped, limestone islands separated by a deep navigable channel. The continental shelf is much broader to the northeast of the Cape, sloping away from the Muiron Islands to the shelf break some 30 km seaward. The western shores of the islands are characterised by limestone cliffs fronted by sandy beaches, reef flats and inter-tidal limestone pavements and rubble deposits. The eastern shores of the islands comprise sandy beaches backed by low dunes. They have gently sloping subtidal sand with patch reefs and coral bommies, eventually levelling out to muddy soft substrata.

Detailed bathymetry, side-scan sonar and high resolution seismic surveys were undertaken in February 2005 to accurately map water depth and to detect seabed geophysical and geotechnical sediment characteristics at the nearby Pyrenees Facility. Seabed cores were also obtained to assist in interpretation of data. The western portion of the seabed in the area (190 to 260 m depth) is characterised by gravely fine to coarse carbonate sands, while the seabed sediments in the eastern part of the area (190 to 200 m depth) are soft, fine sediments, mainly carbonate silts and clays.

4.4 Biological Environment

4.4.1 Shallow Water Benthic Habitat

The distribution of shallow water and coastal benthic habitats of the Ningaloo Reef and Muiron Islands is well understood. Perhaps the most comprehensive study is the recent work conducted by the Ningaloo Collaboration Cluster, and funded in part by BHP, to provide a highly resolved classification of benthic habitats associated with the reef and coastal shallow waters. In summary, analysis of the habitat characterisation showed that the majority (54%) of the benthic cover is composed of macroalgal and turfing algae communities, while hard and soft coral cover represents only 7% of the mapped area (762 km^2). There were 5,854 hectares (ha) of coral mosaics mapped along the Ningaloo Reef. The single largest coral mosaic type was continuous tabulate coral (2,155 ha or 37% of all corals). The majority of the coral classes (66%) were a mix of dense to continuous tabulate coral, sparse digitate coral, soft coral and sparse sub-massive and massive corals. Continuous to patchy digitate and tabulate coral made up approximately 10% of the coral cover, while the branching coral species *Acropora* was approximately 8.5%. The majority of the hard coral occurred as either very dense (continuous >90%) cover or as patchy distribution (20 to 45%). Approximately 15,200 ha (21%) of the mapped habitats were in close proximity to the shore (0 to 500 m).

Coral Reefs

The hyperspectral data (125 spectral bands between 450 to 2,500 nm and an average spectral resolution of 15 nm) was acquired in 2006 at 3.5 m ground resolution. The total area of the survey covered 3,400 km^2, encompassing Ningaloo Reef to a depth of approximately 20 m, as well as the coastal strip adjacent to the NMP.

This dataset represents an unprecedented baseline dataset with a spatial extent that spans about 300 km from Bundegi in the north to Red Bluff in the south and includes the Muiron Islands.

Ningaloo Reef and the reefs around the Muiron Islands support a number of habitats, including:

- The outer reef slope is relatively short and steep, extending from sea level to about 10 m depth. It may be undercut or extend seaward into a series of spurs and grooves, often supporting a rich coral growth. The fore reef community is highly diverse with live coral cover over the sloping spur and groove reef.
- The reef crest or outer reef rim is the highest part of the reef and thus most frequently exposed on low tides. It occurs as a narrow band only a few metres in width and distinguishable because of its height. There are occasional reef passes (deep channels), which allow the exchange of seawater and provide access to the lagoon for larger fauna on low tides. Reef crests, which have variable coral cover, are dominated by digitate *Acropora* and massive forms of *Goniastrea* and *Platygyra*.
- The reef flat is the extensive shallow area located on the shoreward side of the crest. At Ningaloo, it may be several hundred metres in width. Live corals occur throughout this area but do not frequently form a total cover due to frequent storm damage and other natural perturbations. The living coral overlies recently dead corals superimposed on Pleistocene aeolian and marine limestone/sandstone deposits. Reef flats have varying cover of rubble deposits and live coral, and sand can be a dominant feature of this area (e.g. as evidenced by the extensive sand areas in the northern section of the Yardie Creek region and adjacent to Point Cloates.
- There is an extensive lagoon system inside the Ningaloo Reef front along the western side of North West Cape. Different habitats in the lagoons include coral bombies, exposed rocky and sandy seabeds and deep holes and channels. The more stable sandy bottoms provide habitat for seagrasses and macroalgae (e.g. the area to the north of Coral Bay).

In Western Australia, 318 species of scleractinian corals from 70 genera have been recorded. Of these, 53 genera and over 250 different species of coral have been recorded so far on Ningaloo Reef, including representatives from all 15 families of corals (Veron and Marsh, 1988) dominated by Acroporidae and Faviidae.

Reef building corals are the most visible and identifiable component of coral reef ecosystems. Smaller coral communities tend to form in the region wherever a hard substratum is available. Reef building corals are generally restricted to the upper photic zone due to the dependence of their unicellular endosymbionts (commonly known as zooxanthallae) on light which in turn drives photosynthesis providing reef-building corals with the majority of their energy requirements (Muscatine, 1990). Consequently, the majority of coral habitat is present in shallow water, in particular on sub-tidal platforms that border most of the mainland and islands.

Each year, most of the corals on the reef undergo one or two mass synchronous spawning events. These spawning events usually happen over three or four nights in March and/or April, during the evening neap tide seven to ten days after the full moon (Simpson *et al*., 1993). There may also be smaller synchronous spawning events during other times of the year. Coincident these events, large swarms of krill have been detected in the shallow coastal waters offshore from Ningaloo Reef from March to June. No aggregations of larger zooplankton (such as krill) were found during an AIMS field study of offshore waters in the vicinity of the Pyrenees Facility in May 2001 and April 2002 (McKinnon *et al*., 2002). However, many aggregations were found in the shallow near-shore waters of Ningaloo Reef.

Macroalgae Beds

Macroalgae are large, visible plants such as kelp, typically attached to hard substrata such as intertidal and sub-tidal rock platforms, limestone reefs, rock/ rubble areas and dead or partially dead corals, typically in water depths less than 10 m but can occur in up to about 50 m (LeProvost Dames & Moore, 2000). Beds of macroalgae, along with seagrass (refer to Section on Seagrasses) provide a major source of benthic production in coastal waters, and support a benthic invertebrate faunal community of high diversity and abundance. Macroalgal beds also provide a complex habitat for cryptic fish and juvenile fish of various species, and a direct food source for many species such as green turtles.

Large beds of macroalgae are known to occur around the Muiron Islands and on the eastern side of Exmouth Gulf (McCook *et al*., 1995). Well-developed macroalgal communities also occur extensively along the Ningaloo Reef tract.

Macroalgal communities occur predominantly in the inter-tidal and sub-tidal waters of the region (up to depths of about 50 m), including limestone pavements, reefs and platforms, coral rubble and dead or partially dead corals (LeProvost Dames & Moore, 2000). Brown algae (Phaeophyte) and red algae species such as *Sargassum* and *Dictyotales* tend to dominate the macroalgal communities in terms of biomass and abundance. Macroalgal communities are ecologically important, being highly productive and providing complex habitat for invertebrates, cryptic fish and juvenile fish of various species, and a direct food source for many species such as green turtles.

Seagrass

Most of the known occurrences of seagrasses in the region are from shallow waters less than 5 m in depth, although one species, *Halophila spinulosa*, has been observed in deeper water (10 to 20 m). Available information suggests that seagrasses in the region on the western side of Exmouth Gulf tend to form small meadows, which are sparse (rarely greater than 5 to 10% density) with a patchy distribution (McCook *et al*., 1995). Seven different species have been recorded in the region of which *Halophila ovalis* is the most common of the seagrasses found on the western side of Exmouth Gulf. It is a tropical species and although widespread throughout the Ningaloo Reef and Rowley Shelf region, it is usually restricted to sparse and patchy occurrences. Seagrasses, including *Halophila*, are eaten by dugongs and also provide a complex habitat for juvenile fish and invertebrates of various species, and are therefore ecologically important.

Seagrass beds also occur in the shallow waters around the Muiron Islands.

4.4.2 Shoreline Habitats

Mangroves

Typically, mangroves occupy areas of the intertidal zone, where tidal inundation is sufficient to maintain an adequate supply of sediment (Furukawa and Wolanski, 1996). They are an important source of primary production and are an important ecological component to the marine and coastal environment as they are a food resource for a range of species. Mangroves provide habitat and shelter for various birds and marine species, including juvenile reef fish species, rock lobster and prawns, increasing the importance of the protection of the discrete stands within the region. Their root system acts as a breeding ground and nursery for crustaceans and fish species, by providing protection from predation. Their extensive root system also reduces water velocity and energy causing entrapment and deposition of suspended sediments, their providing stability and protection of coastlines by acting as a buffer zone and attenuating wave energy and current flow, reducing erosion and storm surge damage in coastal areas.

Six different species of mangroves are reported to occur within the region, with three species identified within the Ningaloo Marine Park. The dominant species is the white mangrove (*Avicennia marina*), with the spotted-leaved red mangrove (*Rhizophora stylosa*) and the ribbed-fruit orange mangrove (*Bruguiera exaristata*) existing in limited numbers (CALM/MRPA, 2005a).

Well-developed white mangrove communities occur along the eastern and southern sides of Exmouth Gulf, and a small fringing mangal occurring on the western shore of the Gulf to the south of Bundegi Reef. The largest mangrove community within the Marine Park is found within Mangrove Bay. The mangal is characterised by established trees to 5 m in height. Established mangrove stands can also be found associated with the Park’s tidal creek systems, including a well-developed mangal within Yardie Creek. While the area of mangal is less than 0.1% of the Marine Park, the mangroves are considered to represent a unique community within the Ningaloo Reef system. There are no reported mangrove communities on the Muiron Islands or any of the offshore islands in the region (DEWHA, 2008a).

There are no reported mangrove communities on the Muiron Islands or any of the offshore islands in the region (DEWHA, 2008a).

Sandy Beaches and Intertidal Sediments

Sandy beaches and intertidal sediments occur extensively along the Ningaloo coast, the western side of Exmouth Gulf and on the Northwest mainland (Onslow region). They are also found on many of the Northwest offshore islands, including but not limited to the Muiron Islands, the Barrow-Lowendal-Montebello island group and Thevenard Island. They represent an important habitat that supports burrowing fauna of crabs, mainly ghost crabs, and burrowing bivalve molluscs, as well as a diverse community of benthic infauna comprising polychaetes, crustaceans and gastropods. In addition, the beaches provide seasonally important habitat for turtle nesting and migratory wading birds. Further details on coastline sensitivities can be found in the Joint Carnarvon Operations North West Shelf Sensitivity Mapping Report Part A (June 2012).

Some of the offshore islands with sandy beaches and intertidal sediments are also biologically important for breeding seabirds and migratory wading birds, for example Caspian terns, little tern, wedge-tailed shearwaters and ospreys breed on Serrurier Island and Airlie Island; and wedge-tailed shearwater breed on Bessieres Island. The intertidal beaches of some of the offshore islands such as the Muiron Islands and Serrurier and Thevenard Island are also important nesting areas turtles.

Rocky Shores and Limestone Platforms

Rocky shore habitats are common along the Ningaloo coastline, offshore islands and western side of the Exmouth Gulf. They range in physical structure from relatively planar limestone/sandstone pavement to dissected low cliffs that provide a range of habitat niches. The diversity of fauna increases with the increasing complexity of the substrate and is dominated by sedentary fauna of rock oysters, barnacles and burrowing bivalves, and a mobile fauna comprised largely of crabs, chitons and gastropod molluscs. Further details on coastline sensitivities can be found in the Joint Carnarvon Operations North West Shelf Sensitivity Mapping Report Part A (June, 2012).

4.4.3 Pelagic Environment

Plankton

The trophic system in the pelagic zone of the North West Marine Region is based on phytoplankton (DEWHA, 2008a). The distribution of plankton is often associated with localised and seasonal productivity that result in sporadic bursts of phytoplankton and zooplankton communities (DEWHA, 2008a). However, in general, the mixing of warm surface waters with deeper, more nutrient-rich waters generates phytoplankton production and zooplankton blooms.

Cyclones can influence to the distribution and abundance of plankton. Observations of Cyclone Tiffany, which affected the North West Shelf in January 1988, noted that communities of phytoplankton rapidly recovered as a result of changed nutrient condition while zooplankton species were transported into areas beyond their normal range due to changes in current, wind and wave patterns (DEHWA, 2008a).

Fishes

Some 1,400 species of finfish are known to occur in the region, mostly of a tropical Indo-West Pacific affinity, with a greater proportion occurring in shallow coastal waters (DEWHA, 2008a). In general, most fish in the region are associated with coral reefs. For example, the abundance, species richness and assemblage structure of juvenile fishes was quantified in 2009 to 2011 at 20 locations extending from Bundegi to 3-Mile Camp, approximately 280 km of the Ningaloo coastline. Sampling included back reef and lagoonal reef zones as well as sanctuary and recreational management zones. In total, 36,791 juvenile fishes from 120 species were observed over the three recruitment years, providing an average of 53 individuals (± 2.6 standard error) per 30 m^2 transect. Interestingly, recruitment rates varied significantly among sampling times (i.e. temporal variation). Transect abundance means ranged from 82 ± 6.3 individuals (2009), 19 ± 1.2 individuals (2010) to 77 ± 4.6 individuals (2011) (Depczynski *et al.*, 2011). The authors of this study noted that the 75% drop in abundance in 2010 coincided with a small increase in mean species richness. A number of different pelagic fish occur in the deeper offshore waters of the region. Pelagic fish species are seasonally abundant and may pass through the area during annual migrations. The most notable species of deep water pelagic fishes in the area are the billfish, which include sailfish, marlin (both Family Istiophoridae) and swordfish (*Xiphias gladius*).

The region also supports diverse and abundant shark and ray populations. Whaler sharks (Family Carcharhinidae) are the most numerous and diverse, occurring in a wide range of habitats such as intertidal (black-tip reef shark – *Carcharhinus melanopterus*), offshore reefs (grey reef shark - *C. amblyrhynchos*) and deep ocean areas (oceanic white-tip - *C. longimanus*).

The Ningaloo Marine Park (State Waters) Management Plan 2005 to 2015 (CALM/MRPA, 2005a) outlines a suite of management strategies to protect marine plants and animals found in the region. The offshore waters of the Ningaloo Reef and Muiron islands have diverse and abundant shark and ray populations. Section 7.1.14 of the Ningaloo Marine Park (State Waters) Management Plan 2005 to 2015 makes reference to several locations in the Ningaloo Marine Park including Pelican Point, Bundegi Sanctuary Zone, Mangrove Bay and Bills Bay, are suggested aggregation points (nursery areas) for juvenile sharks and ray populations. The best known of these is Bills Bay, where up to 100 sharks have been witnessed in water depths as shallow as 0.5 m. Aggregations recorded in other locations of the reserves have so far represented fewer individuals. Due to stable diversity and abundance of shark and ray numbers, there is at present a low level of threat to these populations. The current major pressure is from commercial and recreational fishing; however, population information is limited.

A number of commercial fisheries operate in the area including wetline fisheries, demersal line fishery, mackerel fishery, the Exmouth Gulf Prawn Managed Fishery (EGPMF), the Shark Bay snapper fishery and the marine aquarium and specimen shell fisheries. Section 7.2.1.1 of the of the Ningaloo Marine Park (State Waters) Management Plan 2005 to 2015 describes the primary role of management within the reserves in relation to commercial fishing is, in liaison with Department of Fisheries, to ensure that commercial fishing activities are ecologically sustainable and help maintain the natural values (e.g. high water and sediment quality) of the reserves on which the industry depends. Maintenance of habitat (e.g. nursery grounds, areas of high productivity) is the highest priority, as well as consideration of spawning areas of key fish species adjacent to the operational area (Table 4-4).

The most notable species of deep water pelagic fishes in the area are the billfish, which include sailfish, marlin (both Family Istiophoridae) and swordfish (*Xiphias gladius*), discussed further in Section 4.8. The region also supports diverse and abundant shark and ray populations, with 94 species known in the region (DEWHA, 2008a).

Table 4-4: Listed key fish species that may occur in the vicinity of the operational area

Key Fish Species	Spawning/ Aggregation Times
Baldchin groper (*Choerodon rubescens*)	Sep – Feb
Spanish mackerel (*Scomberomorus commerson*)	Aug – Nov
Rankin cod (*Epinephelus multinotatus*)	Aug – Oct
Red emperor (*Lutjanus sebae*)	Oct – Mar
Pink snapper (*Pagrus auratus*)	May – Jul
Blacktip shark (*Carcharhinus melanopterus*)	Nov – Dec
Sandbar shark (*Carcharhinus plumbeus*)	Oct – Jan
Crystal (snow) crab (*Chaceon* spp.)	All year
King George whiting (*Sillaginodes punctate*)	Jun – Sep
Spangled emperor (*Lethrinus nebulosus*)	Sep – Dec

4.4.4 Deep Water Benthic Habitats

The continental slope and shelf are, for the most part, ecosystems built on a soft sediment habitat with gradational variation in species composition due to depth, water temperature, light penetration and sediment composition/structure. It consists of generally sparse populations of sessile sponges, soft corals and algae (at shallower depths), with a mobile population of burrowing crustaceans, echinoderms and molluscs.

Seabed communities in the operational area are relatively sparse, with diversity and abundance tending to decrease with increasing depth, except where occasional areas of exposed or outcropping rock occur, resulting in localised increases of abundance and diversity. Soft sediment communities are dominated by invertebrate infauna, including polychaetes, crustaceans, molluscs, echinoderms and sponges. Exposed or outcropping rocky areas are dominated by sponges, soft corals and gorgonians, with various finfish, ascidians, crustaceans, echinoderms (urchins and brittle stars), polychaetes and molluscs also occurring. Video footage from a sled towed across parts of the adjacent Pyrenees Facility area showed rippled sediment, with rocky nodules and sparse but reasonably even distribution of sponges and soft corals. Typically, soft corals or sponges were seen attached to these small patches of hard substrate, with fish and other invertebrates gathered around (AIMS, 2002).

4.5 Matters of National Environmental Significance

Conservation values and sensitivities listed and protected under the EPBC Act include Matters of Environmental Significance (MNES) and Other Protected Matters. MNES occurring, or potentially occurring in the EMBA (at the low hydrocarbon exposure values) are summarised in Table 4-5. The full EPBC Act Protected matters reports are provided in Appendix D.

Table 4-5: Summary of conservation values and sensitivities within the EMBA

Value / Sensitivity	EMBA Presence	
	Operational Area	Wider EMBA
Commonwealth Marine Areas	1	2
Listed Threatened Species	20	44
Listed Migratory Species	35	75
Listed Marine Species	47	147
Australian Marine Parks	x	8
State Marine Parks and Marine Management Areas	x	7
World Heritage	x	2
Wetlands of International Importance (Ramsar)	x	x
National Heritage Properties	x	5
Commonwealth Heritage Places	x	2
Threatened Ecological Communities	x	x
Key Ecological Features	1	13

Note: Appendix D includes terrestrial species. As terrestrial species are not considered relevant, they have been excluded from the tally of species provided in Table 4-5.

4.5.1 Commonwealth Marine Areas

The operational area and wider EMBA are within the Australia's exclusive economic zone (EEZ) and Territorial Sea which is a Commonwealth Marine Area, and the the wider EMBA also includes the extended continental shelf. The Commonwealth marine area is any part of the sea, including the waters, seabed, and airspace, within Australia's EEZ and/or over the continental shelf of Australia, that is not State or Northern Territory waters. The Commonwealth marine area stretches from 3-200 nautical miles from the coast.

4.5.2 World Heritage Properties

There are four Western Australian places on the World Heritage List. There are no World Heritage Places within the operational area. The wider EMBA intercepts the boundary of two World Heritage Places, the Ningaloo Coast and Shark Bay.

Ningaloo Coast

The Ningaloo Coast was included on the World Heritage List in June 2011 recognised for its natural beauty, aesthetic importance and significant habitats of biological diversity containing threatened species. Located on Western Australia's remote coast along the East Indian Ocean, it covers an area of 6,045 km^2 and includes one of the longest nearshore reefs in the world (UNESCO, 2020). The Ningaloo Coast World Heritage Area is comprised of the Ningaloo Marine Park (State waters and the adjoining Commonwealth waters section), the Muiron Islands Marine Management Area and Nature Reserve, the Bundegi and Jurabi coastal parks and the Cape Range National Park, in addition to Crown leasehold and freehold land. The following values are recognised by the World Heritage listing:

- Landscapes and seascapes of the property are comprised of mostly intact and large-scale marine and terrestrial environments.
- Whale shark aggregations following the mass coral spawning and seasonal upwelling each autumn at Ningaloo Reef, one of the few places in the world where this species congregates.
- Forms part of the annual migration route for the endangered humpback whale and other whales and turtles.
- Marine turtle density is exceptionally high with green turtles being most abundant.
- The Ningaloo Coast is on the migratory route of many trans-equatorial wader bird species and provides feeding grounds for many migratory seabirds.
- Over 300 documented coral species and 155 species of sponges.
- Over 700 species of reef fish and over 650 species of mollusc (shell fish, sea snails, octopus and cuttlefish).
- 600 species of crustacean.
- A high diversity of echinoderms (sea stars, sea urchins, sea cucumbers) including 25 new species.

Shark Bay

Shark Bay was included on the World Heritage List in 1991 primarily on the basis of three natural features: vast seagrass beds, which are the largest (4,800 km^2) and the most species-rich in the world; dugong population (estimated at 11,000); and its stromatolites (colonies of algae that form hard, dome-shaped deposits and are amongst the oldest forms of life on earth (UNESCO, 2020). Located on the most western point of the coast of Australia, it covers an area of 23,000 km^2 and is renowned for its marine fauna. Key features supporting the World Heritage listing include:

- 12 species of seagrass in the bay make it one of the most diverse seagrass assemblages in the world.
- Seagrass beds cover an area of 4,800 km^2 with the Wooramel Seagrass Bank (1,030 km^2) being the largest structure of its type in the world.
- Hamelin Pool in Shark Bay is a hypersaline pool that contains the most diverse and abundant examples of stromatolite forms in the world, representative of life-forms which lived some 3,500 million years ago.
- Humpback and southern right whales use the bay as a migratory staging post.
- Bottlenose dolphins occur in the bay, and green and loggerhead turtles nest on the beaches.
- Large numbers of sharks including bay whaler, tiger shark and hammerhead are frequently observed and there is an abundant population of rays, including the manta ray.
- The estimated population of about 11,000 dugongs is one of the largest populations in the world.

4.5.3 National Heritage Properties

No National Heritage Properties are located in the operational area. Five National Heritages Properties have boundaries that lie within the wider EMBA:

- Natural National Heritage Properties:
  - Ningaloo Coast;
  - Shark Bay;
- Historic National Heritage Properties:
  - Batavia Shipwreck Site and Survivor Camps Area 1629 – Houtman Abrolhos;
  - Dirk Hartog Landing Site 161 – Cape Inscription Area; and
  - HMAS Sydney II and HSK Kormoran Shipwreck Sites.

The Ningaloo Coast

Refer to previous Section 4.5.2 for heritage values.

Shark Bay

Refer to previous Section 4.5.2 for heritage values.

Batavia Shipwreck Site

Included on the National Heritage List in April 2006, the *Batavia* is the oldest of the known Verenigde Oost-Indische Compagnie (VOC) wrecks on the WA coast and has a unique place in Australian shipwrecks associated with the discovery and delineation of the WA coastline. The *Batavia* wreck site is located about 800 m east from the southwest corner of the Morning Reef in the Wallabi group of the Houtman Albrolhos, a series of low reefs and islands lying between latitudes 28 degrees 14’S and 29 degrees 00’S and longitudes 113 degrees 35’E and 114 degrees 04’E about 65 km off the Western Australian coast (DAWE, 2020a). The shipwreck is protected under the *Underwater Cultural Heritage Act 2018*. Recovered sections of the hull have been reconstructed in the Western Australian Maritime Museum and provides information on the 17th Century Dutch ship building techniques (DAWE, 2020a).

Dirk Hartog Landing Site – Cape Inscritpion Area, Dirk Hartog Island

Included on the National Heritage List in April 2006, the Cape Inscription is the site of the oldest known landings of Europeans on the western coast of the Australian continent, and its associated with a series of landings and surveys by notable explorers over a 250 year period (DAWE, 2020a). The first known European landing on the west coast of Australia was by Dirk Hartog of the Dutch East India Company’s ship the *Eendracht* at Cape Inscription on 25 October 1616 (DAWE, 2020a).

HMAS Sydney II and HSK Kormoran Shipwreck Sites, Carnarvon

Included on the National Heritage List in March 2011, the shipwreck sites of *HMAS Sydney II* and HSK *Kormoran* have outstanding heritage value to the nation because of their importance in a defining event in Australia’s cultural history, their contribution to a greater understanding of Australia’s history of World War II and for their part in the development of the process of the defence of Australia (DAWE, 2020a). The battle occurred between *HMAS Sydney II* and the German raider HSK *Kormoran* of the WA coast on the 19 November 1941.

The two areas that make up the heritage listing are located approximately 290 km west southwest of Carnarvon and 211 km of the coast of WA. The heritage place includes the surface of the seabed and includes both the water column above the seabed and airspace above the sea (DAWE, 2020a).

4.5.4 Wetlands of International Importance

There are 12 Wetlands of International Importance under the Convention on Wetlands of International Importance (the Ramsar Convention) in Western Australia. None of these Ramsar wetlands are located in, or adjacent, to the operational area or wider EMBA. The nearest Ramsar wetland to the operational area is Eighty Mile Beach, located near Port Hedland.

4.5.5 Threatened Ecological Communities

There are no marine threatened ecological communities under the EPBC Act within the operational area or wider EMBA.

4.5.6 Protected Species

A search of the EPBC Act Protected Matters Search Tool was used to identify listed threatened and migratory species that may occur within the operational area and wider EMBA (Table 4-6), based on the low hydrocarbon exposure values. A total of 20 threatened species (18 of which are also listed as migratory) and a further 17 migratory species may potentially occur, or have habitat, within the operational area. A total of 44 threatened species (32 of which are also listed as migratory) and a further 43 migratory species may potentially occur within the wider EMBA. Descriptions of the threatened and migratory species are provided below. The full list of marine species from the protected matters search is provided in Appendix D. Note that terrestrial species (such as terrestrial mammals, reptiles and bird species) that appear in the protected matters search of the EMBA and do not have habitats along shorelines are not relevant to the Crosby-3H1 impacts and risks and therefore have been excluded from Table 4-6.

Table 4-6: Listed threatened and migratory marine species under the EPBC Act potentially occurring within the EMBA

Value/ Sensitivity				EMBA	
Common Name	Species Name	EPBC Act Status		Operational Area	Wider EMBA
Marine Mammals					
Sei whale	*Balaenoptera borealis*	Vulnerable	Migratory	✓	✓
Blue whale	*Balaenoptera musculus*	Endangered	Migratory	✓	✓
Fin whale	*Balaenoptera physalus*	Vulnerable	Migratory	✓	✓
Southern right whale	*Eubalaena australis*	Endangered	Migratory	✓	✓
Humpback whale	*Megaptera novaeangliae*	Vulnerable	Migratory	✓	✓
Australian sea lion	*Neophoca cinerea*	Vulnerable	-	x	✓
Bryde's whale	*Balaenoptera edeni*	-	Migratory	✓	✓
Orca, killer whale	*Orcinus orca*	-	Migratory	✓	✓
Sperm whale	*Physeter macrocephalus*	-	Migratory	✓	✓
Spotted bottlenose dolphin (Arafura/ Timor Sea population)	*Tursiops aduncus* (Arafura/Timor Sea population)	-	Migratory	✓	✓
Pygmy right whale	*Caperea marginata*	-	Migratory	x	✓
Dusky dolphin	*Lagenorhynchus obscurus*	-	Migratory	x	✓
Indo-Pacific humpback dolphin	*Sousa chinensis*	-	Migratory	x	✓
Antarctic minke whale	*Balaenoptera bonaerensis*	-	Migratory	x	✓
Dugong	*Dugong dugon*	-	Migratory	x	✓
Marine Reptiles					
Loggerhead turtle	*Caretta caretta*	Endangered	Migratory	✓	✓
Green turtle	*Chelonia mydas*	Vulnerable	Migratory	✓	✓
Leatherback turtle	*Dermochelys coriacea*	Endangered	Migratory	✓	✓

Value/ Sensitivity				EMBA	
Common Name	**Species Name**	**EPBC Act Status**		**Operational Area**	**Wider EMBA**
Hawksbill turtle	*Eretmochelys imbricata*	Vulnerable	Migratory	✓	✓
Flatback turtle	*Natator depressus*	Vulnerable	Migratory	✓	✓
Short-nosed seasnake	*Aipysurus apraefrontalis*	Critically endangered	-	x	✓
Fish, Sharks and Rays					
Grey nurse shark (west coast population)	*Carcharias taurus*	Vulnerable	-	✓	✓
White shark, great white shark	*Carcharodon carcharias*	Vulnerable	Migratory	✓	✓
Dwarf sawfish	*Pristis clavata*	Vulnerable	Migratory	✓	✓
Green sawfish	*Pristis zijsron*	Vulnerable	Migratory	✓	✓
Whale shark	*Rhincodon typus*	Vulnerable	Migratory	✓	✓
Narrow sawfish, knife sawfish	*Anoxypristis cuspidata*	-	Migratory	✓	✓
Shortfin mako	*Isurus oxyrinchus*	-	Migratory	✓	✓
Longfin mako	*Isurus paucus*	-	Migratory	✓	✓
Reef manta ray	*Manta alfredi*	-	Migratory	✓	✓
Giant manta ray	*Manta birostris*	-	Migratory	✓	✓
Porbeagle, mackerel shark	*Lamna nasus*	-	Migratory	x	✓
Birds					
Red knot	*Calidris canutus*	Endangered	Migratory	✓	✓
Curlew sandpiper	*Calidris ferruginea*	Critically endangered	Migratory	✓	✓
Southern giant petrel	*Macronectes giganteus*	Endangered	Migratory	✓	✓
Eastern curlew	*Numenius madagascariensis*	Critically endangered	Migratory	✓	✓
Australian fairy tern	*Sternula nereis nereis*	Vulnerable	-	✓	✓
Common noddy	*Anous stolidus*	-	Migratory	✓	✓
Flesh-footed shearwater	*Ardenna carneipes*	-	Migratory	✓	✓
Streaked shearwater	*Calonectris leucomelas*	-	Migratory	✓	✓
Lesser frigatebird	*Fregata ariel*	-	Migratory	✓	✓
Common sandpiper	*Actitis hypoleucos*	-	Migratory	✓	✓
Sharp-tailed sandpiper	*Calidris acuminata*	-	Migratory	✓	✓
Pectoral sandpiper	*Calidris melanotos*	-	Migratory	✓	✓
Osprey	*Pandion haliaetus*	-	Migratory	✓	✓
Great knot	*Calidris ferruginea*	Critically endangered	Migratory	x	✓
Greater sand plover	*Charadrius leschenaultii*	Vulnerable	Migratory	x	✓
Amsterdam albatross	*Diomedea amsterdamensis*	Endangered	Migratory	x	✓
Tristan albatross	*Diomedea dabbenena*	Endangered	Migratory	x	✓
Southern royal albatross	*Diomedea epomophora*	Vulnerable	Migratory	x	✓
Wandering albatross	*Diomedea exulans*	Vulnerable	Migratory	x	✓

Value/ Sensitivity				EMBA	
Common Name	**Species Name**	**EPBC Act Status**		**Operational Area**	**Wider EMBA**
Northern royal albatross	*Diomedea sanfordi*	Endangered	Migratory	x	✓
Blue petrel	*Halobaena caerulea*	Vulnerable	-	x	✓
Northern giant petrel	*Macronectes halli*	Vulnerable	Migratory	x	✓
Fairy prion (southern)	*Pachyptila turtur subantarctica*	Vulnerable	-	x	✓
Abbott's Booby	*Papasula abbottii*	Endangered	-	x	✓
Sooty albatross	*Phoebetria fusca*	Vulnerable	Migratory	x	✓
Indian yellow-nosed albatross	*Thalassarche carteri*	Vulnerable	Migratory	x	✓
Shy albatross	*Thalassarche cauta cauta*	Vulnerable	Migratory	x	✓
White-capped albatross	*Thalassarche cauta steadi*	Vulnerable	Migratory	x	✓
Campbell albatross	*Thalassarche melanophris impavida*	Vulnerable	Migratory	x	✓
Black-browed albatross	*Thalassarche melanophris*	Vulnerable	Migratory	x	✓
Australian lesser noddy	*Anous tenuirostris melanops*	Vulnerable	-	x	✓
Bar-tailed godwit (baueri)	*Limosa lapponica baueri*	Vulnerable	-	x	✓
Northern Siberian bar-tailed godwit	*Limosa lapponica menzbieri*	Critically endangered	-	x	✓
Soft-plumaged petrel	*Pterodroma mollis*	Vulnerable	-	x	✓
Australian painted snipe	*Rostratula australis*	Endangered	-	x	✓
Ruddy turnstone	*Arenaria interpres*	-	Migratory	x	✓
Fork-tailed swift	*Apus pacificus*	-	Migratory	x	✓
Wedge-tailed shearwater	*Ardenna pacifica*	-	Migratory	x	✓
Great frigatebird	*Fregata minor*	-	Migratory	x	✓
Red-tailed tropicbird	*Phaethon rubricauda*	-	Migratory	x	✓
Sanderling	*Calidris alba*	-	Migratory	x	✓
Red-necked stint	*Calidris ruficollis*	-	Migratory	x	✓
Caspian tern	*Hydroprogne caspia*	-	Migratory	x	✓
Bridled tern	*Onychoprion anaethetus*	-	Migratory	x	✓
Roseate tern	*Sterna dougallii*	-	Migratory	x	✓
Oriental plover	*Charadrius veredus*	-	Migratory	x	✓
Oriental pratincole	*Glareola maldivarum*	-	Migratory	x	✓
Bar-tailed godwit	*Limosa lapponica*	-	Migratory	x	✓
Black-tailed godwit	*Limosa limosa*	-	Migratory	x	✓
Whimbrel	*Numenius phaeopus*	-	Migratory	x	✓
Grey plover	*Pluvialis squatarola*	-	Migratory	x	✓
Crested tern	*Thalasseus bergii*	-	Migratory	x	✓
Grey-tailed tattler	*Tringa brevipes*	-	Migratory	x	✓
Common greenshank	*Tringa nebularia*	-	Migratory	x	✓
Terek sandpiper	*Xenus cinereus*	-	Migratory	x	✓

Listed Species Recovery Plans, Conservation Advice and Threat Abatement Plans

BHP considered recent updates to Recovery Plans, Conservation Management Plans, Threat Abatement Plans or approved Conservation Advice in place for EPBC Act-listed threatened species that may potentially occur or utilise habitat within the EMBA (Table 4-7).

Recovery Plans set out the research and management actions necessary to stop the decline of, and support the recovery of listed threatened species. In addition, Threat Abatement Plans provide for the research, management, and any other actions necessary to reduce the impact of a listed key threatening process on native species and ecological communities. The Minister decides whether a threat abatement plan is required for key threatening processes listed under Section 183 of the EPBC Act. Table 4-7 provides information on the specific requirements of the relevant conservation advice, species recovery plans and threat abatement plans that is applicable to the petroleum activity, and demonstrates how current management requirements have been taken into account during the preparation of the EP. Through the implementation of relevant control measures, performance outcomes and performance standards, potential risks and impacts of the petroleum activity are managed to ALARP and acceptable levels.

Table 4-7: Summary of relevant species recovery plans, approved conservation plans and threat abatement plans

Species or Group	Relevant Plan/Conservation Advice	Threats and or Management Strategies Relevant to the Activity	Addressed in EP Section
All Vertebrate Fauna			
All vertebrate fauna	Threat Abatement Plan for the impacts of marine debris on vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018)	Ship-sourced marine debris as a risk to vertebrate marine life through entanglement or ingestion	**Section 8.7**
Marine Mammals			
Sei whale	Conservation Advice for the Sei Whale (Threatened Species Scientific Committee, 2015a)	Noise interference	**Section 7.5**
		Habitat degradation including pollution	**Section 8.3 & 8.5**
		Vessel strike	**Section 8.8**
Blue whale	Conservation Management Plan for the Blue Whale (DoE, 2015a)	Noise interference	**Section 7.5**
		Habitat modification	**Section 8.3 & 8.5**
		Vessel disturbance	**Section 8.8**
Fin whale	Approved Conservation Advice for the Fin Whale (Threatened Species Scientific Committee, 2015b)	Noise interference	**Section 7.5**
		Habitat degradation including pollution	**Section 8.3 & 8.5**
		Vessel strike	**Section 8.8**
Southern right whale	Conservation Management Plan for the Southern Right Whale 2011-2021 (DSEWPaC, 2012a)	Noise interference	**Section 7.5**
		Habitat modification	**Section 8.3 & 8.5**
		Marine debris	**Section 8.7**
		Vessel disturbance/ strike	**Section 8.8**
Humpback whale	Approved Conservation Advice for the Humpback Whale (Threatened Species Scientific Committee, 2015c)	Noise interference	**Section 7.5**
		Habitat degradation	**Section 8.3 & 8.5**
		Marine debris	**Section 8.7**
		Vessel strike	**Section 8.8**
Australian sea lion	Recovery Plan for the Australian Sea Lion (DSEWPaC, 2013a)	Habitat degradation including pollution and oil spills	**Section 8.3**

Species or Group	Relevant Plan/Conservation Advice	Threats and or Management Strategies Relevant to the Activity	Addressed in EP Section
Marine Reptiles			
EPBC Act listed marine turtles in the EMBA: • Loggerhead turtle • Green turtle • Hawksbill turtle • Flatback turtle • Leatherback turtle	National Light Pollution Guidelines for Wildlife, including marine turtles, seabirds and migratory shorebirds (DoEE, 2020). Recovery Plan for Marine Turtles (DoEE, 2017). Approved Conservation Advice for leatherback turtle (DEWHA, 2008).	Light pollution	**Section 7.4**
		Noise interference	**Section 7.5**
		Marine debris	**Section 8.7**
		Vessel disturbance/ strike	**Section 8.8**
		Habitat loss/ modification. Chemical discharge/ deteriorating water quality	**Section 8.3 & 8.5**
Short-nosed seasnake	Approved Conservation Advice for *Aipysurus apraefrontalis* (Short-nosed Sea Snake) (TSSC, 2011a)	Habitat degradation	**Section 8.3 & 8.5**
Fish, Sharks and Rays			
White shark	National Recovery Plan for the White Shark (*Carcharodon carcharias* (DSEWPaC, 2013b)	Habitat modification	**Section 8.3 & 8.5**
Grey nurse shark	Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (DoE, 2014)	Habitat modification	**Section 8.3 & 8.5**
Dwarf sawfish	Approved Conservation Advice for *Pristis clavata* (Dwarf Sawfish) (DEWHA, 2009) Sawfish and River Sharks Multispecies Recovery Plan (DoE, 2015)	Habitat degradation and modification	**Section 8.3 & 8.5**
Green sawfish	Approved Conservation Advice for the Green Sawfish (*Pristis zijsron*) (Threatened Species Scientific Committee, 2008) Sawfish and River Sharks Multispecies Recovery Plan (DoE, 2015b)	Habitat degradation and modification	**Section 8.3 & 8.5**
Whale shark	Approved Conservation Advice for the Whale Shark (*Rhincodon typus)* (TSSC, 2015d)	Marine debris	**Section 8.7**
		Habitat disruption	**Section 8.3 & 8.5**
		Boat strike	**Section 8.8**

Species or Group	Relevant Plan/Conservation Advice	Threats and or Management Strategies Relevant to the Activity	Addressed in EP Section
Birds			
Seabirds and migratory shorebirds	National Light Pollution Guidelines for Wildlife, including marine turtles, seabirds and migratory shorebirds (DoEE, 2020)	Light pollution	**Section 7.4**
Relevant EPBC Act-listed seabirds in the EMBA: • Northern giant petrel • Southern giant petrel • Soft-plumaged petrel • Amsterdam albatross • Black-browed albatross • Campbell albatross • Indian yellow-nosed albatross • Northern royal albatross • Shy albatross • Sooty albatross • Southern royal albatross • Tristan albatross • Wandering albatross • White-capped albatross • Yellow-nosed albatross	Background Paper, Population Status and Threats to Albatrosses and Giant Petrels Listed as Threatened under the EPBC Act 1999 (DSEWPaC, 2011b) Approved Conservation Advice for the soft-plumaged petrel (*Pterodroma mollis*) (TSSC, 2015e)	Marine pollution	**Section 8.3 & 8.5**
		Marine debris	**Section 8.7**
Australian lesser noddy	Approved Conservation Advice for the Australian lesser noddy (*Anous tenuirostris melanops*) (TSSC, 2015f)	Pollution and oil spills	**Section 8.3 & 8.5**
Red knot	Approved Conservation Advice for the red knot (*Calidris canutus*) (TSSC, 2016a)	Habitat loss and degradation Pollution/ contamination impacts	**Section 8.3 & 8.5**
Great knot	Approved Conservation Advice for the great knot (*Calidris tenuirostris*) (TSSC, 2016b)	Habitat loss and degradation from pollution	**Section 8.3 & 8.5**
Greater sand plover	Approved Conservation Advice for the greater sand plover (*Charadruis leschenaultii*) (TSSC, 2016c)	Habitat loss and degradation from pollution	**Section 8.3 & 8.5**
Curlew sandpiper	Approved Conservation Advice for the curlew sandpiper (*Calidris ferruginea*) (TSSC, 2015g)	Habitat loss and degradation from pollution	**Section 8.3 & 8.5**
Blue petrel	Approved Conservation Advice for the blue petrel (*Halobaena caerulea*) (TSSC, 2015h)	None listed relevant to the activity	**N/A**

Species or Group	Relevant Plan/Conservation Advice	Threats and or Management Strategies Relevant to the Activity	Addressed in EP Section
Bar-tailed godwit (baueri)	Approved Conservation Advice for the bar-tailed godwit (western Alaskan) (*Limosa lapponica baueri*) (TSSC, 2016d)	Habitat loss and degradation from pollution	**Section 8.3 & 8.5**
Northern Siberian bar-tailed godwit	Approved Conservation Advice for the bar-tailed godwit (northern Siberian) (*Limosa lapponica menzbieri*) (TSSC, 2016e)	Habitat loss and degradation from pollution	**Section 8.3 & 8.5**
Eastern curlew	Approved Conservation Advice for eastern curlew (*Numenius madagascariensis*) (TSSC, 2015i)	Habitat loss and degradation from pollution	**Section 8.3 & 8.5**
Fairy prion (southern)	Approved Conservation Advice for fairy prion (southern) (*Pachyptila turtur subantarctica*) (TSSC, 2015j)	None listed relevant to the activity	**N/A**
Abbott's booby	Approved Conservation Advice for Abbott's booby (*Papasula abbotti*) (TSSC, 2015k)	Marine pollution	**Section 8.3**
Australian painted snipe	Approved Conservation Advice for Australian painted snipe (*Rostratula australis*) (DSEWPaC, 2013c)	None listed relevant to the activity	**N/A**
Australian fairy tern	Approved Conservation Advice for Australian fairy tern (*Sternula nereis nereis*) (TSSC, 2011)	Oil spills	**Section 8.3 & 8.5**

Biologically Important Areas and Habitat Critical to the Survival of a Species

The Conservation Values Atlas[1] identifies biologically important areas (BIAs) for some of the region's protected species. These are areas that are considered to be particularly important for the conservation of protected species and where aggregations of individuals display biologically important behaviour such as breeding, foraging, resting or migration. BIAs are not protected matters and should not be confused with 'critical habitat' as defined in the EPBC Act.

A review of the Conservation Values Atlas identified the following BIAs for protected species that intersect with the operational area. BIAs for four species overlap with the operational area. The identified protected species and the relevant BIAs are:

- Humpback whales – migratory corridor (North and South) and waters to about 50 km offshore (Figure 4-6);
- Pygmy blue whale – distribution (Exmouth, North West Cape area) (Figure 4-6);
- Flatback turtle – inter-nesting (North West Cape area, Exmouth Gulf) (Figure 4-7); and
- Wedge-tailed shearwater – breeding and foraging (North West Cape area) (Figure 4-14).

In addition, a number of BIAs occur within the wider EMBA (Table 4-8). Refer to the specific species descriptions for further information.

Table 4-8: BIAs within the wider EMBA

Species	BIA Type	Approx. distance from operational area (km)
Marine Mammals		
Pygmy blue whale (refer to Figure 4-6)	Migration (Exmouth, North West Cape)	10 km
	Foraging (Ningaloo)	40 km
Blue whale and pygmy blue whale (refer to Figure 4-6)	Foraging (on migration) (outer continental shelf from south of Jurien Bay to Cape Naturaliste)	1,015 km
Dugong (refer to Figure 4-12)	Multi-use (breeding, foraging/nursing/calving) (Ningaloo coast[1], Exmouth Gulf, Shark Bay)	22 km
Australian sea lion (refer to Figure 4-13)	Breeding, foraging, haul-out sites (Houtman Abrolhos Islands)	720 km
Marine Reptiles		
Flatback turtle (refer to Figure 4-7)	Foraging (Barrow Island)	141 km
	Nesting (Thevenard Island[1], Barrow Island, Montebello Islands)	90 km
	Inter-nesting (North West Cape[1], Muiron Islands, Thevenard Island, Barrow Island, Montebello Islands)	Intercepts operational area
Green turtle (refer to Figure 4-8)	Foraging (Barrow Island)	141 km
	Nesting (North West Cape[1], Muiron Islands, Barrow Island, Montebello Islands)	27 km
	Inter-nesting (North West Cape[1], Muiron Islands, Barrow Island, Montebello Islands)	5 km
Hawksbill turtle (refer to Figure 4-9)	Nesting (Ningaloo coast and Jurabi coast[1], Thevenard Island, Barrow Island, Lowendal Islands)	25 km
	Inter-nesting (Ningaloo coast and Jurabi coast[1], Thevenard Island, Barrow Island, Lowendal Islands, Montebello Islands)	25 km

[1] Department of the Environment and Energy. Commonwealth of Australia Atlas. <http://www.environment.gov.au/arcgis-framework/apps/ncva/ncva.jsf>

Species	BIA Type	Approx. distance from operational area (km)
Loggerhead turtle (refer to Figure 4-10)	Nesting (Ningaloo and Jurabi coast[1], Muiron Islands, Montebello Islands, Dirk Hartog Island)	4 km
	Inter-nesting (Ningaloo[1], Muiron Islands, Montebello Islands, Dirk Hartog Island)	4 km
Fish/ Sharks		
Whale shark (refer to Figure 4-11)	Foraging (Ningaloo Marine Park and adjacent Commonwealth waters)	200 m
White shark (refer to Figure 4-11)	Foraging (Houtman Abrolhos Islands, coastal waters from Dongara to Wedge Island)	730 km
Birds		
Australian lesser noddy (refer to Figure 4-14)	Foraging (Houtman Abrolhos Islands)	730 km
Bridled tern (refer to Figure 4-14)	Foraging (south from north of Abrolhos Islands)	680 km
Caspian tern (refer to Figure 4-14)	Foraging (south from north of Abrolhos Islands)	680 km
Common noddy (refer to Figure 4-14)	Foraging (Houtman Abrolhos Islands)	730 km
Fairy tern (refer to Figure 4-14)	Breeding and foraging (North West Cape[1], Thevenard Island, Barrow Island, Montebello islands, Shark Bay)	30 km
Lesser crested tern[2] (refer to Figure 4-14)	Breeding (Thevenard Island[1], Lowendal Islands, island off Dirk Hartog Island)	65 km
Little shearwater[2] (refer to Figure 4-14)	Foraging (coastal and offshore waters south from Kalbarri)	640 km
Pacific gull (refer to Figure 4-14)	Foraging (Houtman Abrolhos Islands)	730 km
Roseate tern (refer to Figure 4-14)	Breeding and foraging (Ningaloo[1], Thevenard Island, Barrow Island, Shark Bay)	90 km
Soft-plumaged petrel (refer to Figure 4-14)	Foraging (offshore waters south of Geraldton)	835 km
Sooty tern (refer to Figure 4-14)	Foraging (offshore waters west of Shark Bay)	490 km
Wedge-tailed shearwater (refer to Figure 4-14)	Breeding and foraging (Exmouth[1], islands off Onslow, Barrow Island, Shark Bay)	Intercepts operational area

[1] Where multiple BIAs overlap with the wider EMBA, the distance shown is the distance of the closest BIA to the operational area.
[2] The little shearwater, lesser crested tern, Pacific gull and sooty tern are not listed as threatened or migratory under the EPBC Act.

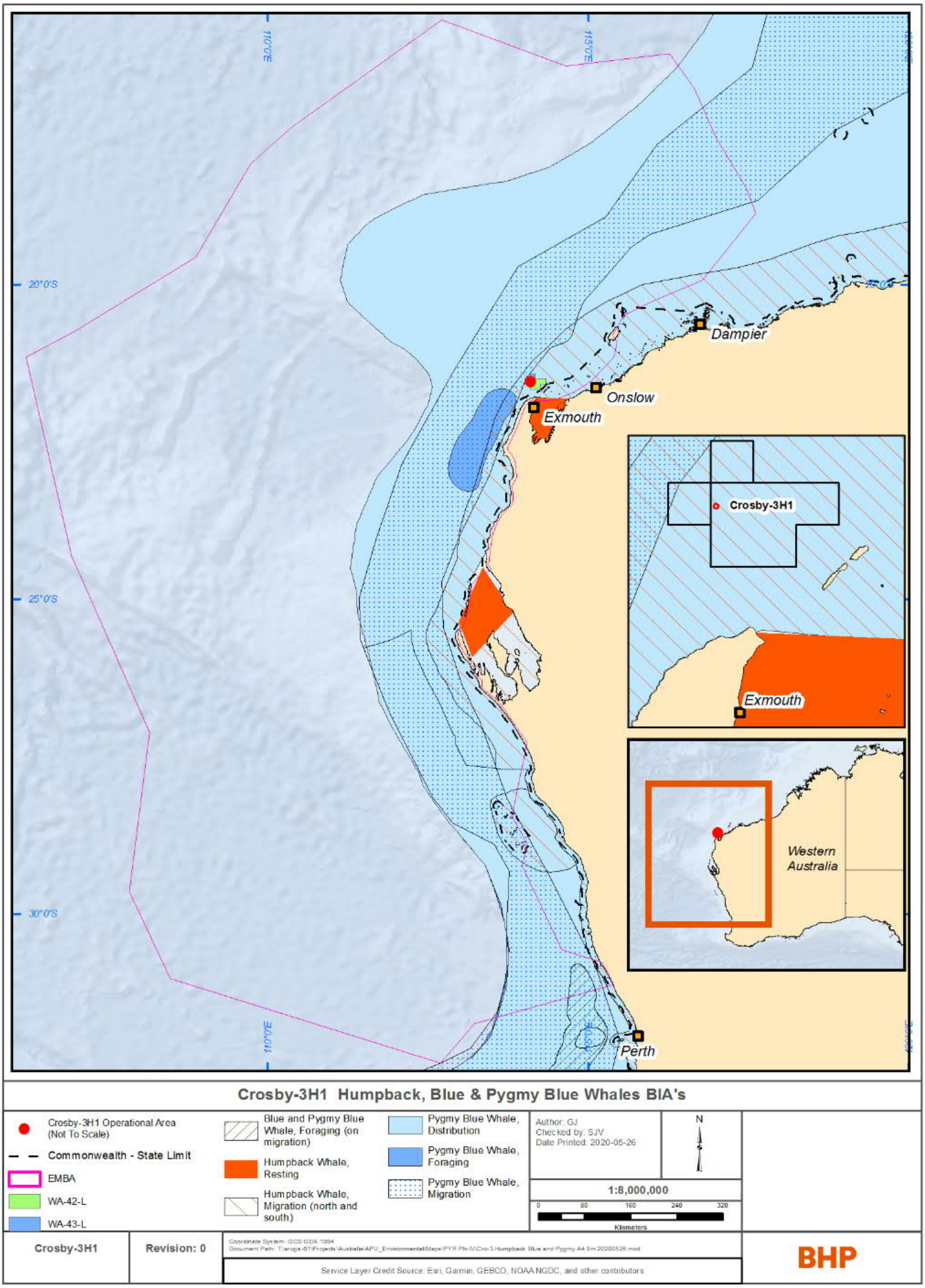


Figure 4-6: Biologically important areas for humpback, blue and pygmy blue whales

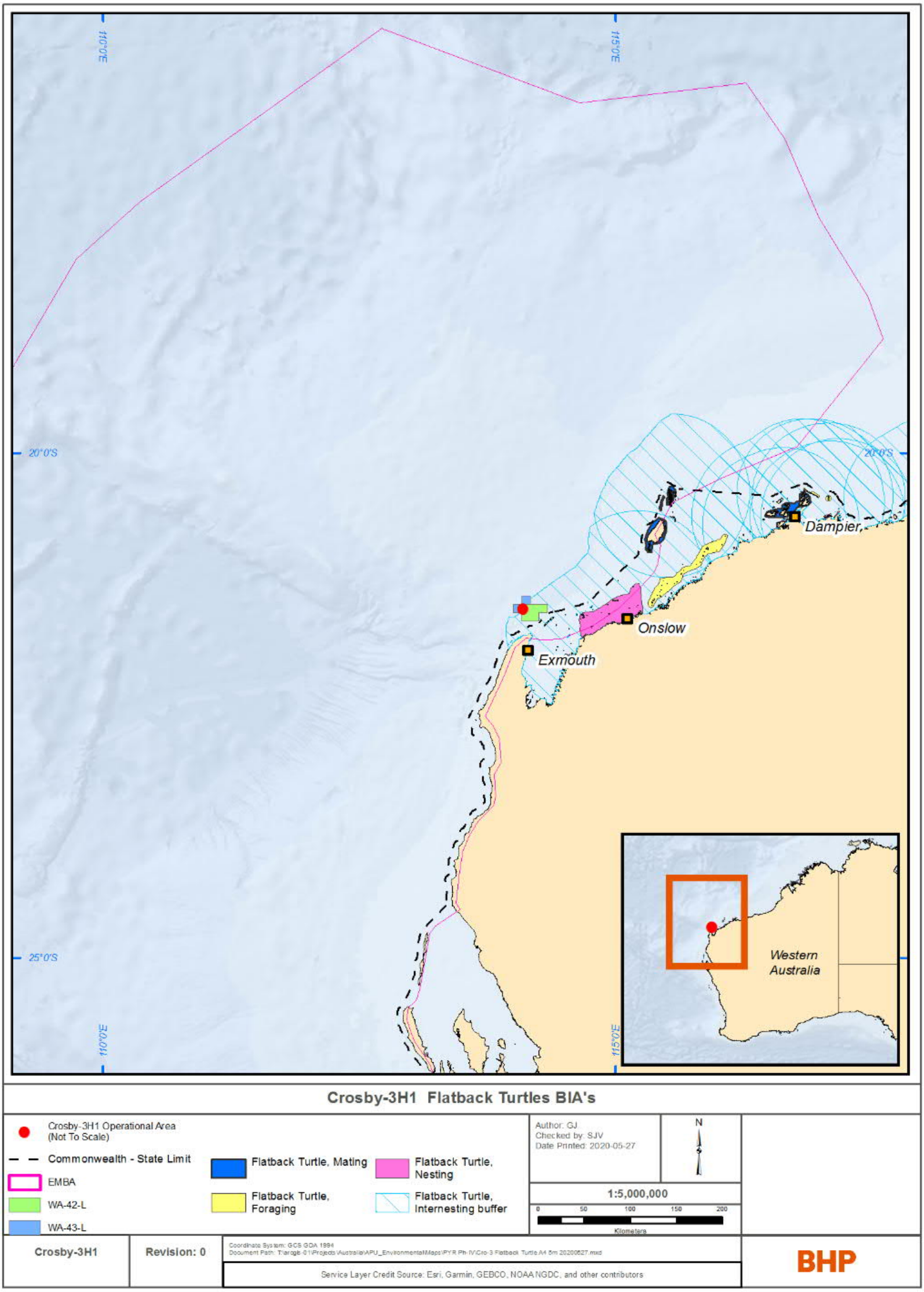


Figure 4-7: Biologically important areas for flatback turtles

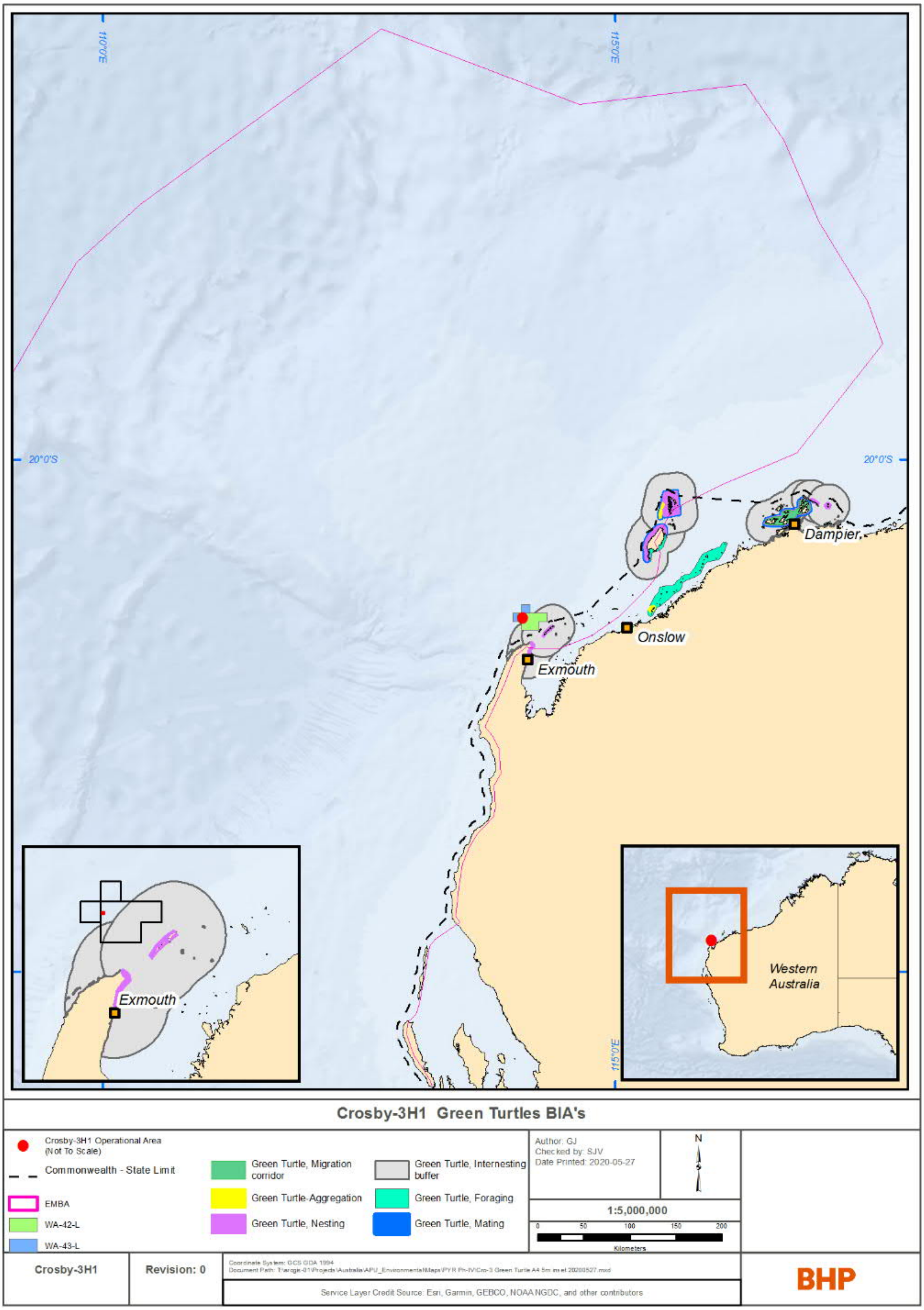


Figure 4-8: Biologically important areas for green turtles

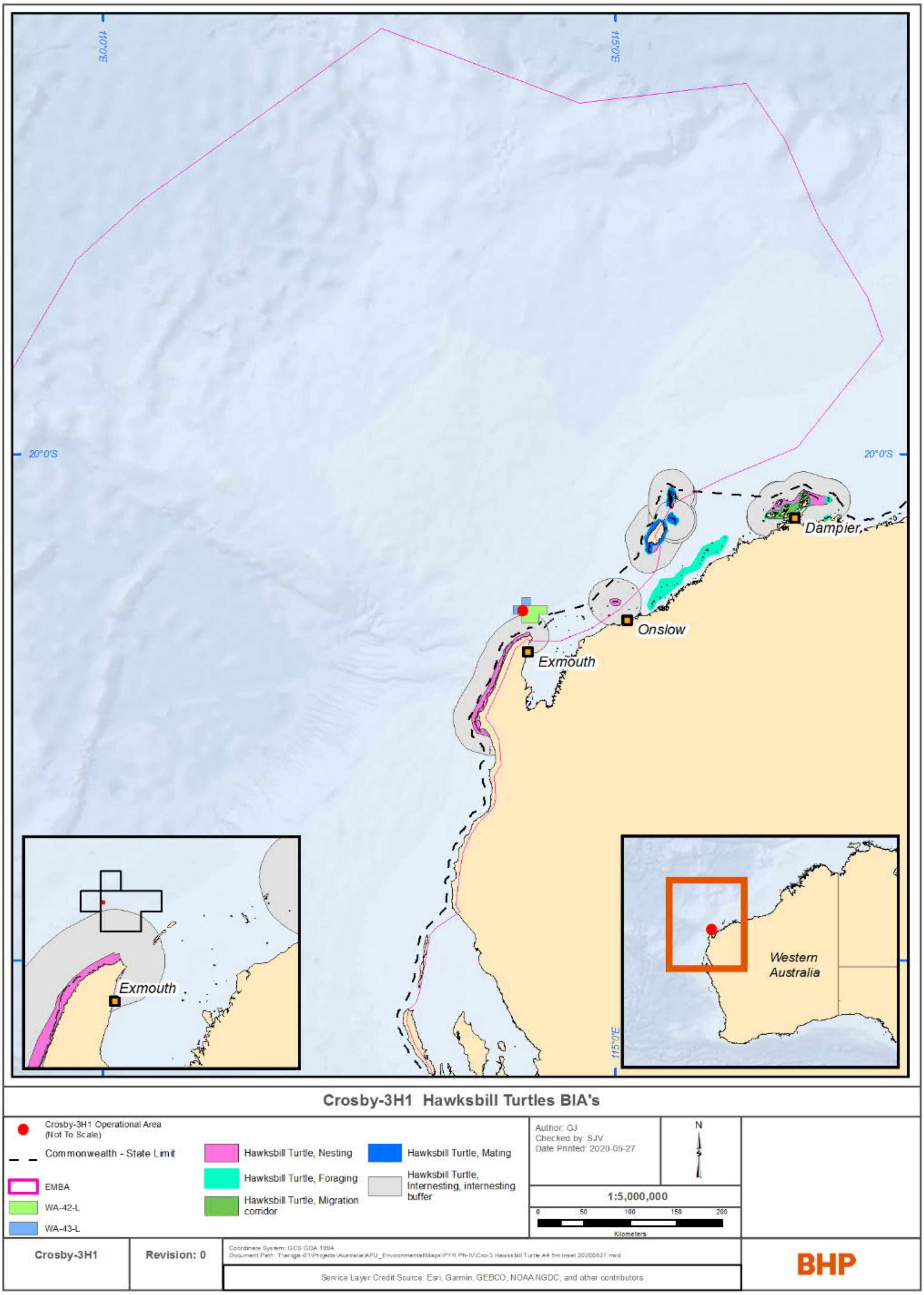


Figure 4-9: Biologically important areas for hawksbill turtles

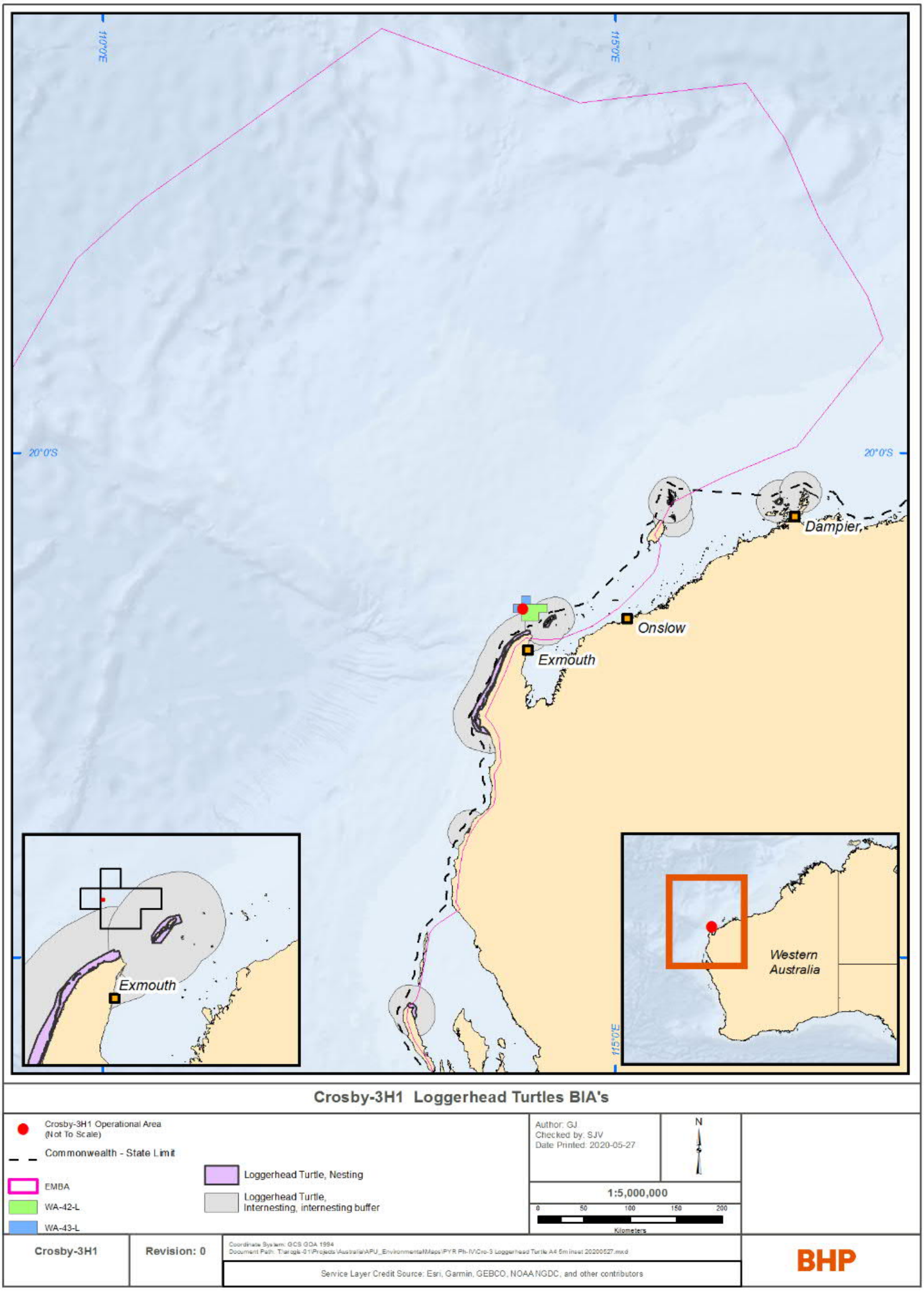


Figure 4-10: Biologically important areas for loggerhead turtles

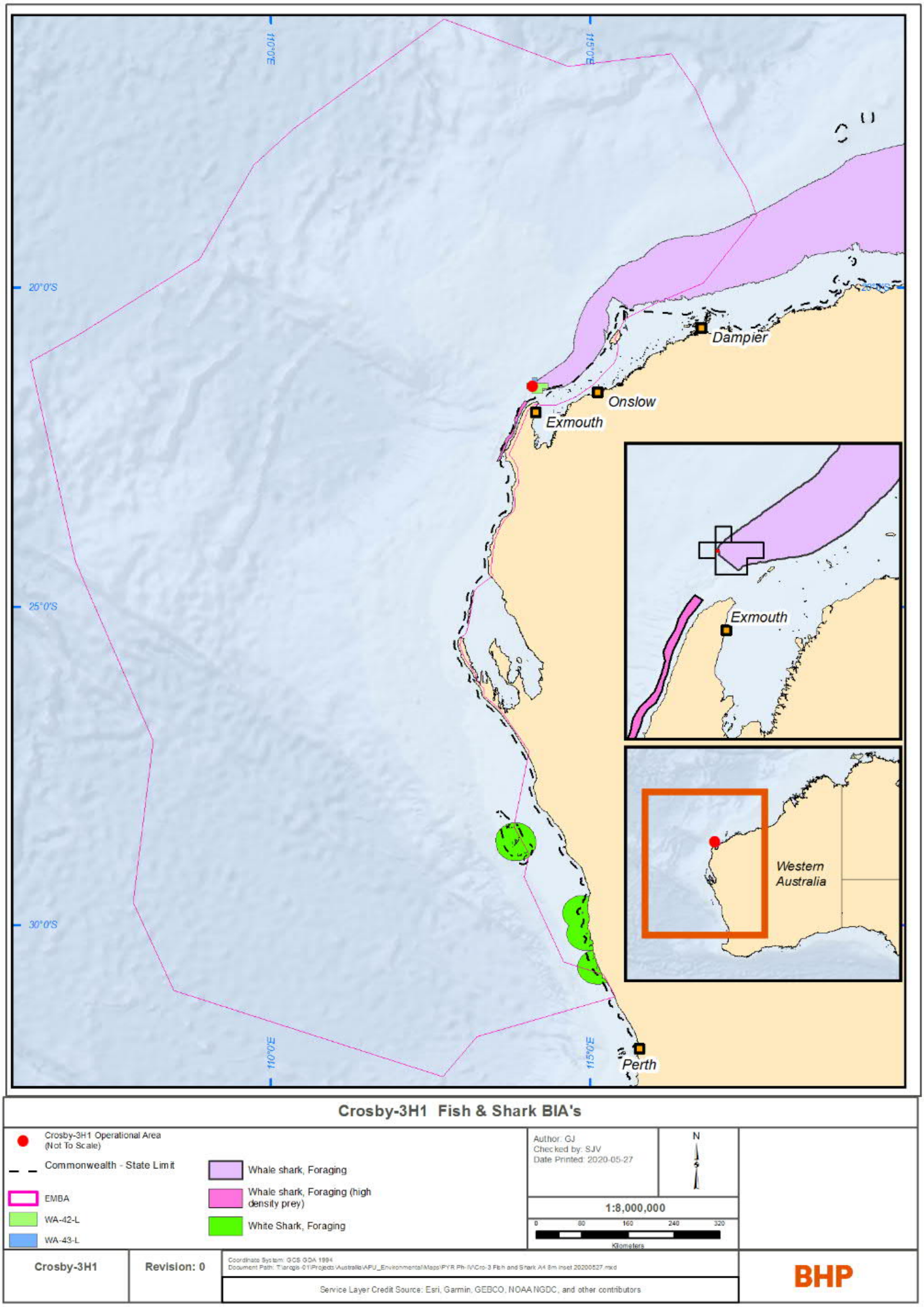


Figure 4-11: Biologically important areas for whale shark and white shark

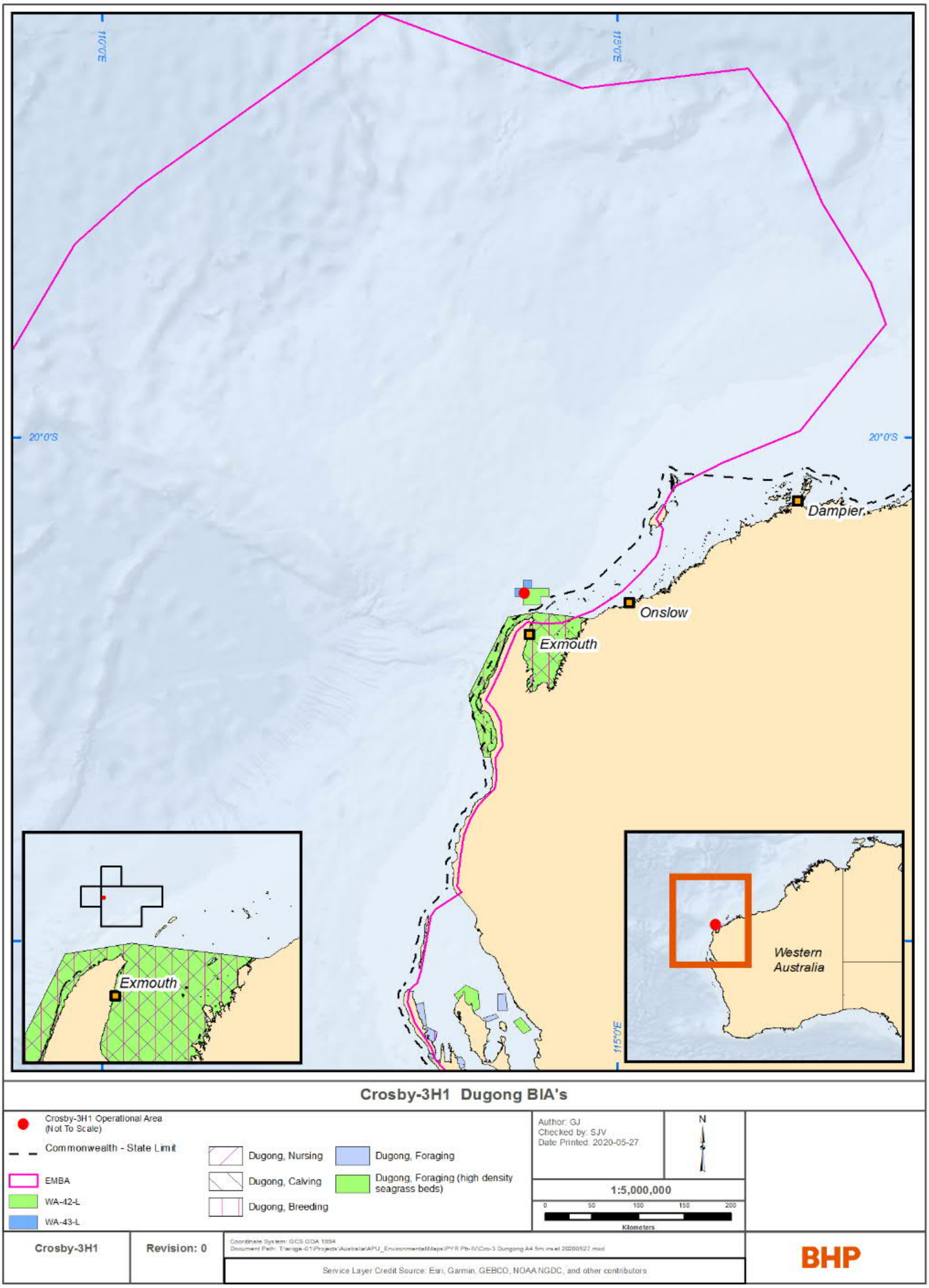


Figure 4-12: Biologically important areas for dugongs

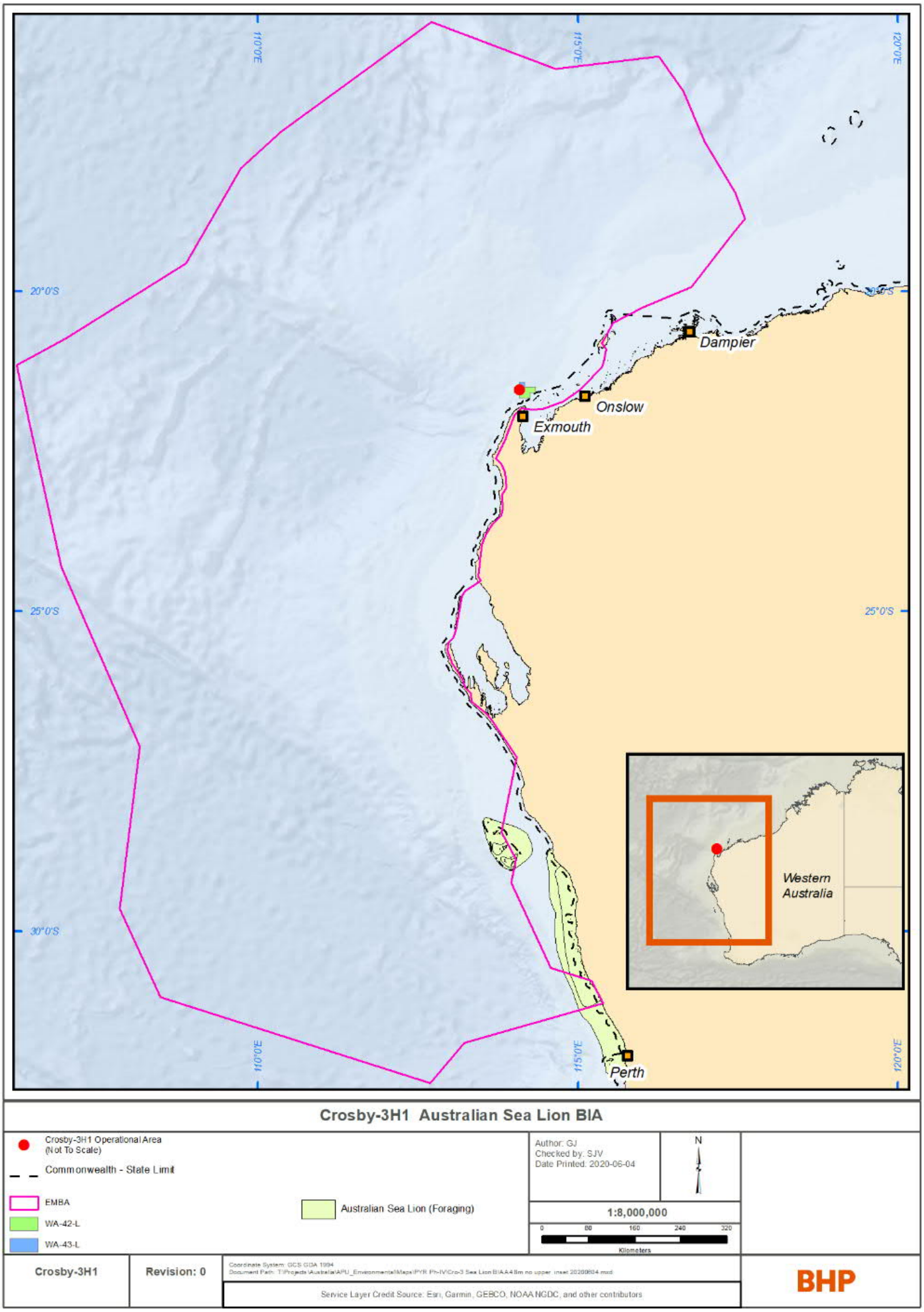


Figure 4-13: Biologically important areas for Australian sea lion

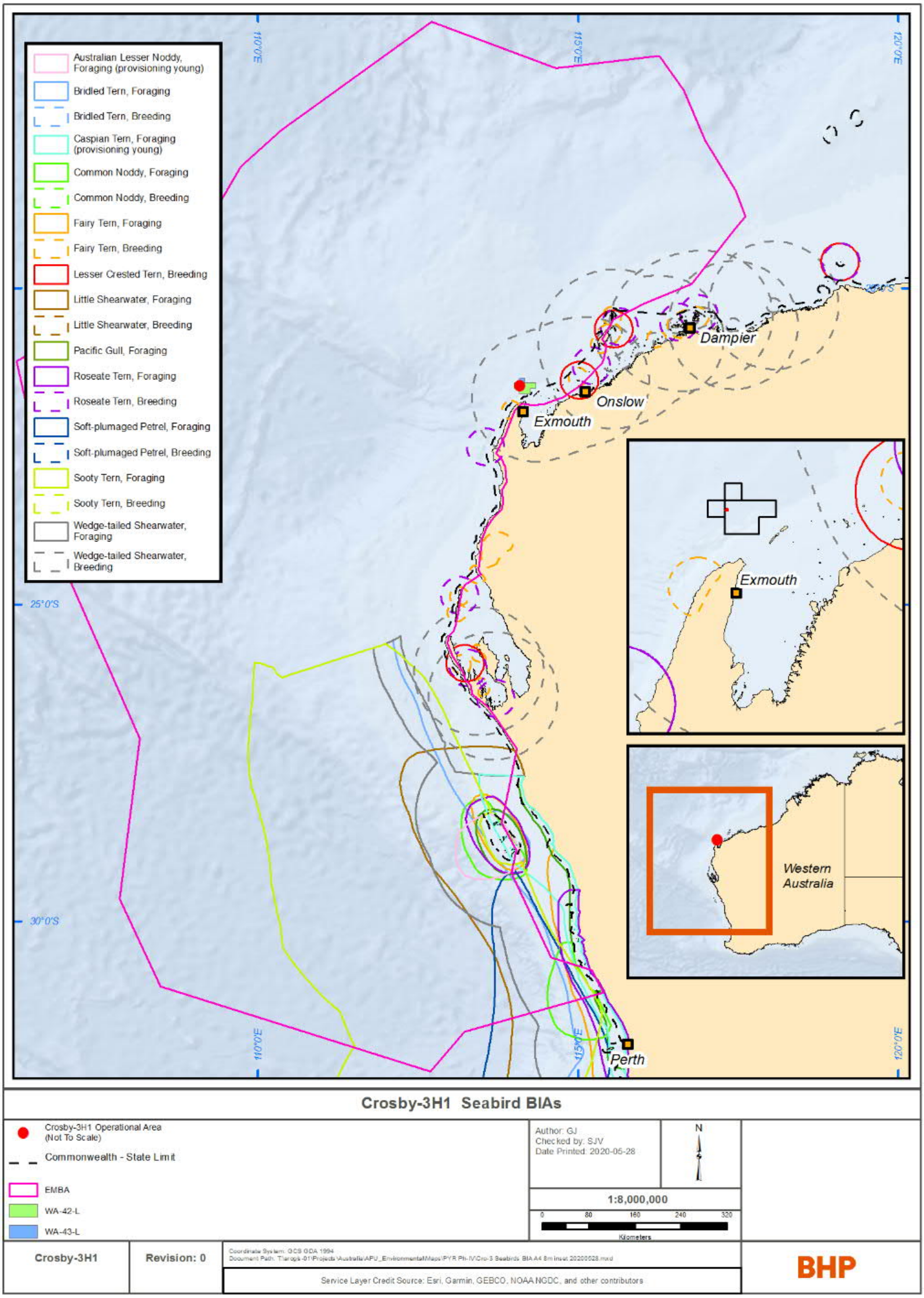


Figure 4-14: Biologically important areas for seabirds

Habitat Critical to the Survival of a Species

'Habitat critical to the survival of a species' is defined within the EPBC Act Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DoE, 2013) as areas that are necessary:

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

The Recovery Plan for Marine Turtles in Australia (DoEE, 2017) provides details of habitat critical to the survival of several species of marine turtle genetic stock (summarised in Table 4-9). The EMBA intercepts the following:

- Inter-nesting habitat critical to the survival of flatback turtles (intercepts the operational area); and
- Inter-nesting habitat critical to the survival of flatback, green, loggerhead and hawksbill turtles (intercepts the wider EMBA).

Figure 4-15 shows the habitat critical to the survival of relevant marine turtles that intercept the EMBA.

Table 4-9: Nesting and inter-nesting areas identified as 'habitat critical to the survival of marine turtles' within the EMBA

Turtle Species	Nesting Location / Inter-nesting Buffer	Nesting Period	EMBA	
			Operational Area	Wider EMBA
Flatback turtle (Pilbara stock)	60 km radius of nesting locations: Muiron Islands, Pilbara coast, coastal islands from Cape Preston to Locker Island, Montebello Islands	Oct-Mar	✓	✓
Green turtle (NWS genetic stock)	20 km radius of nesting locations: Serrurier Island, Northwest Cape, Exmouth Gulf, Barrow Island, Montebello Islands, Thevenard Island, Shark Bay to Ningaloo coast	Nov-Mar	x	✓
Hawksbill turtle (WA stock)	20 km radius of nesting locations: Muiron Islands, and mainland beaches from Cape Range to Ningaloo and Gnaraloo to Red Buff, Cape Preston to mouth of Exmouth Gulf, Montebello Islands	Oct-Feb	x	✓
Loggerhead turtle (WA stock)	20 km radius of nesting locations: North West Cape, Ningaloo coast, Muiron Islands, Gnaraloo Bay, Dirk Hartog Island	Nov-May	x	✓

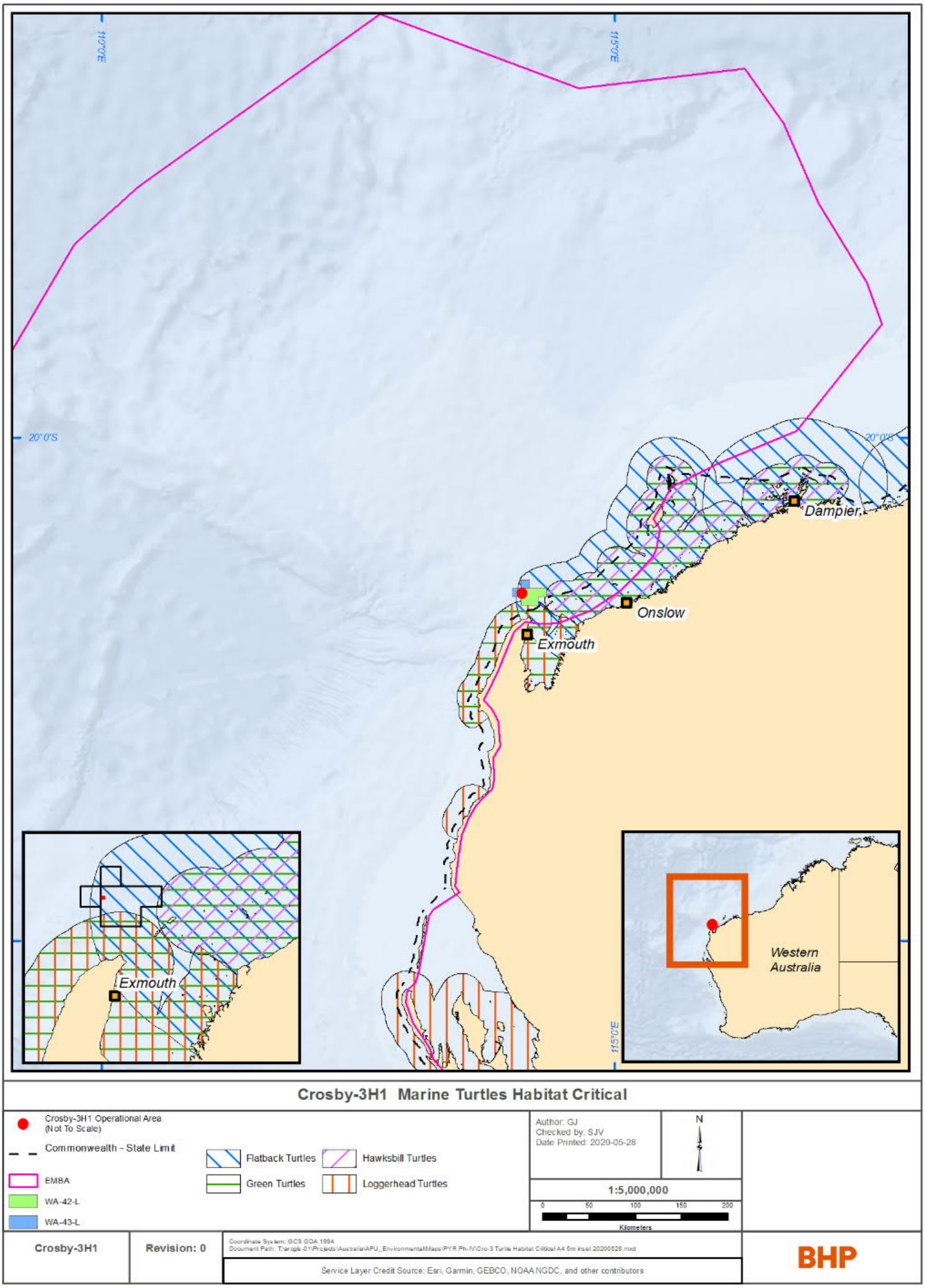


Figure 4-15: Habitat critical to the survival of marine turtles within the EMBA

Summary of Windows of Ecological Sensitivity

Table 4-10 provides a summary of the windows of ecological sensitivity for values identified within and around the operational area and the wider EMBA, with approximate closest distance to the operational area. These receptors are considered throughout the EP in terms of the identified potential risk.

Table 4-10: Key environmental sensitivities and timing of biologically important activity

Category	Environmental Sensitivity	Month											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Habitats/ Communities	Phytoplankton abundance												
	Zooplankton abundance												
	Coral spawning												
	Seagrass												
	Macroalgae	growing				shedding fronds				growing			
Marine Fauna (threatened/ migratory species)	Green turtle nesting												
	Loggerhead turtle nesting												
	Leatherback turtle nesting												
	Hawksbill turtle nesting												
	Flatback turtle nesting												
	Humpback whale migration						north			south			
	Humpback whale calving								calving				
	Blue whale migration				north							south	
	Whale shark (Ningaloo)				aggregation								
	Dugong aggregation	breeding								breeding			
	Seabird nesting												
	Australian sea lion (Houtman Abrolhos Is.) breeding	Non-annual breeding cycle – breeding times differ between colonies											
Legend		Peak occurrence/ activity (reliable and predictable)											
		Low level of occurrence/ activity (may vary from year to year)											
		Activity can occur throughout the year											
		No occurrence											

4.6 Marine Mammals

4.6.1 Threatened Species

A search of the EPBC Protected Matters database identified six threatened species (five of which are also migratory species) as having the potential to occur or have habitat within the wider EMBA. Five of the six species may also occur within the operational area.

Sei Whale (*Balaenoptera borealis*)

Sei whales (*Balaenoptera borealis*) are listed as vulnerable and migratory under the EPBC Act. Sei whales are not commonly recorded in Australian waters and their similarity to Bryde's whales has resulted in confusion about their distributional limits and the accuracy of recorded observations (DoE, 2020). There are no known mating or calving areas in Australian waters. The species migrates 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 in Victoria) as well as in deeper offshore waters and have only been sighted in summer and autumn (DAWE, 2020).

Sei whales were identified as potentially occurring within the operational area and wider EMBA; however due to infrequent sightings in Australia, there occurrence is considered unlikely.

Blue Whale

Blue whales (*Balaenoptera musculus*) are listed as endangered and migratory under the EPBC Act There are two recognised subspecies of blue whale in the southern hemisphere that are both recorded in Australian waters, the southern (or 'true' blue whale (*Balaenoptera musculus intermedia*) and the 'pygmy' blue whale (*Balaenoptera musculus brevicauda*). In general, southern blue whales occur in waters south of 60°S and pygmy blue whales occur in waters north of 55°S (i.e. not in the Antarctic). By this definition, all blue whales in waters from Kalbarri to the Northern Territory border are assumed to be pygmy blue whales, and are discussed below.

Pygmy blue whales have a southern hemisphere distribution, migrating from tropical water breeding grounds in winter to temperate and polar water feeding grounds in summer (Bannister *et al*., 1996; Double *et al*., 2014). Passive acoustic data documented pygmy blue whales migrating along the Western Australian shelf break at depth of 500 to 1,000 m (McCauley & Jenner, 2010) (Figure 4-16).

During the southern migration, pygmy blue whales pass south of the Montebello Islands and Exmouth from October to the end of January, peaking in late November to early December (Double *et al*., 2012). On the return journey, 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. Blue whales have been detected off Exmouth and the Montebello Islands between April and August (Double *et al*., 2012; McCauley & Jenner, 2010) (Figure 4-16).

Blue whales were identified as potentially occurring within the operational area and wider EMBA. Foraging and migration BIAs for the pygmy blue whale intercept the wider EMBA (Figure 4-6). Considering the known usage of the area, it is likely that the pygmy blue whale will be regionally present, particularly over the summer season and may occur in the wider EMBA between April and August (north-bound migration) and October to January (south-bound migration).

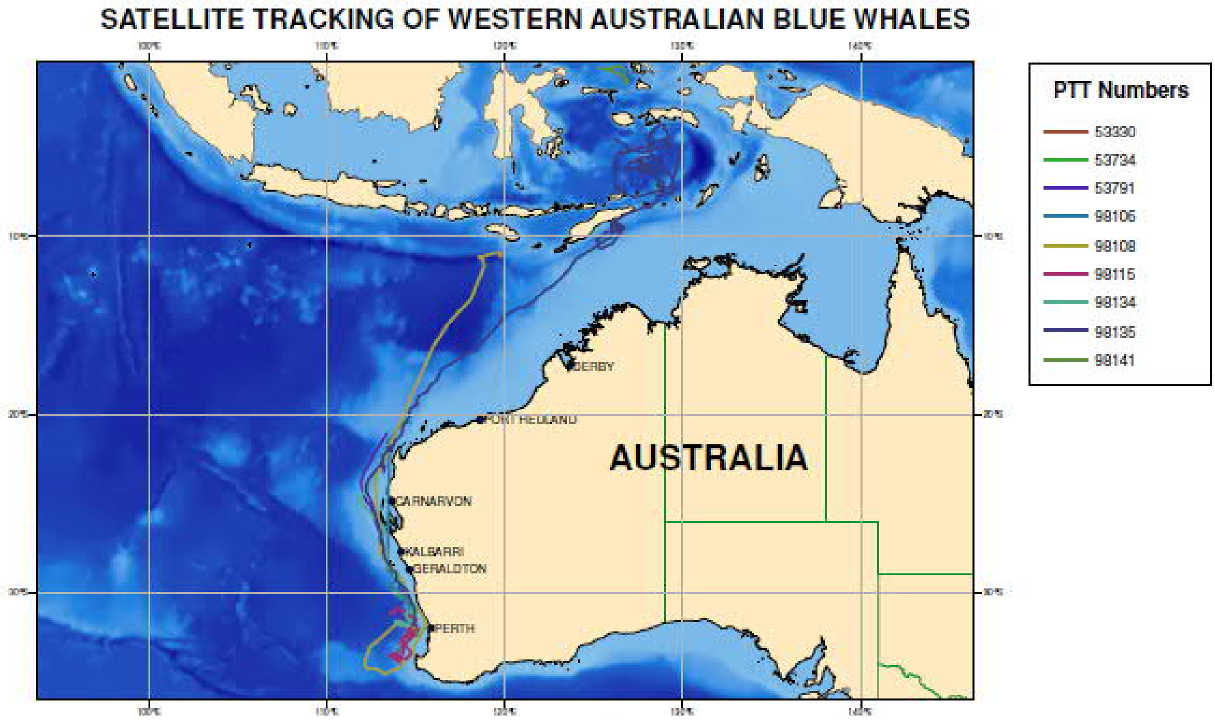


Figure 4-16: Satellite tracking of blue whales in 2010/2011, modified from Double *et al*., (2012)

Fin Whale

The fin whale (*Balaenoptera physalus*) is listed as vulnerable and migratory under the EPBC Act. The fin whale is the second-largest whale species after the blue whale. Fin whale distribution in Australian waters is known primarily from stranding events and whaling records. Due to scarcity of sighting records, the distribution cannot be accurately determined although it is thought to be present along the western coast of Australia, southern Australia around to Tasmania. The Australian Antarctic waters are important feeding grounds but there are no known mating or calving areas in Australian waters (Morrice *et al*., 2004). The migration routes and location of winter breeding grounds are uncertain, but presence in Australian waters has been detected in summer and autumn months (DoEE, 2017).

Fin whales were identified as potentially occurring within the operational area and wider EMBA; however due to infrequent sightings in Australia the likelihood of these whales being present is low.

Southern Right Whale

The southern right whale (*Eubalaena australis*) is listed as endangered and migratory under the EPBC Act. It is seasonally present on the Australian coast between May and November and recorded in the coastal waters of all Australian states (Bannister *et al*., 1996). Major calving areas are located in Western Australia at Doubtful Island Bay, east of Israelite Bay in the south-west; and in South Australia at Head of Bight (Bannister *et al*., 1996). The distribution of southern right whales in Australian waters other than near the coast is unknown and very little information is known about the migratory patterns, habitats, calving areas or feeding habits; but peak periods for mating are known to be from mid-July through to August (DAWE, 2020).

Isolated individuals have been seen outside the normal season but a summer sighting would be very unusual. Australian southern right whales migrate seasonally between higher and middle latitudes. The general timing of migratory arrivals and departures varies slightly each year. Migratory pathways are not well known (Bannister *et al*., 1996). A circular, anticlockwise migration pattern south of the Australian continent was proposed by Hart *et al*. (1842), based on the seasonal location of whaling activity. This generalised migratory pattern is further supported by the majority of inter-year coastal movements being in a westerly direction and between-year coastal movements being in an easterly direction (Burnell, 2001).

Southern right whales were identified as potentially occurring within the operational area and wider EMBA. No BIAs are present within the EMBA, and as such, their presence is likely to be limited to individuals transiting the area.

Humpback Whale

The humpback whale (*Megaptera novaengliae*) is listed as vulnerable and migratory under the EPBC Act. Humpback whales occur throughout Australian waters, their distribution being influenced by their migratory pathways and aggregation areas for resting, breeding and calving. In the southern hemisphere, humpback whale populations spend the summer months feeding in the Antarctic polar region before migrating north to tropical breeding/calving grounds in the coastal waters of the Kimberley.

Aerial surveys and noise logger recordings undertaken for Chevron's Wheatstone Project show that the main distribution of humpback whales were sighted at an average distance of 50 km from the mainland during the northern migration and 35 km during the southbound migration (RPS, 2010). The southbound migration moves down the coast between late August and November, although females with calves have been documented leaving the calving areas last, with a later peak in abundance observed from mid-August to mid-September (Jenner *et al*., 2001). Figure 4-17 illustrates the results of aerial surveys conducted during a single year between the north-west cape and Barrow Island.

Humpback whales were identified as occurring within the operational area and the wider EMBA (Figure 4-6). The operational area intersects the humpback whale migration BIA and waters out to about 50 km offshore as part of the migratory corridor for these whales. The wider EMBA intersects a portion of the Exmouth Gulf resting area. Individuals may be sighted particularly between June and December whilst transiting through to rest areas of the Exmouth Gulf.

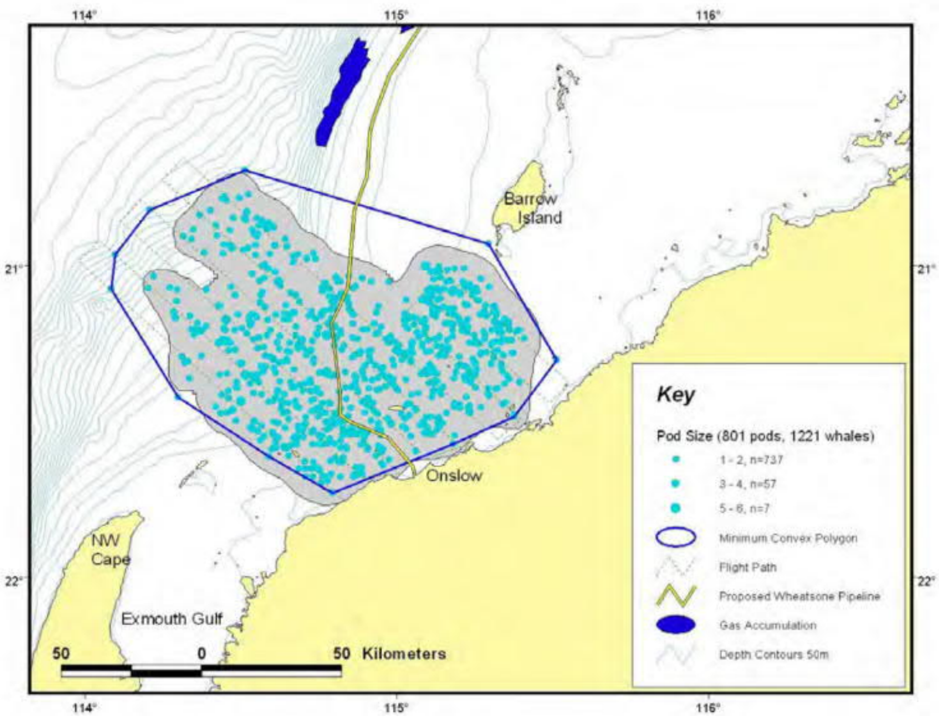


Figure 4-17: Aerial survey sightings of humpback whales from June to December 2009 (taken from Jenner *et al*., 2010)

Australian Sea Lion

The Australian sea lion (*Neophoca cinerea*) is lised as vulnerable under the EPBC Act. The Australian sea lion is the only pinniped endemic to Australia. The breeding range extends from Houtman Abrolhos, Western Australia, to The Pages Island, east of Kangaroo Island, South Australia. Breeding colonies occur on islands aor remote sections of coastline. Over 66 breeding colonies have been recorded: 28 in WA and 38 in SA (DAWE, 2020). The Australian sea lion exhibits high site fidelity and little movement of females between colonies have been observed.

Australian sea lions use a wide variety of habitats for breeding sites (called rookeries), and during the non-breeding season, for haul-out sites. Onshore habitats used include exposed islands and reefs, rocky terrain, sandy beaches and vegetate for dunes and swales (DAWE, 2020). They feed on a wide variety of prey, including cephalopods, fish, sharks, rock lobsters and sea birds.

The Australian sea lion were identified as occurring within the wider EMBA, with breeding known to occur at the Houtman Abrolhos Islands. The wider EMBA intersects BIAs (breeding, foraging, haul-out sites) for the species (Figure 4-13).

4.6.2 Migratory Species

A search of the EPBC Protected Matters database identified an additional nine migratory species as having the potential to occur or have habitat within the wider EMBA, of which four may also occur within the operational area.

Bryde's Whale

Bryde's whale (*Balaenoptera edeni*) is listed as migratory under the EPBC Act. Bryde's whale is considered the least migratory of the whale species in Australian waters and is typically found in tropical waters between 40°S and 40°N year round (Bannister *et al*., 1996; DAWE, 2020). This is supported by noise logger recordings of Bryde's whales year round near Scott Reef. The species frequents oceanic waters as well as nearshore areas following zones of upwelling around the continental shelf (Mustoe and Edmunds, 2008).

Bryde's whales were identified as potentially occurring within the operational area and wider EMBA.

Orca, Killer Whale

Orca (*Orcinus orca*) is listed as migratory under the EPBC Act and is the largest member of the dolphin family. Orca are found in both tropical and temperate waters in oceanic, pelagic and neritic waters (DAWE, 2020). Orca usually travel in groups of 10-30 individuals and make seasonal migrations, and may follow regular migratory pathways; however this has not been proven. No specific information on migratory pathways along the WA coast is documented. Orca have been recorded relocating to Antarctic waters during summer months and back to warmer waters during winter. This suggests that during the winter months would be the highest likelihood of occurrence of orca on the NWS.

Orca have been identified as potentially occurring within the operational area and wider EMBA.

Sperm Whale

The sperm whale (*Physeter macrocephalus*) is listed as migratory under the EPBC Act. They have a wide distribution extending from the polar regions to the equator although they are usually found in deeper oceanic waters near continental breaks and canyons (DAWE, 2020). Females and young males tend to remain in warmer waters, whereas adult males venture further away from the equator to colder waters. Limited information exists on sperm whale distribution in Australian waters.

Sperm whales were identified as potentially occurring within the operational area and wider EMBA.

Spotted Bottlenose Dolphin

The spotted bottlenose dolphin (Arafura/Timor Sea population) (*Tursiops aduncus*) is listed as migratory under the EPBC Act. Occurring Australia wide, this species resembles the common bottlenose dolphin. This species prefers shallower inshore bays and estuaries and travels in groups consisting on average of between five and 16 individuals (DAWE, 2020). Migratory movements in Australia are variable, and are likely to be triggered by baitfish movements. This species can spend all year in one location, but can also make long-range movements.

The spotted bottlenose dolphin was identified as potentially occurring within the operational area and wider EMBA.

Pygmy Right Whale

The pygmy right whale (*Caperea marginata*) is listed as migratory under the EPBC Act. Little is known of this small and elusive baleen whale with few sightings recorded. In Australia, they have been recorded between 32º S and 47º S, but are not uniformly spread around the coast, with the northern distribution on the west coast may be limited by the Leeuwin current.

The pygmy right whale may occur within the southernmost extent of the wider EMBA.

Dusky Dolphin

The dusky dolphin (*Lagenorhynchus obscurus*) is listed as migratory under the EPBC Act and occur mostly in temperate and sub-Antarctic zones. In Australia, the dusky dolphin has been sighted in southern Australia from WA to Tasmania. The area of occupancy is unknown, but it is considered to primarily inhabit inshore waters, but may also move offshore to seek out colder waters in summer months (DAWE, 2020).

Dusky dolphins have been identified as potentially occurring within the southernmost extent of the wider EMBA.

Indo-Pacific Humpback Dolphin

The Indo-Pacific humpback dolphin (*Sousa chinensis*) is listed as migratory under the EPBC Act. The species is known to occur along the Exmouth Gulf around the North West Cape round to the Queensland/NSW border. The total population size of the Indo-Pacific humpback dolphin in Australian waters is not known. The dolphin inhabits shallow coastal, estuarine and occasionally riverine habitats and usually in waters less than 20 m, but have occasionally been seen as far offshore as 55 km in relatively shallow water (Corkeron *et al*., 1997). The Indo-Pacific humpback dolphin's migratory patterns in the NWS region are not well documented.

The Indo-Pacific humpback dolphin was identified as potentially occurring within the wider EMBA.

Antarctic Minke Whale

The Antarctic minke whale (*Balaenoptera bonaerensis*) is listed as migratory under the EPBC Act. This large baleen whale swims alone or in pairs; numbers are not well documented. The distribution of this species in WA is unknown, however they are known to occur offshore within cold temperate to Antarctic waters (DAWE, 2020). Migrates between Antarctic feeding grounds to warmer tropical and subtropical waters and calving occurs in warmer waters during late May and early June after winter migration from Antarctic waters.

The Antarctic minke whale was identified as potentially occurring within the wider EMBA.

Dugong

Dugongs (*Dugong dugon*) are protected under the *Biodiversity Conservation Act 2016* WA and under the EPBC Act, which lists them as marine and migratory species. They are large herbivorous marine mammals that feed on seagrass and mostly inhabit shallow (up to 5 m) waters fringing coasts and offshore islands occurring in close conjunction with the seagrass and algae beds on which they feed. There is little data on the presence of dugongs in deeper offshore waters, although the absence of food would suggest this is unlikely.

The distribution of dugongs in Australia ranges from Shark Bay in WA extending around the Northern Territory coastline to Moreton Bay in Queensland. Dugongs are long-lived and slow breeding. Breeding occurs from September through to April.

Dugong aggregation and feeding habitat are known to occur within the wider EMBA. Given the water depth in the operational area which does not support seagrass habitat, individuals are not likely to be encountered in the operational area. The wider EMBA intersects a known BIA (foraging and nursing) in the Exmouth Gulf, Ningaloo Coast and Shark Bay (Figure 4-12).

4.7 Marine Reptiles

4.7.1 Threatened Species

A search of the EPBC Protected Matters database identified six threatened species (five of which are also migratory) as having the potential to occur or have habitat within the wider EMBA; five of these threatened species were identified as also being present in the operational area.

Loggerhead Turtle

The loggerhead turtle (*Caretta caretta*) is listed as endangered and migratory under the EPBC Act. The loggerhead turtle has a worldwide distribution, living and breeding in subtropical to tropical locations (Limpus, 2008a). The annual nesting population in WA is thought to be 3,000 females annually (Baldwin *et al*., 2003), and this is considered to support the third largest population in the world (Limpus, 2008a).

Nesting and breeding occurs from October to March, with a peak in late December/early January (DAWE, 2020). Major nesting beaches include the Dampier Archipelago and the Montebello Islands. Lower density nesting is known from the Lowendal Islands, Barrow Island, the Muiron Islands, and the Ningaloo Coast at Cape Range, and south to Carnarvon.

Foraging areas are widespread for loggerhead turtle populations and migrations from nesting to feeding grounds can stretch 1,000s of kilometres, including feeding grounds as far north as the Java Sea of Indonesia for the WA population (Limpus, 2008a). Loggerhead turtles are carnivorous and feed primarily on benthic invertebrates from depths of ranging from approximately 50 m to near shore tidal areas (DAWE, 2020) including areas of rocky and coral reef, muddy bays, sand flats, estuaries and seagrass meadows (Limpus, 2008a).

The loggerhead turtle was identified as occurring within the operational area and wider EMBA. The wider EMBA intersects a known BIA (nesting and inter-nesting) for the species. No BIAs for the species lie within the operational area. However, the wider EMBA intersects known BIAs (nesting and inter-nesting habitat) (Figure 4-10) and habitat critical to the survival of the species (refer to Table 4-9 and Figure 4-15).

Green Turtle

The green turtle (*Chelonia mydas*) is listed as vulnerable and migratory under the EPBC Act. The green turtle has a worldwide tropical and subtropical distribution and is widespread and abundant in WA waters, with an estimated 20,000 individuals occurring in WA; arguably the largest population in the Indian Ocean (Limpus, 2008b). The principal rookeries in WA include the Lacepede Islands, Barrow Island, Montebello Islands (all with sandy beaches), Muiron Islands, Browse Island, Northwest Cape, and Ningaloo coast north. Nesting occurs between November and March, with the peak period between January and March.

Green turtles are omnivores, mainly feeding in shallow benthic habitats on seagrass and/or algae, but are also known to feed on sponges, jellyfish and mangroves (Limpus, 2008b). Green turtles are unlikely to forage or dwell within deeper off shore waters due to the water depths; however, they may occasionally migrate through it.

The green turtle was identified as occurring within the operational area and wider EMBA. No BIAs for the species lie within the operational area. However, the wider EMBA intersects known BIAs (foraging, nesting and inter-nesting habitat) (Figure 4-8) and habitat critical to the survival of the species (refer to Table 4-9 and Figure 4-15).

Leatherback Turtle

The leatherback turtle (*Dermochelys coriacea*) is listed as endangered and migratory under the EPBC Act. The leatherback turtle has the widest distribution of any marine turtle, and can be found from tropical to temperate waters throughout the world (Márquez, 1990). There are no major centres of nesting activity that have been recorded in Australia, although scattered isolated nesting (one to three nests per annum) occurs in southern Queensland and the Northern Territory (Limpus & McLachlin, 1994). There have been several records of leatherback turtles off the coast of WA, but no confirmed nesting sites (Limpus, 2009).

The leatherback turtle was identified as occurring within the operational area and wider EMBA; however, no BIAs or habitat critical to the survival of the species lie within the operational area or wider EMBA.

Hawksbill Turtle

The hawksbill turtle (*Eretmochelys imbricata*) is listed as vulnerable and migratory under the EPBC Act. Hawksbill turtles have a global distribution throughout tropical and sub-tropical marine waters. The WA stock is concentrated on the NWS, one of the largest hawksbill populations in the world. The most significant breeding areas are around the sandy beaches of the Dampier Archipelago and the Montebello Islands. Hawksbill turtles also nest at North West Cape/ Ningaloo coast, Muiron Islands, Varanus Island, the Lowendal Islands, and Rosemary Island. Nesting occurs throughout the year in WA, peaking between October and January.

Adults tend to forage in tropical tidal and sub-tidal coral and rocky reef habitat where they feed on an omnivorous diet of sponges, algae, jellyfish and cephalopods (DAWE, 2020).

The hawksbill turtle was identified as occurring within the operational area and wider EMBA. No BIAs for the species lie within the operational area. However, the wider EMBA intersects a known BIA (nesting and inter-nesting habitat) (Figure 4-9) and habitat critical to the survival of the species (refer to Table 4-9 and Figure 4-15). As hawksbill turtle rookeries and foraging areas are known to occur within the area, individuals are likely to be encountered in the EMBA.

Flatback Turtle

The flatback turtle (*Natator depressus*) is listed as vulnerable and migratory under the EPBC Act. The flatback turtle has an Australasian distribution, with all recorded nesting beaches occurring within tropical to sub-tropical Australian waters (Limpus, 2007). They are known to feed on mid-water plankton and benthic organisms, and can forage in mid-shelf water depths (up to about 50 m). Breeding and nesting is restricted to northern WA (Limpus, 2007). The southern WA nesting population of flatback turtles occurs from Exmouth to the Lacepede

Islands off the Kimberley coast (DAWE, 2020). Nesting activity within the Ningaloo Reef/ Exmouth Gulf area is low. Counts of nesting conducted by the Ningaloo Turtle program found no nesting activity during the 2010/2011 season in the Ningaloo Reef area. Significant rookeries are centred on Barrow Island especially the east coast beaches (DAWE, 2020). Inter-nesting flatback turtles can travel up to 62 km away from their rookery between nesting events (Whittock *et al*., 2014).

Unlike other sea turtles, the flatback turtle lacks a wide oceanic dispersal phase and adults tend to be found in soft sediment habitats within the continental shelf of northern Australia (DAWE, 2020).

The flatback turtle was identified as occurring within the operational area and wider EMBA. The operational area lies within an inter-nesting BIA (North West Cape area and Exmouth Gulf) for the species; and the wider EMBA intersects known BIAs (foraging, nesting and inter-nesting) (Figure 4-7) and habitat critical to the survival of the species (refer to Table 4-9 and Figure 4-15).

Short-nosed Seasnake

The short-nosed seasnake (*Aipysurus apraefrontalis*) is listed as critically endangered under the EPBC Act. It is a fully aquatic, small snake and is endemic to WA. It has been recorded from Exmouth Gulf, WA to the reefs of the Sahul Shelf, in the eastern Indian Ocean. This species is believed to show strong site fidelity to shallow coral reef habitats in less than 10 m of water, with most specimens having been collected from Ashmore and Hibernia reefs (Minton & Heatwole, 1975; Guinea & Whiting, 2005).

The species prefers the reef flats or shallow waters along the outer reef edge in water depths to 10 m (McCosker, 1975; Cogger, 2000). The species has been observed during daylight hours, resting beneath small coral overhangs or coral heads in 1–2 m of water (McCosker, 1975). Guinea & Whiting (2005) reported that very few short-nosed seasnakes moved even as far as 50 m away from the reef flat and are therefore unlikely to be expected in high numbers in off shore, deeper waters.

The short-nosed seasnake was identified as occurring within the wider EMBA.

4.8 Fish, Sharks and Rays

4.8.1 Threatened Species

A search of the EPBC Protected Matters database identified five threatened species (five of which are also migratory) as having the potential to occur or have habitat within the operational area and wider EMBA.

Grey Nurse Shark

The grey nurse shark (*Carcharias taurus*, west coast population) is listed as vulnerable under the EPBC Act. Globally, the species is listed as vulnerable in the IUCN Red List of Threatened Species. Grey nurse shark are now restricted to two populations, one on the east coast from southern Queensland to southern NSW and the other around the south-west coast of Western Australia. The grey nurse shark is now considered extinct in Victorian waters. It is believed that the east and west coast populations do not interact. The west coast population has a broad inshore distribution, primarily in sub-tropical to cool temperate waters (Last and Stevens, 2009). The population of grey nurse sharks (west coast population) is predominantly found in the south-west coastal waters of Western Australia (DoE, 2014) and has been recorded as far north as the North West Shelf (Stevens, 1999; Pogonoski *et al*., 2002). The greatest threat to grey nurse sharks is considered to be incidental bycatch in commercial fisheries.

Grey nurse sharks are frequently observed hovering motionless just above the seabed in or near deep sandy-bottomed gutters or rocky caves, and in the vicinity of inshore rocky reefs and islands (Pollard *et al*., 1996). Adult grey nurse sharks feed on a wide range of fish, other sharks, squid, crabs and lobsters. Grey nurse shark was identified as potentially occurring within the operational area and wider EMBA.

White Shark

The white shark (*Carcharodon carcharias*) is listed as vulnerable and migratory under the EPBC Act. It occurs in almost all coastal and offshore waters of the major oceans that have water temperature between 12 and 24°C with greater concentrations in the United States (Atlantic Northeast and California), South Africa, Japan, Australia/Oceania, Chile, and the Mediterranean. This shark reaches its maturity around 15 years of age and can have a life span of over 30 years. White sharks are known to prey on marine mammals and a variety of other marine animals, including fish and seabirds and have been frequently recorded in WA particularly during humpback whale migrations. The white shark was identified as potentially occurring within the operational area and the wider EMBA. BIAs for the white shark fall within the wider EMBA (Figure 4-11).

Whale Shark

The whale shark (*Rhincodon typus*) is listed as vulnerable and migratory under the EPBC Act and it is also classified as endangered on the IUCN Red List of Threatened Species. In WA, whale sharks are protected under the *Biodiversity Conservation Act 2016*.

The whale shark is widely distributed in Australian waters and is also known to frequent the region, aggregating each year between March and June, with the largest numbers generally recorded in April (Meekan *et al*., 2006). The Ningaloo population of whale sharks has been shown to be part of a wider Indian Ocean whale shark stock that is likely to encompass much of the south eastern Indian Ocean and the waters of South East Asia (Meekan *et al*., 2006).

The whale shark was identified as occurring within the operational area and wider EMBA. A BIA (foraging) intersects with the wider EMBA only, for the waters adjacent to Ningaloo coastline (known for intensive foraging), and the offshore Commonwealth waters along the North West Shelf (Figure 4-11).

Dwarf Sawfish/Queensland Sawfish

The dwarf sawfish (*Pristis clavata*) is listed as vulnerable and migratory under the EPBC Act. Dwarf sawfish are rays, somewhat resembling sharks, with an elongated and serrated rostrums. The distribution dwarf sawfish is considered to be restricted to northern Australia, ranging from northern Queensland to the Pilbara coastline. Sawfish generally inhabit shallow coastal waters along with estuaries, which are utilised as nurseries for juveniles. Surveys have found most captures of dwarf sawfish over soft sediment environments. The diets of sawfish are primarily made up of small fish, which they stun using their serrated rostrums (DAWE, 2020).

The dwarf sawfish may occur within the operational area and some shallower coastal mainland locations within the wider EMBA.

Green Sawfish

The green sawfish (*Pristis zijsron*) are listed as vulnerable and migratory under the EPBC Act. They have a shark-like body, a flattened head and an elongated snout or rostrum, which is studded with 24–28 pairs of unevenly spaced rostral teeth. This tooth-studded rostrum is commonly described as the 'saw'. The first dorsal fin origin is slightly behind the pelvic fin origin and the lower lobe of the caudal fin is much shorter than half the length of the upper lobe. Green sawfish are greenish brown or olive in colour on their upper surfaces and pale to white on their undersides. Mature adult Green Sawfish can grow to 5 m in length in Australian waters (Last & Stevens, 2009). Little is known about their historical distribution in Western Australia and the Northern Territory (Stevens *et al*., 2005).

The green sawfish may occur within the operational area and some shallower coastal mainland locations within the wider EMBA.

4.8.2 Migratory Species

A search of the EPBC Protected Matters database identified an additional six migratory species as having the potential to occur or have habitat within the wider EMBA, of which five may also occur within the operational area.

Narrow Sawfish

The narrow sawfish (*Anoxypristis cuspidata*), also known as the knifetooth sawfish, is listed as a migratory species under the EPBC Act. The species inhabits estuarine, inshore and offshore waters to at least 40 m depth (Last & Stevens, 2009). Inshore and estuarine waters are important for juveniles and pupping females, whilst adults predominantly occur offshore (Peverell, 2005). The narrow sawfish may occur within the operational area and wider EMBA.

Shortfin Mako Shark

The shortfin mako shark (*Isurus oxyrinchus*) is listed as a migratory species under the EPBC Act. It is a coastal, oceanic species occurring from the surface to at least 500 m depth and is widespread in temperate and tropical waters of all oceans from about 50°N (up to 60°N in the northeast Atlantic) to 50°S. It is occasionally found close inshore where the continental shelf is narrow. The shortfin mako shark may occur within the operational area and the wider EMBA.

Longfin Mako Shark

The longfin mako (*Isurus paucus*) is listed as a migratory species under the EPBC Act. It is a widely distributed but rarely encountered oceanic shark. This species is known to be caught as bycatch in tropical pelagic longline fisheries for tuna, swordfish and sharks and in other oceanic fisheries. This species appears to be cosmopolitan in tropical and warm temperate waters. However, at present records are sporadic and the complete distribution remains unclear. The longfin mako shark may occur within the operational area and the wider EMBA.

Reef Manta Ray

The reef manta ray (*Manta alfredi*) is a listed migratory species under the EPBC Act. The reef manta ray has a widespread distribution in tropical and subtropical waters worldwide, which includes WA. Reef manta rays are thought to have a relatively sedentary behaviour with precise areas for cleaning and feeding still within close proximity of coasts, reefs or islands. The migratory pattern in WA is not well documented; however, it is possible that the ray may occur within the operational area and wider EMBA.

Giant Manta Ray

The giant manta ray (*Manta birostris*) is a listed migratory species under the EPBC Act and is the largest of the rays. The species has a tropical and semi-temperate distribution worldwide that includes WA. The giant manta ray appears to be a seasonal visitor to coastal sites and satellite tracking studies have revealed it to be capable of migrations of over 1,000 km in distance. The migratory pattern in WA is not well documented; however, it is possible that the species may occur within the operational area and wider EMBA.

Porbeagle, Mackerel Shark

The porbeagle, also named mackerel shark (*Lamna nasus*) is a listed migratory species under the EPBC Act. The porbeagle is a wide-ranging, coastal and oceanic shark found in temperate and cold temperate waters worldwide (DAWE, 2020). The migratory movements of the mackerel shark on Australia's NWS are not well documented. The porbeagle was identified as potentially occurring within the wider EMBA.

4.8.3 Conservation Dependent Species

In addition, there are two conservation dependent species that may occur within the operational area and wider EMBA.

Scalloped Hammerhead Shark

The scalloped hammerhead shark (*Sphyrna lewini*) listed as endangered by the IUCN (IUCN Red List of Threatened Species: 2019.2 List) and was listed as a conservation dependent species on 15 March 2018. There is no adopted or made Recovery Plan for this species. The following information is sourced from the Listing Advice (TSSC, 2018).

The scalloped hammerhead is a coastal and semi-oceanic shark. Pups are born in shallow intertidal habitats where they remain in shallow inshore habitats for the first few years. Information collected from deeper water fisheries (but still on the continental shelf) suggests that juveniles and some adults, particularly males, remain in coastal waters, while some mature adults may move into deeper pelagic waters.

The principal threat to the species is fishing activity. The species has a circum-global distribution in tropical and sub-tropical waters and the Australia stock is likely to be shared with Indonesia and possibly a broader Indo-Pacific population. Within Australian waters, scalloped hammerheads are found across northern and temperate Australian waters extending from New South Wales, around the north of the continent and then south into WA, to approximately Geographe Bay. The distribution of the species in WA is sparse. They have been recorded in WA in the catch of the Pilbara Fish Trawl Fishery. It is possible scalloped hammerheads may be present in the operational area and wider EMBA.

Southern Bluefin Tuna

The southern bluefin tuna (*Thunnus maccoyii*) listed as critically endangered by the IUCN (IUCN Red List of Threatened Species: 2019.2 List) and was listed as a conservation dependent species on 15 December 2010. There is no adopted or made Recovery Plan for this species. The following information is sourced from the Commonwealth Listing Advice (TSSC, 2010).

The southern bluefin tuna is a highly migratory species that occurs globally in waters between 30^{o}S and 50^{o}S, though is mainly found in the eastern Indian Ocean and in the south Western Pacific Ocean. In Australian waters, the southern bluefin tuna ranges from northern WAS, around the southern region of the continent, to northern New South Wales. The southernmost portion of the spawning ground lies within Australia's EEZ.

Juvenile southern bluefin tuna are targeted in the Great Australian Bight by Australian purse sein fishing vessels and taken to Port Lincoln where they are transferred to ocean cages where they are fed intensively for 6-8 months before being exported to Japan. More than 95% of Australia's total catch is taken by this method. The main threat to southern bluefin tuna is historic and on-going fishing pressure.

It is possible southern bluefin tuna may be present in the operational area and wider EMBA.

4.9 Seabirds and Migratory Shorebirds

4.9.1 Threatened Species

A search of the EPBC Protected Matters database identified five threatened bird species (four of which are also listed as migratory species), as having the potential to occur or have habitat within the operational area and wider EMBA. An additional 22 threatened species (14 of which are also listed as migratory species) were identified as having the potential to occur in the wider EMBA.

Red Knot

The red knot (*Calidris canutus*) is listed as endangered and migratory under the EPBC Act. The red knot breeds in Siberia and spends the non-breeding season in Australia and New Zealand. The non-breeding season is spent on tidal mudflats or sandflats where the omnivorous species feeds on intertidal invertebrates, especially shellfish (Garnet *et al*., 2011). Although the species is found throughout main suitable habitats in Australia, the highest numbers of the species are found throughout the northwest of Australia, between Eighty Mile Beach and Roebuck Bay.

The red knot was identified as potentially occurring within the operational area and wider EMBA.

Curlew Sandpiper

The curlew sandpiper (*Calidris ferruginea*) is a listed as critically endangered and migratory shorebird under the EPBC Act. Curlew sandpiper breeding grounds occur in Siberia and they reach the northern shores of Australia in late August and early September (Higgins & Davies, 1996). Curlew sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast. This species forages mainly on invertebrates, including worms, molluscs, crustaceans, and insects, as well as seeds.

The curlew sandpiper was identified as potentially occurring within the operational area and in coastal areas of the wider EMBA.

Southern Giant Petrel

The southern giant petrel (*Macronectes giganteus*) is listed as endangered and migratory under the EPBC Act. The southern giant petrel is considered to be a sibling species to the northern giant-petrel. It is a large seabird with a widespread distribution range through the Southern Ocean from the Antarctic to subtropical waters. The southern giant-petrel breeds once a year between August and September, returning from foraging locations to breeding grounds in Antarctic waters.

The southern giant petrel was identified as potentially occurring within the operational area and wider EMBA. There are no breeding, roosting grounds or critical feeding areas within the operational area, although this species may transit the EMBA from time-to-time foraging for food.

Eastern Curlew

The eastern curlew (*Numenius madagascariensis*) is listed as a critically endangered and migratory under the EPBC Act. Within Australia, this shorebird has a primarily coastal distribution and is found in all states, particularly the north, east, and southeast regions including Tasmania. They have a continuous distribution from Barrow Island and Dampier Archipelago, through the Kimberley and along Northern Territory, Queensland, and NSW coasts and the islands of Torres Strait. They are patchily distributed elsewhere. The Eastern curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. They are often recorded among saltmarsh and on mudflats fringed by mangroves, and sometimes use the mangroves. This shorebird is carnivorous, mainly eating crustaceans (including crabs, shrimps and prawns), small molluscs, as well as some insects.

The eastern curlew was identified as potentially occurring within the operational area and wider EMBA.

Australian Fairy Tern

The Australian fairy tern (*Sternula nereis nereis*) is listed as vulnerable under the EPBC Act and has been identified as a conservation value in the northwest marine region. Breeding occurs between October to February on continental islands, coral cays, on sandy islands and beaches inside estuaries, and on open sandy beaches (DAWE, 2020).

The Australian fairy tern was identified as occurring within the operational area and wider EMBA. The wider EMBA intersects a known BIA (Figure 4-14), with important breeding and foraging various locations along coastline and offshore islands in the Pilbara region.

Great Knot

The great knot (*Calidris tenuirostris*) is listed as critically endangered and migratory shorebird under the EPBC Act. The great knot has a global distribution, breeding in northeast Siberia and spending the non-breeding season along coasts from Arabia to Australia. Non-breeding birds migrate to inlets, bays, harbours, estuaries and lagoons with large intertidal mud and sand flats where they feed on bivalves, gastropods, crustaceans and other invertebrates (Higgins & Davies 1996 in Garnet *et al*., 2011). The greatest numbers of the species are found in northern Australia, between the Pilbara and the Kimberley. The species typically roosts in the fringing vegetation surrounding coastal inlets where damp sediments lower temperatures.

The great knot was identified as potentially occurring within the wider EMBA.

Greater Sand Plover

The greater sand plover is listed as vulnerable and migratory under the EPBC Act. This plover breeds in China, Mongolia and Russia, and spends the non-breeding season along coasts from Japan through Southeast Asia to Australasia, (Bamford *et al*., 2008). Non-breeding birds occur along all Australian coasts, especially in the north for the greater sand plover. Non-breeding birds forage on beaches, saltmarshes, coastal bays and estuaries, and feed on marine invertebrates including molluscs, worms, crustaceans and insects (Marchant & Higgins 1993 in Garnet *et al*., 2011). The species typically roosts higher up the beach well above the high water mark of sand spits, rocky lagoons or salt marsh.

The greater sand plover was identified as potentially occurring within the wider EMBA.

Amsterdam Albatross

The Amsterdam albatross (*Diomedea amsterdamensis*) is listed as endangered and migratory under the EPBC Act. The Amsterdam albatross breeds on Amsterdam Island (territory of France), in the southern Indian Ocean and is a non-resident visitor to Australia occurring in southwest and south Australian waters (DAWE, 2020).

The Amsterdam albatross was identified as potentially occurring within the wider EMBA for foraging, for foraging, but given that their numbers in Australian waters are unknown, and believed to be small (if occurring at all), the likelihood of this species being present is low.

Tristan Albatross

The Tristan albatross (*Diomedea dabbenena*) is listed as endangered and migratory under the EPBC Act. This large albatross is very similar to the the wandering albatross (*Diomedea exulans*) and they are often indistinguishable at sea. Their distribution in Australia is poorly defined with only a few records sightings off the southern coast of WA and SA (DAWE, 2020). The Tristan albatross is a marine, pelagic seabird foraging in open waters close to the waters surface to feed on squid, fish and crustaceans. It is non-breeding in Australia.

The Tristan albatross may occur within the southern extent of the wider EMBA.

Southern Royal Albatross

The southern royal albatross (*Diomedea epomophora*) is listed as vulnerable and migratory under the EPBC Act. The southern royal albatross has a circumpolar distribution within the Southern Oceans. Within Australia, they range over waters of SA at all time of year, especially between July and October and have been recorded from Byron Bay in the east to southwestern WA. Most records are from the shelf-break areas, specially of western an southern Tasmanian and around Victoria (DSEWPaC, 2011b).

The southern royal albatross may occur within the southern extent of the wider EMBA.

Wandering Albatross

The wandering albatross (*Diomedea exulans*) is listed as vulnerable and migratory under the EPBC Act. The species has a circumpolar distribution and breeds on six sub-Antarctic island groups including Macquarie Island and feeds throughout the Southern Ocean (DAWE, 2020). This species is wide-ranging and may potentially over-fly the worst-case hydrocarbon EMBA from time-to-time in transit or for foraging. There is no nesting or feeding areas within the EMBA.

The wandering albatross was identified as potentially occurring within the wider EMBA. As this species distribution is wide-ranging and it may potentially transit the wider EMBA from time-to-time foraging.

Northern Royal Albatross

The northern royal albatross (*Diomedea sanfordi*) is listed as endangered and migratory under the EPBC Act. The northern royal albatross has a circumpolar distribution being most common between 36º S to at least 52º S with most sightings confined to the shelf edge and slope. Within Australia, they are regularly recorded throughout the year around Tasmania and SA at the edge of the continental shelf, and infrequently in waters off NSW (DSEWPaC, 2011b).

The northern royal albatross may occur within the southern extent of the wider EMBA.

Blue Petrel

The blue petrel (*Halobaena caerulea*) is listed as vulnerable under the EPBC Act. The blue petrel has a circumpolar distribution ranging from the pack ice to 30º S (DAWE, 2020). It breeds on offshore stacks near Macquarie island (500-600 breeding pairs).

The blue petrel may occur within the southern extent of the wider EMBA between July and September.

Northern Giant Petrel

The northern giant petrel (*Macronectes halli*) is listed as vulnerable and migratory under the EPBC Act. It is a highly active migratory bird that has a large natural range (DAWE, 2020). The northern giant petrel breeds in the sub-Antarctic, and visits areas off the Australian mainland mainly during the winter months (May to October) (DAWE, 2020).

The northern giant petrel was identified as potentially occurring within the wider EMBA.

Fairy Prion (southern)

The fairy prion (southern) (*Pachyptila turtur subantarctica*) is listed as vulnerable under the EPBC Act. It breeds on Macquarie island and a number of other sub-Antarctic islands outside of Australia. There are 80 to 250 breeding pairs in Australia and a global population of ~80,000 (DAWE, 2020). Some individuals migrate towards New Zealand and southern Australia in winter.

The fairy prion (southern) may occur within the southern extent of the wider EMBA.

Abbott’s Booby

Abbott’s booby (*Papasula abbotti*) is listed as endangered under the EPBC Act. In Australia, it is only known to breed on Christmas Island and to forage in the waters surrounding the island. This marine species spends much of its time at sea where it feeds on fish and squid and it is thought that they may travel up to 400 km to feeding grounds (DAWE, 2020).

The Abbott’s booby may occur within the northern extent of the wider EMBA.

Sooty Albatross

The sooty albatross (*Phoebetria fusca)* is listed as vulnerable and migratory under the EPBC Act. The sooty albatross breeds on islands in the southern Indian and Atlantic Oceans, and forages south of the 30ºS, between southern NSW and Argentina (DAWE, 2020). In Australia, it has sometimes been observed foraging in inshore waters in southern Australia. The sooty albatross is a rare, but probably regular migrant to Australia, mostly in autumn and winter. The sooty albatross flies within 10 to 15 m of the sea surface, using updrafts from wave fronts for lift. It forages at the sea surface feeding on fish, cephalopods, crustaceans and penguin carrion (DAWE, 2020).

The sooty albatross may occur within the southern extent of the wider EMBA.

Indian Yellow-nosed Albatross

The Indian yellow-nosed albatross (*Thalassarche carteri*) is listed as vulnerable and migratory under the EPBC Act. This species forages mostly in the southern Indian Ocean where it is particularly abundant off WA. It also breeds on islands of the southern Indian Ocean. In breeding and non-breeding seasons, the species concentrates over the productive waters of continental shelves, often at coastal upwellings and the boundaries of currents (DAWE, 2020).

The Indian yellow-nosed albatross was identified as potentially occurring within the wider EMBA.

Shy Albatross

The shy albatross (*Thalassarche cauta cauta*) is listed as vulnerable and migratory under the EPBC Act. The shy albatross appears to occur in all Australian coastal waters below 25°S. It is most commonly observed over the shelf waters around Tasmania and south-eastern Australia (DAWE, 2020). Breeding occurs on Albatross Island, Bass Strait, and Mewstone and Pedra Branca, off southern Tasmania. The shy albatross feeds in waters over the continental shelf as well as within harbours and bays (DAWE, 2020). This species may occur within the EMBA; although is not an area this species uses for breeding or resting, it may be used as foraging ground.

The shy albatross was identified as potentially occurring within the wider EMBA, although is not an area this species uses for breeding or resting, it may be used for foraging.

White-capped Albatross

The white-capped albatross (*Thalassarche cauta steadi*) is listed as vulnerable and migratory under the EPBC Act. This is a marine species that occurs in sub-Antarctic and subtropical waters. It occurs in both inshore and offshore waters, and has been observed in shelf-waters around breeding islands during breeding and non-breeding seasons. It is thought that the species breeds annually and colonially, laying eggs in mid-November (DAWE, 2020).

The white-capped albatross was identified as potentially occurring within the wider EMBA.

Campbell Albatross

The Campbell albatross (*Thalassarche melanophris impavida*) is listed as vulnerable and migratory under the EPBC Act. The Campbell albatross is a non-breeding visitor to Australian waters. The Campbell albatross only breeds on Campbell Island, south of New Zealand. The population migrates northward towards the end of the breeding season and the species is common during the non-breeding period in continental shelf waters around Australia, New Zealand and the Pacific Islands (DAWE, 2020).

The Campbell albatross was identified as potentially occurring within the wider EMBA

Black-browed Albatross

The black-browed albatross (*Thalassarche melanophris*) is listed as vulnerable and migratory under the EPBC Act. The black-browed albatross breeds within Australian waters on Heard Island, McDonald Islands, Macquarie Island and Bishop and Clerk Islets. Individuals are mostly confined to sub-Antarctic and Antarctic waters surrounding these islands in the breeding season. The population migrates northward towards the end of the breeding season and the species is common in the non-breeding period at the continental shelf and shelf-break of South Australia, Victoria, Tasmania, western and eastern Bass Strait and NSW. Individuals are also observed at these times in lesser numbers at the continental shelf break of southern and south-western WA (DAWE, 2020).

The black-browed albatross was identified as potentially occurring within the wider EMBA, where it may transit or use the area for foraging.

Australian Lesser Noddy

The Australian lesser noddy (*Anous tenuirostris melanops*) is listed as vulnerable under the EPBC Act. The Australian lesser noddy is usually found only around its breeding islands in the Houtman Abrolhos Islands in Western Australia (Storr *et al*., 1986) (Figure 4-14), but there are also some records north of the breeding islands, for example at the Wallabi Group of islands, in the northern Houtman Abrolhos Islands, on Barrow Island, and at Webb Island (Higgins & Davies, 1996). The Australian lesser noddy usually occupies coral-limestone islands that are densely fringed with white mangrove *Avicennia marina*. It occasionally occurs on shingle or sandy beaches (Higgins & Davies, 1996).

The Australian lesser noddy was identified as potentially occurring within the wider EMBA.

Bar-tailed Godwit (baueri)

The bar-tailed godwit (baueri) (*Limosa lapponica baueri*) is listed as vulnerable under the EPBC Act and spends non-breeding seasons in Australia. One of two sub-species, the bar-tailed godwit (baueri) forages at the water's edge mainly around tidal estuaries and shallow water habitats. The species feeds on worms, molluscs, and crustaceans.

The bar-tailed godwit (baueri) was identified as potentially occurring within the wider EMBA, where it may be present between August-December.

Northern Siberian Bar-tailed Godwit

The northern Siberian bar-tailed godwit (*Limosa lapponica menzbieri*) is listed as critically endangered under the EPBC Act. This species is closely related to the Baueri sub-species, however breeds in northern Siberia. During the non-breeding period, the species is most commonly found in the north and northwest region of WA and in south east Asia. The species can be found surround most coastal environments including lagoons, inlets, estuaries and mudflats.

The northern Siberian bar-tailed godwit was identified as potentially occurring within the wider EMBA.

Soft-plumaged Petrel

The soft-plumaged petrel (*Pterodroma mollis*) is listed as vulnerable under the EPBC Act. This marine bird is found in temperate and sub-Antarctic regions. The petrel is a regular and quite common visitor to southern Australian seas, but is more common on the west than in the south and southeast (Marchant & Higgins, 1990). The population in Australia is currently unknown. Breeding is believed to take place on south Australian islands with fledglings dispersing mainly northwards during May and June.

The soft-plumaged petrel was identified as potentially occurring within the wider EMBA. BIAs for the species occur in the wider EMBA (Figure 4-14).

Australian Painted Snipe

The Australian painted snipe (*Rostratula australis*) is listed as endangered under the EPBC Act. The painted snipe is a wading shorebird that has been recorded at wetlands in all states of Australia. It is most common in eastern Australia and has been recorded less frequently at a small number of scattered locations in WA, the Northern Territory and South Australia. It is generally seen singly or in pairs, or less often in small flocks (Marchant & Higgins, 1993).

The Australian painted snipe was identified as potentially occurring within the wider EMBA.

4.9.2 Migratory Species

A search of the EPBC Protected Matters database identified an additional 20 migratory species as having the potential to occur or have habitat within the wider EMBA, of which eight may also occur within the operational area.

Common Noddy

The common noddy (*Anous stolidus*) is listed as migratory under the EPBC Act. There are four sub-species of the common noddy recognised, but only the sub-species *Anous stolidus pileatus*, occurs in the Australia region, where it occurs mainly off the Queensland coast, but also off the northwest and central WA coast.

The migratory movements of the species are poorly known. The common noddy is a gregarious bird, normally occurring in flocks, sometimes of hundreds of individuals, when feeding or roosting. They feed on mainly fish, but are also known to take squid, pelagic molluscs and aquatic insects by dipping or skimming the sea surface. Bird usually feed during the day, but will also feed at night when there is a full moon. Timing of breeding varies between sites and may be annual, or twice a year. On some islands, the species is known to breed throughout the year.

The common noddy was identified as potentially occurring within the operational area and wider EMBA. BIAs for the species occur in the wider EMBA (Figure 4-14).

Flesh-Footed Shearwater

The flesh-footed shearwater (*Ardenna carneipes*) is a listed migratory species under the EPBC Act. It is a large broad-winged shearwater that typically forages over continental shelves/slopes and occasionally inshore waters. The distribution of the shearwater is mainly off southern Australia migrating between breeding colonies in the southern Indian and south-western to north-western Pacific Ocean (Marchant & Higgins, 1993).

The flesh-footed shearwater was identified as potentially occurring within the operational area and wider EMBA.

Streaked Shearwater

The streaked shearwater (*Calonectris leucomelas*) is a listed migratory seabird under the EPBC Act and spends non-breeding periods in the tropical west Pacific (October to March). It has been regularly recorded offshore from Broome to Timor Sea, and from Barrow Island to the Houtman Abrolhos Islands, occurring over pelagic and inshore waters but usually found offshore more than 18 km from mainland coast (Marchant & Higgins, 1993).

The streaked shearwater was identified as potentially occurring within the operational area and wider EMBA.

Lesser Frigatebird

The lesser frigatebird (*Fregata ariel*) is listed as a migratory species under the EPBC Act and is found widespread throughout the northern reaches of Australia, from approximately Geraldton on the West Coast throughout the north to the east coast. The species is found throughout most shorelines. The species is the smallest frigatebird and is well adapted for an aerial existence and may range significant distances from land. This seabird found in tropical waters of the Indian Ocean, breeds on small, remote tropical and sub-tropical islands in mangroves or bushes, and even on bare ground. It feeds on fish, cephalopods, seabird eggs chicks, carrion and fish scraps.

Little information is available on the migratory movements of this species. Breeding appears to occur between May and December in Australia. Outside the breeding season, the species is sedentary.

The lesser frigatebird was identified as potentially occurring within the operational area and wider EMBA.

Common Sandpiper

The common sandpiper (*Actitis hypoleucos*) is listed as a migratory species under the EPBC Act, breeding in eastern Europe before migrating to spend its non-breeding season in Australia. In Australia, it can be found singularly or in small groups along all coastlines and many inland areas. Important sites in WA include Roebuck Bay and Nuytsland Nature Reserve. The species inhabits a wide range of coastal wetlands, and is most often found around the muddy margins, mangroves and rocky shores. Their diet consists of bivalves, crustaceans and a variety of insects and are mostly found in coastal and inland locations.

The common sandpiper was identified as potentially occurring within the operational area and wider EMBA

Sharp-Tailed Sandpiper

The sharp-tailed sandpiper (*Calidris acuminata*) is listed as a migratory species under the EPBC Act and spends the non-breeding season in Australia. The species is known to be widespread from Cape Arid to Carnarvon, the coastal plains of the Pilbara region and east Kimberley division. The species inhabits intertidal mudflats, sheltered bays, inlets, estuaries and seashores. Foraging habitat includes the seagrass wrack on shorelines and algal mats. The species are common throughout Australia between August and March.

The sharp-tailed sandpiper was identified as potentially occurring within the operational area and wider EMBA.

Pectoral Sandpiper

The pectoral sandpiper (*Calidris melanotos*) is a listed migratory species under the EPBC Act. This small-medium wader spends non-breeding seasons across Australia, but are rare in WA and have been recorded in the coastal Gascoyne, the Pilbara and Kimberley regions, feeding on algae, seeds, crustacean and insects. This species is most commonly found around coastal areas.

The pectoral sandpiper was identified as potentially occurring within the operational area and wider EMBA.

Osprey

The osprey (*Pandion haliaetus*) is a listed migratory species under the EPBC Act. It is a medium-sized raptor that primarily inhabits coastal and estuarine habitats (Marchant & Higgins, 1993). The species prefers littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands (DAWE, 2020). Breeding range extends around the northern coast of Australia from Albany in WA to Lake Macquarie in NSW, with a second breeding population on the coast of SA. The total range of the species is much more widespread (DAWE, 2020).

The osprey was identified as potentially occurring within the operational area and wider EMBA.

Ruddy Turnstone

The ruddy turnstone (*Arenaria interpres*) is a listed migratory species under the EPBC Act. This medium-size bird is widespread within Australia during its non-breeding period of the year, when it is found in most coastal regions preferring rocky shores or beaches where there is plenty of stranded seaweed. The birds in the western areas of Australia migrate north and south to and from East Asia. Barrow Island is one of five sites of international importance within Australia for the ruddy turnstone.

The ruddy turnstone was identified as potentially occurring within the wider EMBA.

Fork-Tailed Swift

The fork-tailed swift (*Apus pacificus*) is a listed migratory species under the EPBC Act. It is a medium to large swift that migrates between Australia and its breeding grounds in Siberia. The swift usually arrives in Australia around October and departs in April, passing via Indonesia (Higgins, 1999). Whilst in Australia the swift is highly mobile occurring mostly over inland plains but also coastal areas, over cliffs and on beaches.

The fork-tailed swift was identified as potentially occurring within the wider EMBA, most likely between October and April.

Wedge-Tailed Shearwater

The wedge-tailed shearwater (*Ardenna pacifica*) is a listed migratory species under the EPBC Act. This medium-sized seabird, can nearly always be found over oceanic waters off WA except when roosting in colonies. It forages at sea, feeding mostly on fish, cephalopods, insects, jellyfish and prawns. In WA, they breed on multiple offshore islands between Ashmore Reef and Carnac Island (Dunlop et al., 2002) and over one million pairs are estimated to breed across these sites (Burbidge *et al*., 1996). The operational area falls within a BIA located in the Pilbara region extending northeast from the Cape Range National Park to north of Port Hedland, and includes the Muiron Island and surrounding waters (Figure 4-14). The Islands along North West Cape and near Onslow also house breeding populations (DEWHA, 2008a, Cannell *et al*., 2019). Within the wider EMBA, the Barrow-Lowendal-Montebello Island complex and northwards are important nesting areas for the species, and as such the area is as BIA for breeding, as well as Shark Bay (Figure 4-14).

The wedge-tailed shearwater was identified as potentially occurring within the wider EMBA.

Great Frigatebird

The great frigatebird (*Fregata minor*) is a listed migratory species under the EPBC Act. It is widespread and breeds on numerous tropical islands. Within the North-west Marine Region, it breeds in small numbers on Ashmore Reef (DSWEPaC, 2012d). This species is pelagic although breeding birds probably forage within 100–200 kilometres of the colony during the early stages of the breeding season (DSWEPaC, 2012d). The diet consists mainly of flying fish with some cephalopods.

The great frigatebird may occur within the northernmost extent of the wider EMBA.

Red-Tailed Tropicbird

The red-tailed tropicbird (*Phaethon rubricauda*) is a listed migratory species under the EPBC Act. It is a marine species native to tropical parts of the Indian and Pacific Oceans where it eat fish, mainly flying fish and squid, after catching them by plunge-diving into the water. Red-tailed trophicbirds spend most of their lives at sea, returning to land only to breed (Surman & Nicholson, 2009b).

The great frigatebird is likely to occur and breeding is known to occur (Houtman Abrolhos Islands) within the southern extent of the wider EMBA.

Sanderling

Sanderling (*Calidris alba*) is a listed migratory species under the EPBC Act and occurs in most coastal areas from the coast from Eyre to Derby, and north to around southern Shark Bay with more sparsely scattered records further north in the Gascoyne and Pilbara Regions. The species has a circumpolar breeding distribution, migrating south to spend the non-breeding season predominantly on sandy coastal shores of all continents except Antarctica. Sanderling are omnivorous, foraging on beaches, mudflats and on the edges of shallow pools feeding on plants, seeds, worms, crustaceans, insects, and occasionally on fish and larger molluscs and crustaceans taken as carrion.

Sanderling was identified as potentially occurring within the wider EMBA.

Red-necked Stint

One of the smallest shorebirds in Australia, the red-necked stint (*Calidris ruficollis*) is a listed migratory species under the EPBC Act. It is found in all states and territories inhabiting coastal areas such as bays, sheltered inlets, lagoons and estuaries. The species is present in Australia during the non-breeding season from August through to late September. The species are found in coastal sections in the Pilbara region and towards Eighty Mile Beach.

The red-necked stint was identified as potentially occurring within the wider EMBA.

Caspian Tern

The Caspian tern (*Hydroprogne caspia*) is a migratory species under the EPBC Act. It is the largest of the terns found in Australia, occurring in both coastal areas (including islands) and inland habitats. It is gregarious when nesting but outside of breeding season it occurs mostly singly or in small known colonies. Limited information is available regarding migratory movements or timing throughout the NW of Australia. Birds may move from coastal breeding colonies to inland.

The Caspian tern was identified as potentially occurring within the wider EMBA and breeding is known to occur within the Pilbara region. BIAs for the species occur in the wider EMBA (Figure 4-14).

Bridled Tern

The bridled tern (*Onychoprion anaethetus*) is a listed migratory species under the EPBC Act and is found throughout tropical and sub-tropical regions of Australia. The species is most common on offshore islands as opposed to coastal areas. Foraging singly or in small flocks, primarily on fish by swooping on schools and dipping only the head in the water (as opposed to plunge diving). Breeding populations exist at Ashmore Reef, the Montebello/Lowendal island groups and Barrow Island (DEWHA, 2008a). Birds return to breeding colonies at various island locations throughout northern WA between late September and mid-October and leave from early May to mid-September.

The bridled tern was identified as potentially occurring (and breeds) within the wider EMBA. BIAs for the species occur in the wider EMBA (Figure 4-14).

Roseate Tern

The roseate tern (*Sterna dougallii*) is a listed migratory species under the EPBC Act. It is a coastal seabird that occurs in a variety of habitats including beaches, reefs and sandy/coral islands. It is a specialist forager for small pelagic fish, and prefers nesting sites adjacent to clear shallow hunting areas. Nests are generally a bare scrape in sand, shingle or coral rubble. Breeds in large mixed-species colonies from April to June, breeding populations are located around the North West Cape area and the Montebello islands (DEWHA, 2008a), as such the EMBA includes a BIA for breeding and foraging various locations along coastline and offshore islands (in the Pilbara region) (Figure 4-14).

The roseate tern is likely to be encountered around the coastal sections of the EMBA.

Oriental Plover

The oriental plover (*Charadruis veredus*) is a listed migratory species under the EPBC Act. It is a non-breeding visitor to Australia and occurs in both coastal and inland areas, mostly in northern Australia between Exmouth Gulf and Derby in WA (DAWE, 2020). Insects are their primary food source from foraging among short grass or on hard stoney ground, mud flats and stranded seaweed. After breeding in the northern hemisphere, they arrive in Australia in early to mid-September, with numbers increasing during October and sometimes November. Once in northern Australia, oriental plovers spend a few weeks in coastal habitats such as estuarine mudflats and sandbanks, on sandy or rocky ocean beaches or nearby reefs, or in near-coastal grasslands, before dispersing further inland and some may fly south across the continent, where they stay before leaving to return to their breeding grounds between February and April, with most having left by the end of March.

The oriental plover was identified as potentially occurring within the wider EMBA and most likely may be encountered around the coastal sections between August and March.

Oriental Pratincole

The oriental pratincole (*Glareola maldivarum*) is a listed migratory species under the EPBC Act. This medium-sized bird is almost exclusively insectivorous and widespread in north-west Australia and is prominent in the Pilbara coastal region. This species does not breed in Australia and is known to inhabit mudflats, beaches and coastal lagoons.

The oriental pratincole may to be encountered around the coastal sections of the wider EMBA.

Bar-tailed Godwit

The bar-tailed godwit (*Limosa laponica*) is a listed migratory species under the EPBC Act. It is a large wader slightly bigger and stockier than the black-tailed godwit (*Limosa limosa*). They have been recorded in coastal areas of all Australian states. In WA, it is widespread around the coast from Eyre to Derby, with scattered records in the Kimberley region, and with Eighty Mile Beach recognised as a site of international importance. This godwit species breeds in the north of Scandinavia, Russian and NW Alaska. They usually forage near the edge of water or in shallow water, preferring soft mud and mainly in estuaries and harbours. They have been known to forage among mangroves, coral reefs and rock platforms.

The godwit is likely to be encountered around the coastal sections of the EMBA between August and mid-April.

Black-tailed godwit

The black-tailed godwit (*Limosa limosa*) is a listed migratory species under the EPBC Act. This large wader occurs singularly or in groups and associates with other waders throughout the coastal regions of Australia, with the largest populations on the north coast between Darwin and Weipa in the NT, as well as the Pilbara region and towards Eighty Mile Beach. The species is commonly found in sheltered bays, estuaries and lagoons with large intertidal mud and sandflats, and occasionally on rocky coasts. Their diet consists of worms, crustaceans, bivalves and fish eggs. The black-tailed godwit does not breed in Australia. They arrive in north-west Australia from late August and depart during March and April to breed in the northern hemisphere.

The godwit is likely to be encountered around the coastal sections of the EMBA between August and April.

Whimbrel

The whimbrel (*Numenius phaeopus*) is a medium-sized curlew and a listed migratory species under the EPBC Act. It is a regular non-breeding migrant to Australia and New Zealand. Although scattered inland records of the species is found in all regions, its distribution is primarily coastal, and more common in the north of Australia. It is common and widespread from Carnarvon to the north-west Kimberley and Darwin region. The whimbrel forages on intertidal mudflats, along muddy banks of estuaries and in coastal lagoons and mangroves. The whimbrel begin their migration from breeding grounds in the northern hemisphere in July, arriving on the north coasts from August. They start their northern migration back to breeding grounds by late April.

The whimbrel was identified as potentially occurring within the wider EMBA.

Grey Plover

The grey plover (*Pluvialis squatarola*) is a listed migratory species under the EPBC Act. It is a medium-sized plover that is found solitary, in small flocks, and larger flocks at communal roosts often with other waders. Widespread in coastal regions of Australia, it inhabits sheltered embayments, estuaries and lagoons with mud and sand flats, occasionally on rocky coasts with wave cut platforms. Their diet consists of mostly molluscs, insects, crustaceans and polychaete worms. The grey plover arrive in northern Australia from August to September where they remain until April when they return to their breeding grounds in northern Siberia.

The grey plover is likely to be encountered around the coastal sections of the EMBA between August and April.

Crested Tern

The crested tern (*Sterna bergii*) is listed as a migratory species under the EPBC Act. The crested tern inhabits tropical and subtropical coastlines and forages in the shallow waters of lagoons, coral reefs, bay, harbours, inlets and estuaries; along sandy, rocky, coral or muddy shores; on rocky outcrops in open sea; in mangrove swamps; and in offshore and pelagic waters (Higgins and Davies, 1996). The crested tern usually feeds from the surface of the sea to less than 1 m water depth but can also forage well out to sea. Its diet consists predominantly of pelagic fish, although it will also feed on crustaceans, insects and hatchling turtles opportunistically. The crested tern shows a preference for nesting on offshore islands, low-lying coral reefs, low-lying coral reefs, sandy or rocky coastal islets, coastal spits and lagoon mudflats.

The species and species habitat (including breeding) is known to occur within the wider EMBA.

Grey-tailed Tattler

The grey-tailed tattler (*Tringa brevipes*) is listed as a migratory species under the EPBC Act. This medium-sized wader found in most coastal regions in Australia, but primarily in the north. In WA, the species is widespread from Houtman Abrolhos and mainland to the Kimberley region, with known populations on Barrow

Island. The bird is often found on sheltered coasts with reefs and rock platforms or intertidal muds. Their diet consists primarily of worms, molluscs, crustaceans, insects and occasionally fish. The grey-tailed tattler breeds in Siberia and moves south for the boreal winter, arriving in Australia around August and departing for its breeding grounds by early or mid-April.

The grey-tailed tattler is likely to be encountered around the coastal sections of the EMBA between August and April.

Common Greenshank

The common greenshank (*Tringa negularia*) is a listed migratory species under the EPBC Act. It is a heavily built, elegant wader, seen singly or in small to large flocks (sometimes hundreds) in a variety of coastal and inland wetlands (Higgins & Davies, 1996). It does not breed in Australia; however, the species occurs in all types of wetlands and has the widest distribution of any shorebird in Australia (Higgins & Davies, 1996).

The common greenshank is likely to occur in the coastal sections of the wider EMBA.

Terek Sandpiper

The Terek sandpiper (*Xenus cinereus*) is a listed migratory species under the EPBC Act. This sandpiper has primarily a coastal distribution in Australia, being more widespread and common in the north and east than in the south of Australia. In WA, the Terek sandpiper is widespread in the Pilbara and Kimberley regions and occasionally around Shark Bay. The species prefers intertidal mudflats and has also been recorded on sand spits, near mangroves and also rocky areas. The Terek sandpiper feeds on a variety of invertebrates including crustaceans, insects and molluscs. The species breeds in Eurasia before moving south for the boreal winter.

The Terek sandpiper is likely to be encountered around the coastal sections of the EMBA between September and April.

4.10 Other Values and Sensitivities

4.10.1 Australian Marine Parks

The Commonwealth Marine Reserves Network was established in 2012 for the purpose of protecting the biological diversity and sustainable use of the marine environment. There are six management plans – one for each of the five marine park networks (the North, the North-west, the South-east, the South-west and the Temperate East) and one for the Coral Sea. The operational area does not intersect any marine parks. A number of marine parks fall within the wider EMBA (Table 4-11 and Figure 4-18). Information on the Australian Marine Parks has been extracted from the Parks Australia website (https://parksaustralia.gov.au/) and is summarised below.

Table 4-11: Australian Marine Parks within the EMBA

Value / Sensitivity		Distance from operational area	EMBA	
			Operational Area	Wider EMBA
Ningaloo	National Park Zone (IUCN Category II)	136 km	x	✓
	Recreational Use Zone (IUCN Category IV)	13 km	x	✓
Gascoyne	Habitat Protection Zone (IUCN Category IV)	123 km	x	✓
	Multiple Use Zone (IUCN Category VI)	16 km	x	✓
	National Park Zone IUCN Category II)	225 km	x	✓
Montebello	Multiple Use Zone (IUCN Category VI)	143 km	x	✓
Shark Bay	Multiple Use Zone (IUCN Category VI)	322 km	x	✓
Carnarvon Canyon	Habitat Protection Zone (IUCN Category IV)	345 km	x	✓
Argo-Rowley Terrace	Multiple Use Zone (IUCN Category VI)	485 km	x	✓
Abrolhos	Habitat Protection Zone (IUCN Category IV)	490 km	x	✓
	Multiple Use Zone (IUCN Category VI)	575 km	x	✓
	National Park Zone (IUCN Category II)	740 km	x	✓
	Special Purpose Zone (IUCN Category VI)	650 km	x	✓
Jurien	National Park Zone (IUCN Category II)	1,015 km	x	✓
	Special Purpose Zone (IUCN Category VI)	960 km	x	✓

Ningaloo Marine Park

The Ningaloo Marine Park includes two zones, National Park Zone (IUCN Category II) and Recreational Use Zone (IUCN Category IV). The marine park covers an area of 2,435 km^2 and a water depth range of 30 m to more than 500 m. Together with the Ningaloo Marine Park and the Muiron Islands Marine Management Area, both in State waters, make up the Ningaloo Coastal World Heritage Area (Section 4.5.2). The marine park stretches approximately 300 km along the west coast of the Cape Range Peninsula near Exmouth approximately 1,200 km north of Perth. The marine park was originally proclaimed under the *National Parks and Wildlife Conservation Act 1975* on 20 May 1987 as the Ningaloo Marine Park (Commonwealth Waters), and proclaimed under the EPBC Act on 14 December 2013 and renamed Ningaloo Marine Park on 9 October 2017. The marine park has the following conservation values (Director of National Parks, 2018a):

- Supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act;
- Include biologically important areas (BIAs):
  - Foraging habitat for the vulnerable and migratory whale shark;
  - Foraging habitat adjacent to important nesting and inter-nesting sites for marine turtles;
  - Includes part of the migratory pathway of the protected humpback whale;
  - Foraging habitat and migratory path for pygmy blue whales;
  - Breeding, calving, foraging and nursing habitat for dugong; and
  - Breeding and foraging habitat for seabirds;
- Includes three key ecological features (KEFs):
  - Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula (valued for unique seafloor features with ecological properties of regional significance);

  - Commonwealth waters adjacent to Ningaloo Reef (valued for high productivity and aggregations of marine life); and
  - Continental slope demersal fish communities (valued for high levels of endemism and diversity);
- Includes shallow shelf environments and provides protection for shelf and slope habitats, as well as pinnacle and terrace seafloor features;
- Contains more than 15 known shipwrecks listed under *Underwater Cultural Heritage Act 2018* (replaced the *Historic Shipwrecks Act 1976*);
- Includes examples of the seafloor habitats and communities associated with the Central Western Shelf Transition, the Central Western Transition, the North West Province and the North West Shelf Province; and
- Diverse social values including tourism and recreation, and fishing.

Gascoyne Marine Park

The Gascoyne Marine Park is located approximately 20 km off the west coast of the Cape Range Peninsula, adjacent to the Ningaloo Reef Marine Park and the WA Ningaloo Marine Park, and extends to the limit of Australia's exclusive economic zone (EEZ). The marine park covers an area of 81,766 km^2 and lies in waters ranging from 15 m to 6,000 m. The marine park was proclaimed under the EPBC Act on 14 December 2013 and renamed Gascoyne Marine Park on 9 October 2017. The marine park includes areas zoned as National Park Zone (IUCN Category II), Habitat Protection Zone (IUCN Category IV), and Marine Use Zone (IUCN Category VI). The marine park has the following conservation values (Director of National Parks, 2018a):

- Contains habitats, species and ecological communities associated with the Central Western Shelf Transition, the Central Western Transition and the North West Province;
- Includes some of the most diverse continental slope habitats in Australia, such as the continental slope area between the North West Cape and the Montebello Trough;
- The Marine Park provides a continuous connectivity corridor from shallow depths of around 15 m out to deep offshore waters on the abyssal plain at over 5,000 m in depth.
- Supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act;
- Includes BIAs:
  - Inter-nesting sites for marine turtles;
  - Includes part of the migratory pathway of the protected humpback whale;
  - Foraging habitat and migratory path for pygmy blue whales; and
  - Breeding habitat for seabirds;
- Includes four KEFs:
  - Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula;
  - Commonwealth waters adjacent to Ningaloo Reef;
  - Continental slope demersal fish communities; and
  - Exmouth Plateau (valued as a unique seafloor feature with ecological properties of regional significance);
- Contains more than five known shipwrecks listed under *Underwater Cultural Heritage Act 2018*; and
- Diverse social values including commercial fishing, mining and recreation.

Montebello Marine Park

The Montebello Marine Park is located offshore of Barrow Island and 80 km west of Dampier extending from the WA State waters boundary, and is adjacent to the WA Barrow Island and Montebello Islands Marine Parks. Covering an area of 3,413 km^2 and water depths ranging from less than 15 m to 150 m, the marine park includes one area zoned as Multiple Use Zone (IUCN Category VI). The marine park was proclaimed under the EPBC Act on 14 December 2013 and renamed the Montebello Marine Park on 9 October 2017. The marine park has the following conservation values (Director of National Parks, 2018a):

- Includes habitats, species and ecological communities associated with the North West Shelf Province;
- Includes diverse benthic and pelagic fish communities;
- Supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act;
- Includes BIAs:
  - Inter-nesting, foraging, mating and nesting habitat for marine turtles;
  - Includes part of the migratory pathway of the protected humpback whale;
  - Foraging habitat for whale sharks; and
  - Breeding habitat for seabirds;
- Includes one KEF for the region, the Ancient Coastline at the 125-m Depth Contour (valued as a unique seafloor feature with ecological properties of regional significance);
- Includes a prominent seafloor feature, the Trial Rocks, consisting of two close coral reefs. The reefs are emergent at low tide;
- Includes two known historic shipwrecks listed under *Underwater Cultural Heritage Act 2018*; and
- Diverse social values including tourism, fishing, mining and recreation.

Shark Bay Marine Park

The Shark Bay Marine Park is located approximately 60 km offshore of Carnarvon, adjacent to the Shark Bay World Heritage Property and National Heritage Place. The marine park covers an area of 7,443 km^2, extending from the WA state waters boundary, and with water depths ranging from 15 m to 220 m. Proclaimed under the EPBC Act on 14 December 2013, the marine park was renamed Shark Bay Marine Park on 9 October 2017. The marine park includes one zone, Multiple Use Zone (IUCN Category VI). The marine park has the following conservation values (Director of National Parks, 2018a):

- Includes habitats, species and ecological communities associated with the Central Western Shelf Province and Central Western Transition;
- Provides connectivity between the deeper Commonwealth waters and the inshore waters of the Shark Bay World Heritage Property;
- Supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act;
- BIAs include breeding habitat for seabirds, inter-nesting habitat for marine turtles, and a migratory pathway for humpback whales;
- Includes BIAs:
  - Inter-nesting habitat for marine turtles;
  - Migratory pathway of the protected humpback whale; and
  - Breeding habitat for seabirds;
- The marine park and adjacent coastal areas are important for shallow-water snapper;
- Approximately 20 known shipwrecks listed under the *Underwater Cultural Heritage Act 2018*; and
- Diverse social values including tourism, commercial fishing, mining and recreation.

Carnarvon Canyon Marine Park

The Carnarvon Canyon Marine Park includes one zone, Habitat Protection Zone (IUCN Category IV). The marine park covers an area of 6,177 km^2 and a water depth range from 1,500 m to 6,000 m. The marine park is located approximately 300 km northwest of Carnarvon. The marine park includes the Carnarvon Canyon, a single-channel canyon covering the entire depth range of the marine park. The marine park was proclaimed under the EPBC Act on 14 December 2013 and renamed Carnarvon Canyon Marine Park on 9 October 2017. The marine park has the following conservation values (Director of National Parks, 2018a):

- Supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act;
- Includes deep-water ecosystems associated with the Carnarvon Canyon. The soft-seafloor environment at the base of the canyon is likely to support species that are typical of the deep seafloor (e.g. holothurians, polychaetes and seapens);
- Includes examples of ecosystems representative of the Central West Transition; and
- Commercial fishing is an important activity in the marine park.

Argo-Rowley Terrace Marine Park

The Argo-Rowley Terrace Marine Park includes three zones, National Park Zone (IUCN Category II), Multiple Use Zone (IUCN Category VI) and Special Purpose Zone (Trawl) (IUCN Category VI). The wider EMBA only intercepts the Multiple Use Zone. The marine park is the largest in the North-west Network covering an area of 146,003 km^2 and with water depths ranging from 220 m to 6,000 m. The marine park is located approximately 270 km northwest of Broome, WA, and extends to the limit of Australia’s EEZ. The marine park is adjacent to the Mermaid Reef Marine Park and the WA Rowley Shoals Marine Park. The marine park was proclaimed under the EPBC Act on 14 December 2013 and renamed Argo-Rowley Terrace Marine Park on 9 October 2017. The marine park has the following conservation values (Director of National Parks, 2018a):

- Supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act;
- Includes biologically important areas (BIAs):
  - Migratory path for the pygmy blue whale;
  - Resting and breeding habitat for seabirds;
- Includes two KEFs:
  - Canyons linking the Cuvier Abyssal Plain with the Scott Plateau – an area likely to result in upwelling of nutrient rich water and aggregations of marine life; and
  - Mermaid Reef and Commonwealth waters surrounding Rowley Shoals – an area of enhanced productivity and high species richness, thought to be facilitated by internal wave action generated by internal tides);
- Includes a range of seafloor features such as canyons on the slope between the Argo Abyssal Plain, Rowley Terrace and Scott Plateau – these are believed to be up to 50 million years old;
- Contains two known shipwrecks listed under *Underwater Cultural Heritage Act 2018*: the *Alfred* (wrecked in 1908) and the *Pelsart* (wrecked in 1908);
- Includes examples of ecosystems representative of the Northwest Transition and the Timor Province; and
- Commercial fishing and mining are important activities in the marine park.

Abrolhos Marine Park

The Abrolhos Marine Park includes four zones, National Park Zone (IUCN Category II), Habitat Protection Zone (IUCN Category IV), Multiple Use Zone (IUCN Category VI) and Special Purpose Zone (IUCN Category VI). The marine park is located adjacent to the WA Houtman Abrolhos Islands, covering a large offshore area extending from the WA State water boundary to the edge of Australia’s EEX. The marine park covers an area of 88,060 km^2 and with a water depth range between less than 15 m and 6,000 m. The marine park is located approximately 27 km southwest of Geraldton and extends north to approximately 330 km west of Carnarvon. The marine park is adjacent to the WA Shark Bay World Heritage Property, listed as an area of outstanding universal value under the World Heritage Convention in 1991. The marine park was proclaimed under the EPBC Act on 14 December 2013 and renamed Abrolhos Marine Park on 9 October 2017. The marine park has the following conservation values (Director of National Parks, 2018b):

- Supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act;

- Includes biologically important areas (BIAs):
  - Migratory path for humpback and pygmy blue whales;
  - Foraging and breeding habitat for seabirds;
  - Foraging habitat for Australian sea lions and white sharks;
- Includes seven KEFs:
  - Commonwealth marine environment surrounding the Houtman Abrolhos Islands;
  - Demersal slope and associated fish communities of the Central Western Province;
  - Mesoscale eddies;
  - Perth Canyon and adjacent shelf break, and other west-coast canyons;
  - Western rock lobster;
  - Ancient coastline between 90 m and 120 m depth; and
  - Wallaby Saddle;
- Contains a number of seafloor features including the Houtman Canyon, the second largest submarine canyon on the west coast of Australia;
- Contains 11 known shipwrecks listed under *Underwater Cultural Heritage Act 2018*, including the Zuytdorp (wrecked in 1712), the *HMAS Sydney II* and *HSK Kormoran* (both wrecked in 1941); and the *Batavia* (wrecked on the adjacent Abrolhos Islands in 1629) shipwreck site and survivor camps area are on the National Heritage List;
- Sea country valued for indigenous cultural values. The Nanda and Naaguja People have responsibilities for sea country in the marine park. Artefacts from ancestors are abundant on islands in the adjacent State marine park;
- Includes examples of ecosystems representative of the Central Western Province, the Central Shelf Province; the Central Western Transition and the South-west Shelf Transition; and
- Tourism, commercial fishing, mining and recreation (including recreational fishing) are important activities in the marine park.

Jurien Marine Park

The Jurien Terrace Marine Park includes two zones, National Park Zone (IUCN Category II) and Special Purpose Zone (IUCN Category VI). The marine park covers an area of 1,851 km^2 of continental shelf, extending from the WA State water boundary, and a water depth range of between 15 m and 220 m. The marine park is located approximately 148 km north of Perth and 155 km south of Geraldton, adjacent to the WA Jurien Bay Marine Park. The marine park was proclaimed under the EPBC Act on 14 December 2013 and renamed Jurient Bay Marine Park on 9 October 2017. The marine park has the following conservation values (Director of National Parks, 2018b):

- Supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act;
- Includes biologically important areas (BIAs):
  - Migratory path for humpback and pygmy blue whales;
  - Foraging habitat for seabirds, Australian sea lions and white sharks;
- Includes three KEFs:
  - Ancient coastline between 90 m and 120 m depth – high benthic biodiversity and productivity occur where the ancient coastline forms a prominent escarpment;
  - Demersal slope and associated fish communities of the Central Western Province – an area that provides important habitat for demersal fish communities and is characterised by high species diversity and endemism; and

  - Western rock lobster – plays and important trophic role in many of the inshore ecosystems of the South-west Marine Region. Western rock lobsters are an important part of the food web on the inner shelf, particularly as juveniles;

- Contains a mixture of tropical species carried south by the Leeuwin Current, and temperate species carried north by the Capes Current. Seagrass meadows occur in more sheltered areas as well in the inter-reef lagoons along exposed sections of the coast;
- Cultral values for indigenous peoples – The Noongar people have responsibilitiesw for sea country in the marine park. Artefacts from ancestors are abundant on islands in the adjacent State marine park.
- Contains two known shipwrecks listed under *Underwater Cultural Heritage Act 2018*: the *SS Cambewarra* (wrecked in 1914) and the *Oleander* (wrecked in 1884);
- Includes examples of ecosystems representative of the South-west Shelf Transition and the Central Western Province; and
- Tourism, commercial fishing, mining and recreation (including recreational fishing) are important activities in the marine park.

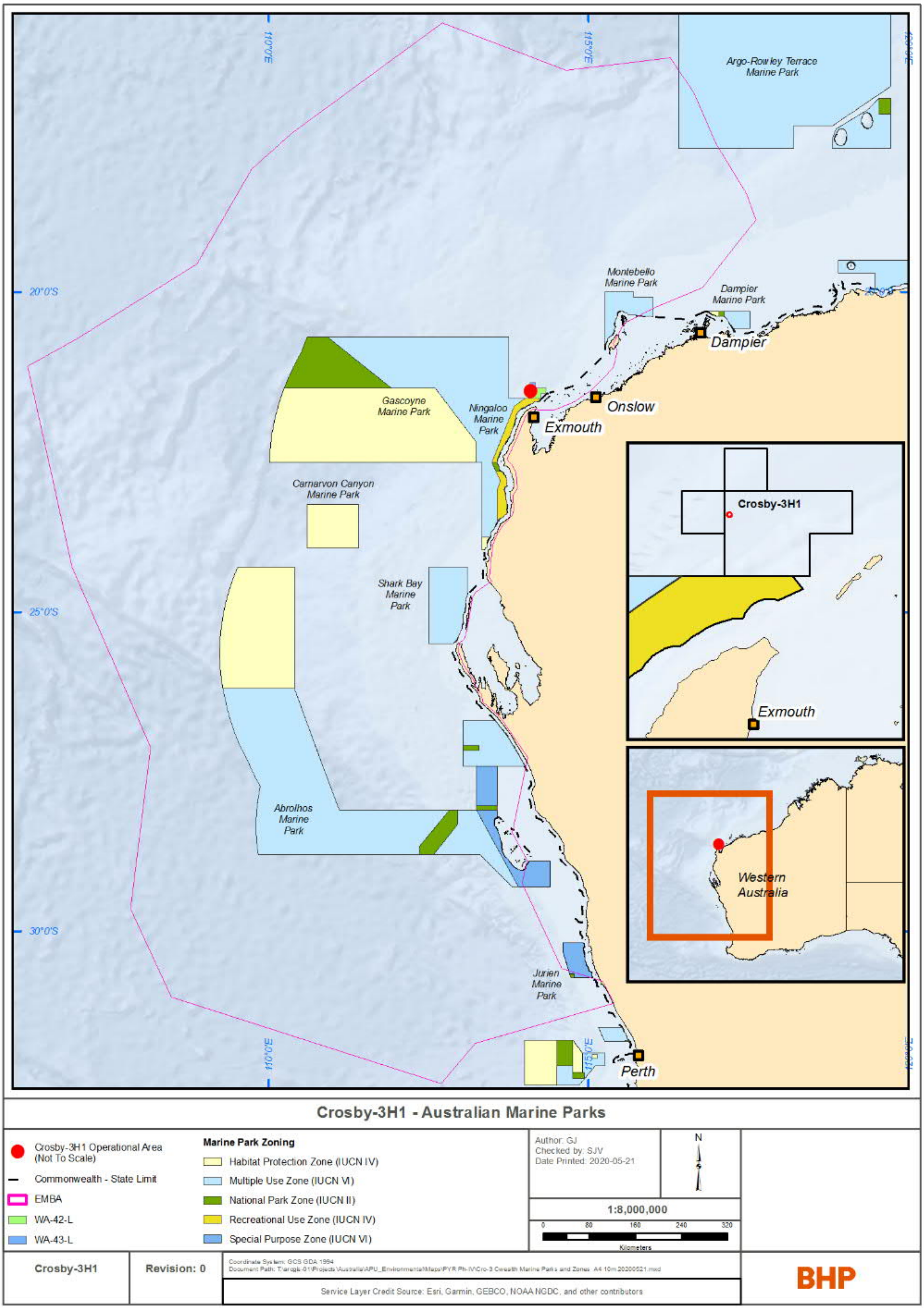


Figure 4-18: Australian marine parks within the EMBA

4.10.2 State Marine Parks and Marine Management Areas

There are no State Marine Parks or Marine Management Areas located within the operational area (Figure 4-19). State Marine Parks and Marine Management Areas that fall within the wider EMBA are listed in Table 4-12, shown on Figure 4-19, and described below.

Table 4-12: State Marine Parks and Marine Management Areas within the EMBA

Value / Sensitivity	Distance from operational area	EMBA	
		Operational Area	Wider EMBA
Ningaloo Marine Park	19 km	x	✓
Muiron Islands Marine Management Area	22 km	x	✓
Barrow Island Marine Park	150 km	x	✓
Barrow Island Marine Management Area	138 km	x	✓
Montebello Islands Marine Park	177 km	x	✓
Shark Bay Marine Park	378 km	x	✓
Jurien Bay Marine Park	950 km	x	✓

Ningaloo Marine Park

The Ningaloo Marine Park and the Muiron Islands Marine Management Area are the marine conservation areas closest in distance to the operational area. The Ningaloo Marine Park was originally declared in 1987 and in June 2011 became part of the World Heritage listed Ningaloo Coast (refer to Section 4.5.2). The marine is a multiple-use marine park that stretches approximately 300 km along the west coast of the Cape Range Peninsula near Exmouth, WA from Bundegi in the north to Red Bluff in the south. The marine park consists of both State and Commonwealth Waters, which are declared under Western Australian and Commonwealth legislation. The combined State and Commonwealth waters of the marine park cover a total area of 5,070 km^2.

The marine park provides habitat for a diverse range of marine species including over 200 species of corals, over 460 species of reef fish, as well as populations of marine turtles, manta rays, sharks, whale sharks, dugongs, dolphins, and whales. Intertidal systems such as rocky shores, sandy beaches, estuaries, and mangroves are also found within the marine park. The most dominant marine habitat is the Ningaloo Reef comprising a mosaic of substrata that includes hard coral, macroalgae, turfing algae, limestone pavement and sand.

Muiron Islands Marine Management Area

The Muiron Islands Marine Management Area was established in 2004 and covers approximately 280 km^2. The area was designated to protect the waters surrounding South Muiron Island, North Muiron Island and Sunday Island. The Muiron Islands Marine management Area is also part of the Ningaloo Coast World Heritage Area.

The Muiron Islands are a continuation of the Cape Range Peninsula and are low dome-shaped, limestone islands separated by a deep navigable channel. The marine fauna and flora of the Muiron Islands are similar to that of the Ningaloo Reef; the western shores of the islands are characterised by limestone cliffs fronted by sandy beaches and intertidal rock platforms beyond which the seafloor slopes away to the shelf edge some 30 km seaward (CALM, 2005a). The Muiron Islands Marine Management Area contains a very diverse marine environment, with coral reefs, filter-feeding communities and macroalgal beds. The foreshores and nearshore reefs of the Muiron/Sunday Islands provide important aggregation and nesting areas for turtle populations. Four species of turtle (green, loggerhead, hawksbill and flatback) have been recorded nesting on the Muiron Islands (Rob *et al.*, 2019). The islands are also important seabird nesting areas.

Barrow Island Marine Park and Marine Management Area, Montebello Islands Marine Park

The Barrow Island Marine Park, the Barrow Island Marine Management Area and the Montebello Island Marine Park lie adjacent to one another and cover areas of approximately 42 km^2, 1,147 km^2, and 583 km^2 respectively (DEC, 2006). The Marine Parks and Marine Management Area comprise numerous low-lying limestone islands, islets and rocky stacks with intertidal and subtidal coral reefs, mangrove macroalgal communities and sheltered lagoons. Many of the islands are nature reserves such as Montebello Islands Conservation Park, Barrow Island Nature Reserve and Boodie, Double and Middle Islands Nature Reserve, and the Lowendal Islands Nature Reserve. The boundary of the majority of the island reserves extends to the low water mark and therefore the intertidal communities are part of these terrestrial reserves. The exception is the Lowendal Islands Nature Reserve, which extends to the high water mark (DEC, 2006).

The island group lies entirely within WA State waters, with the State-Commonwealth boundary extending out to encompass the islands and waters 3 nm west of Barrow Island and north of the Montebello Islands. A summary of specific ecological values include:

- Foraging areas for seabirds and migratory shorebirds;
- Foraging areas for whale sharks;
- Aggregation and nesting sites for marine turtles;
- Includes part of the migratory pathway of the protected humpback whale;
- Feeding grounds for dugongs;
- Mangrove communities on the Montebello Islands are considered to be globally unique;
- Special purpose zones for commercial pearling; and
- Fringing coral reef communities.

Shark Bay Marine Park

The Shark Bay Marine Reserves comprise the Shark Bay Marine Park and the Hamelin Pool Marine Nature Reserve, both of which lie within the Shark Bay World Heritage Area (see previous Section 4.5.2). The Shark Bay Marine Park was gazetted on 30 November 1990 as a Class A Marine Park Reserve No. 7 and vested in the National Park and Nature Conservation Authority (NPNCA) under *the Conservation and Land Management Act 1984* (CALM Act). The marine park covers an area of 748,725 hectares (CALM, 1996).

Shark Bay is renowned for its marine fauna. It is located near the northern limit of a transition region between temperate and tropical marine fauna. Of the 323 fish species recorded from Shark Bay, 83% are tropical with 11% warm temperate and 6% cool temperate species. Similarly, of the 218 species of bivalve molluscs recorded in Shark Bay, 75% have a tropical range and 10% a southern Australian range, with 15% being endemic to the west coast (CALM, 1996).

Key conservation values of the marine park include (CALM, 1996):

- High diversity (12 species) of seagrass, with the 1,030 km^2 Wooramel seagrass bank being the largest known structure of its type in the world;
- A dugong population estimated in the region of 10,000, one of the largest populations in the world;
- Staging post for humpback whales during their migration along the west coast;
- Important nesting sites for green and loggerhead turtles, with Dirk Hartog Island providing the most important nesting site for loggerheads in WA;
- Major nursery area for commercially important fish resources;
- Rich birdlife with a high occurrence of migratory and breeding seabirds;
- Supports significant populations of sharks, rays and seasnakes; and
- Hamelin Pool in Shark Bay contains the most diverse and abundant examples of stromatolite forms in the world, representative of life-forms which lived some 3,500 million years ago.

Jurien Bay Marine Park

The Jurien Bay Marine Park is located on the central west coast of WA about 200 km north of Perth. The marine park covers an area of 82,375 ha and begins south of Wedge Island (South Rocks) and runs to Dynamite Bay in Green Head. The Jurien Bay Marine Park was gazetted on 26 August 2003 as a Class A Marine Park.

The marine park is considered to be broadly representative of the Central West Coast limestone reef system, which a a major marine ecosystem within the bioregion. The marine biota of the area consists of an unusual mix of tropical and temperate species as well as many endemic species (CALM/MRPA, 2005b). The marine biota of the Jurien Bay region is dominated by five major marine habitat types: seagrass beds, bare or sparsely vegetated mobile sand; shoreline and offshore intertidal reef platforms; subtidal limestone reefs; and reef pavements (CALM/MRPA, 2005b). At least nine species of seagrass exist in the extensive seagrass meadows in the marine park. Marine wildlife includes 14 species of cetaceans, a variety of seabirds and shorebirds which nest on the islands and the Australian sea lion – North Fisherman Island to the north of Jurien Bay is one of the main breeding sites for sea lions in the Central West Coast region, and it is believed this breeding population is genetically distinct from the southern coast population. Commercial fishing for western rock lobster as well as commercial wetlining, abalone, shark netting, beach seining for mullet and collecting of specimen shells and aquarium fish are carried out within the marine park (CALM//MRPA, 2005b).

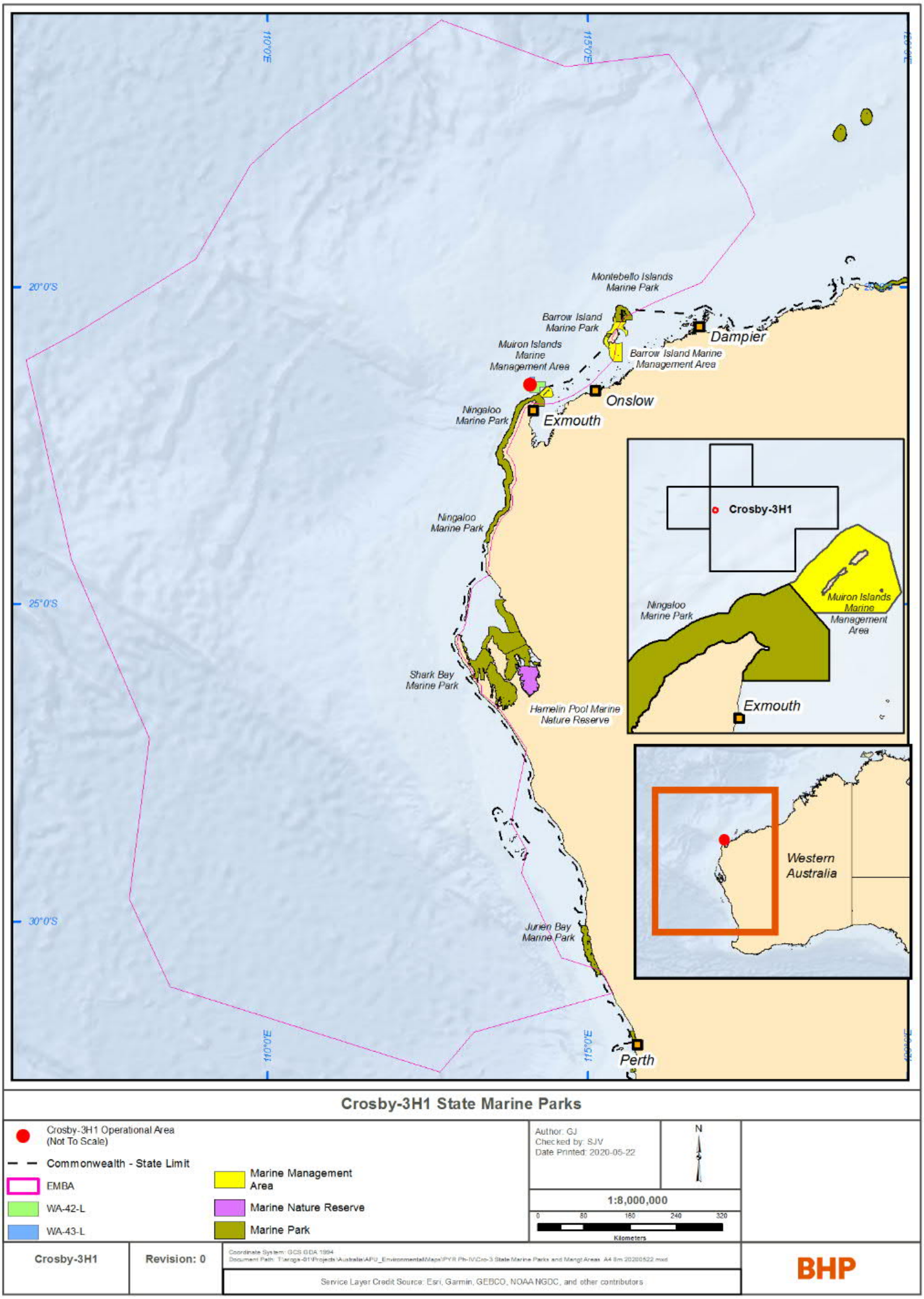


Figure 4-19: State marine reserves and marine management areas within the EMBA

4.10.3 Key Ecological Features

Key ecological features (KEFs) are areas of regional importance for either biodiversity or ecosystem function and integrity within the Commonwealth marine environment and have been identified through the marine bioregional planning process (DSEWPaC, 2012b). KEFs meet one or more of the following criteria:

- A species, group of species or a community with a regionally important ecological role (e.g. a predator, prey that affects a large biomass or number of other marine species);
- A species, group of species or a community that is nationally or regionally important for biodiversity;
- An area or habitat that is nationally or regionally important for:
  - o enhanced or high productivity (such as predictable upwellings - an upwelling occurs when cold nutrient-rich waters from the bottom of the ocean rise to the surface);
  - o aggregations of marine life (such as feeding, resting, breeding or nursery areas);
  - o biodiversity and endemism (species which only occur in a specific area); or;
- A unique seafloor feature, with known or presumed ecological properties of regional significance.

One KEF overlaps the operational area and 13 KEFs have boundaries that lie within the wider EMBA (Table 4-13 and Figure 4-20). Information on the relevant KEFs has been extracted DSEWPaC (2012b; 2012c) and is summarised below.

Table 4-13: Key ecological features within the EMBA

Value / Sensitivity	Distance from to Operational Area	EMBA	
		Operational Area	Wider EMBA
Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	Overlaps with operational area	✓	✓
Continental slope demersal fish communities	3 km	x	✓
Ancient coastline at 125-m depth contour	10 km	x	✓
Commonwealth waters adjacent to Ningaloo Reef	13 km	x	✓
Exmouth Plateau	87 km	x	✓
Glomar Shoals	340 km	x	✓
Western demersal slope and associated fish communities	480 km	x	✓
Wallaby Saddle	500 km	x	✓
Ancient coastline at 90-120 m depth	680 km	x	✓
Western rock lobster	680 km	x	✓
Perth Canyon and adjacent shelf break, and other west coast canyons	710 km	x	✓
Commonwealth marine environment surrounding the Houtman Abrolhos Islands	720 km	x	✓
Commonwealth marine environment within and adjacent to the west coast inshore lagoons	725 km	x	✓

Canyons Linking the Cuvier Abyssal Plain and the Cape Range Peninsula

This KEF is recognised for its biodiversity values (unique sea-floor feature with ecological properties of regional significance), which apply to both the benthic and pelagic habitats within the KEF. The canyons are associated with upwelling as they channel deep water from the Cuvier Abyssal Plain onto the slope. This nutrient-rich and cooler waters interact with the Leeuwin Current at the canyon heads. Thus the canyons probably play a part in the enhanced productivity of the Ningaloo Reef system.

The canyons are also repositories for organic and inorganic particulate matter from the shelf and serve as conduits for its transfer from the surface and shelf to greater depths. Aggregations of whale sharks, manta rays, large predatory fish and seabirds are known to occur in the area.

This KEF intercepts with the operational area and the wider EMBA.

Continental Slope Demersal Fish Communities

This species assemblage is recognised as a KEF because of its biodiversity values, including high levels of endemism.

The diversity of demersal fish assemblages on the continental slope in the Timor Province, the Northwest Transition and the Northwest Province is high compared to elsewhere along the continental slope. The continental slope between North West Cape and the Montebello Trough has more than 500 fish species, 76 of which are endemic, making it the most diverse slope bioregion in Australia. The demersal fish species occupy two distinct demersal community types associated with the upper slope (water depth of 225–500 m) and the mid slope (750–1,000 m).

This KEF is 3 km from the operational area and it intercepts with the wider EMBA.

Ancient Coastline at the 125-m Depth Contour

This KEF is recognised for its biodiversity values (unique seafloor feature with ecological properties of regional significance), which apply to both the benthic and pelagic habitats within the KEF. The shelf of the North West Marine Region contain several terraces and steps that reflect increases in sea level across the shelf that occurred during the Holocene period. The most prominent of these occurs episodically as an escarpment through the North West Shelf Province and the North West Shelf Transition, at a depth of approximately 125 m.

Parts of the ancient coastline, particularly where it exists as a rocky escarpment, are thought to provide biologically important habitats in areas otherwise dominated by soft sediments. Little is known about fauna associated with the hard substrate of the escarpment but it is likely to include sponges, corals, crinoids, molluscs, echinoderms and other benthic invertebrates representative of hard substrate fauna in the North West Shelf bioregion.

The topographic complexity of the escarpment may also facilitate vertical mixing of the water column, providing relatively nutrient-rich local environments. Enhanced productivity may also attract opportunistic feeding by larger marine life including humpback whales, whale sharks and large pelagic fish.

This KEF is 10 km from the operational area and it intercepts with the wider EMBA.

Commonwealth Waters adjacent to Ningaloo Reef

This KEF is recognised for its biodiversity (aggregations of marine life) values, which apply to both the benthic and pelagic habitats within the KEF. The Commonwealth waters adjacent to Ningaloo reef include Ningaloo Marine Park (Commonwealth waters) covering an area of 2,435 km^2. This feature lies adjacent to the Ningaloo Reef State waters margin at the 3 nautical mile limit. Ningaloo Reef is globally significant as the only extensive coral reef in the world that fringes the west coast of a continent. Upwellings associated with canyons on the adjacent slope and interactions between the Ningaloo and Leeuwin currents result in areas of enhanced productivity in the Commonwealth waters adjacent to Ningaloo Reef.

Shelf waters and nutrient-rich upwellings support aggregations and migration pathways of whale sharks, manta rays, humpback whales, seasnakes, sharks, large predatory fish and seabirds. Deepwater biodiversity includes fish, molluscs, sponges, soft corals and gorgonian corals.

This KEF is 13 km from the operational area and it intercepts with the wider EMBA.

Exmouth Plateau

This KEF is recognised for its biodiversity values (unique sea-floor feature with ecological properties of regional significance), which apply to both the benthic and pelagic habitats within the KEF.

The Exmouth Plateau is located in the North West Province and covers an area of 49,310 km^2 in water depths ranging from 800 m to 4,000 m. The Exmouth Plateau is a regionally and nationally unique deep-sea plateau in tropical waters. The plateau is a large topographic obstacle that may modify the flow of deep waters, generating internal tides and may contribute to upwelling of nutrients, thus serving an important ecological role. This KEF is 87 km from the operational area and it intercepts with the wider EMBA.

Glomar Shoals

The Glomar Shoals are a submerged littoral feature located approximately 150 km north of Dampier on the Rowley Shelf at water depths of 33–77 m. The shoals consist of a high percentage of marine-derived sediments with high carbonate content and gravels of weathered coralline algae and shells. The area's higher concentrations of coarse material compared to surrounding areas are indicative of a high energy environment subject to strong seafloor currents.

Biological communities found at the Glomar Shoals have not been comprehensively studied; however, the shoals are known to be an important area for a number of commercial and recreational fish species such as rankin cod, brown striped snapper, red emperor, crimson snapper, bream and yellow-spotted triggerfish. High catch rates for these species indicate that the shoals are an area of high productivity.

The Glomar Shoals are regionally important for their potentially high biological diversity and high localised productivity. Biological data specific to the Glomar Shoals is limited, however the fish of the shoals are probably a subset of reef-dependent species and anecdotal evidence suggests they are particularly abundant.

This KEF is 340 km from the operational area and it intercepts with the wider EMBA.

Demersal Slope and Associated Fish Communities of the Central Western Province

The western continental slope provides important habitat for demersal fish communities, with a high level of diversity and endemism. Its diversity is attributed to the overlap of ancient and extensive Indo-west pacific and temperate Australasian fauna.

Records of 480 species of demersal fish that inhabit the slope have been described, and 31 of these are considered endemic to the bioregion. A diverse assemblage of demersal fish species below a depth of 400 m is dominated by relatively small benthic species such as grenadiers, dogfish and cucumber fish. Unlike other slope fish communities in Australia, many of these species display unique physical adaptations to feed on the sea floor (such as a mouth position adapted to bottom feeding), and many do not appear to migrate vertically in their daily feeding habits.

This KEF is 480 km from the operational area and it intercepts with the wider EMBA.

Wallaby Saddle

The Wallaby Saddle is defined as a KEF for its high productivity and aggregations of marine life. The Wallaby Saddle is an abyssal geomorphic feature covering an area of 7,880 km^2 of seafloor located on the upper continental slope at a depth of 4,000–4,700 m. The feature connects the north-west margin of the Wallaby Plateau with the margin of the Carnarvon Terrace. It is located within the Indian Ocean water mass and is thus differentiated from systems to the north that are dominated by transitional fronts or the Indonesian Throughflow. Little is known about the Wallaby Saddle; however, the area is considered one of enhanced productivity and low habitat diversity. Historical sperm whale aggregations may be attritubable to higher productivity and aggregations of baitfish.

This KEF is 500 km from the operational area and it intercepts with the wider EMBA.

Ancient coastline between 90 and 120 m Depth

The continental shelf of the South-West Marine Region contains several terraces and steps, reflecting a gradual increase in sea level across the shelf that occurred during the Holocene period. Some of these features occur as escarpments of varying elevation and distinctness, creating topographic complexity through the exposure of rocky substrates, that may facilitate small, localised upwellings, benthic biodiversity and enhanced biological productivity.

While the ancient coastline is present throughout the region, it is particularly evident in the western Great Australian Bight at a depth of 90-120 m. Parts of this ancient coastline may support some demersal fish species travelling across the continental shelf to the upper continental slope, thereby supporting ecological connectivity. The feature provides a complex habitat for a number of species including sponge communities of significant biodiversity and structural complexity.

This KEFis 680 km from the operational area and it intercepts with the wider EMBA.

Western Rock Lobster

The Western Rock Lobster KEF is defined due to its presumed ecological role on the west coast continental shelf. The western rock lobster is the dominant large benthic invertebrate in the region and plays an important trophic role in many of the inshore ecosystems of the South-west Marine Region. The species is an important part of the food web on the inner shelf, particularly as juveniles are important prey items of a range of species including octopus, cuttlefish, baldchin groper, dhufish, pink snapper, wirrah cod, breaksea cod and Australian sea lions. The high biomass of western rock lobster, combined with its vulnerability to predation particularly during their seasonal moults in November-December, suggests that they are an important trophic pathway for a range of inshore species that prey upon juvenile lobsters.

This KEF is 680 km from the operational area and it intercepts with the wider EMBA.

Perth Canyon and Adjacent Shelf Break, and other West Coast Canyons

The Perth Canyon is defined as a KEF for its high biological productivity and aggregations of marine life and unique seafloor features with ecological properties of regional significance. The Perth Canyon is long, deep, narrow and steep-sided, cutting 4 km into the continental shelf; it is the largest canyon on the Australian margin. In the Perth Canyon, interactions between the canyon topography and the Leeuwin Current induce clockwise-rotating eddies that transport nutrients upwards in the water column from greater depths. Due to the canyon’s depth and Leeuwin Current’s barrier effect, this remains a subsurface upwelling (depths greater than 400 m), which supports ecological complexity that is typically absent from canyon systems in other areas. This nutrient-rich cold water habitat attracts feeding aggregations of deep-diving mammals, such as pygmy blue whales and large predatory fish that feed on aggregations of small fish, krill and squid. The Perth Canyon also marks the southern boundary for numerous tropical species groups on the shelf, including sponges, corals, decapods and xanthid crabs.

This KEF is 710 km from the operational area and it intercepts with the wider EMBA.

Commonwealth Marine Environment surrounding the Houtman Abrolhos Islands

The Commonwealth marine environment surrounding the Houtman Abrolhos Islands (and adjacent shelf break) KEF is defined for its high biodiversity and endemism in benthic and pelagic habitats. The Houtman Abrolhos Islands and surrounding reefs support a mix of temperate and tropical species, resulting from the southward transport of species by the Leeuwin Current over thousands of years. The reefs are composed of 184 known species of corals that support in the region of 400 species of demersal fish, 492 known species of molluscs, 110 species of sponges, 172 species of echinoderms and 234 species of benthic algae. The Houtman Abrolhos Islands are the largest seabird breeding area in the eastern Indian Ocean, supporting more than one million breeding pairs. The Houtman Abrolhos Islands are the northern-most breeding site of the Australian sea lion.

This KEF is 720 km from the operational area and it and intercepts with the wider EMBA.

Commonwealth Marine Environment within & adjacent to West Coast Inshore Lagoons

This feature consists of a chain of inshore lagoons that extend along the WA coast from south of Mandurah to Kalbarri. The lagoons are formed by distinct ridges of north-south oriented limestone reef with extensive beds of macroalgae (principally *Ecklonia* spp.) and seagrass, and extend between 0-30 m water depth. The seagrass provides important habitat for many marine species, and epiphytes are the main food source in the lagoonal system. Although macroalgae and seagrass appear to be the primary source of production, it is believed that groundwater enrichment may supplement the supply of nutrients to the lagoons.

The lagoons are associated with high biodiversity and endemism, containing a mix of tropical, subtropical and temperate flora and fauna. Emergent reefs and small islands create a diverse topography, and the mix of sheltered and exposed seabeds form a complex mosaic of habitats. The inshore lagoons are important areas for the recruitment of the commercially and recreationally important western rock lobster, dhufish, pink snapper, breaksea cod, baldchin and blue gropers, abalone and many other reef species. Extensive schools of migratory fish visit the area annually, including herring, garfish, tailor and Australian salmon.

This feature is recognised as a habitat that is nationally or regionally important for high benthic productivity and for aggregations of marine life. Both benthic and pelagic habitats within the feature are of conservation value.

This KEF is 725 km from the operational area and it intercepts with the wider EMBA.

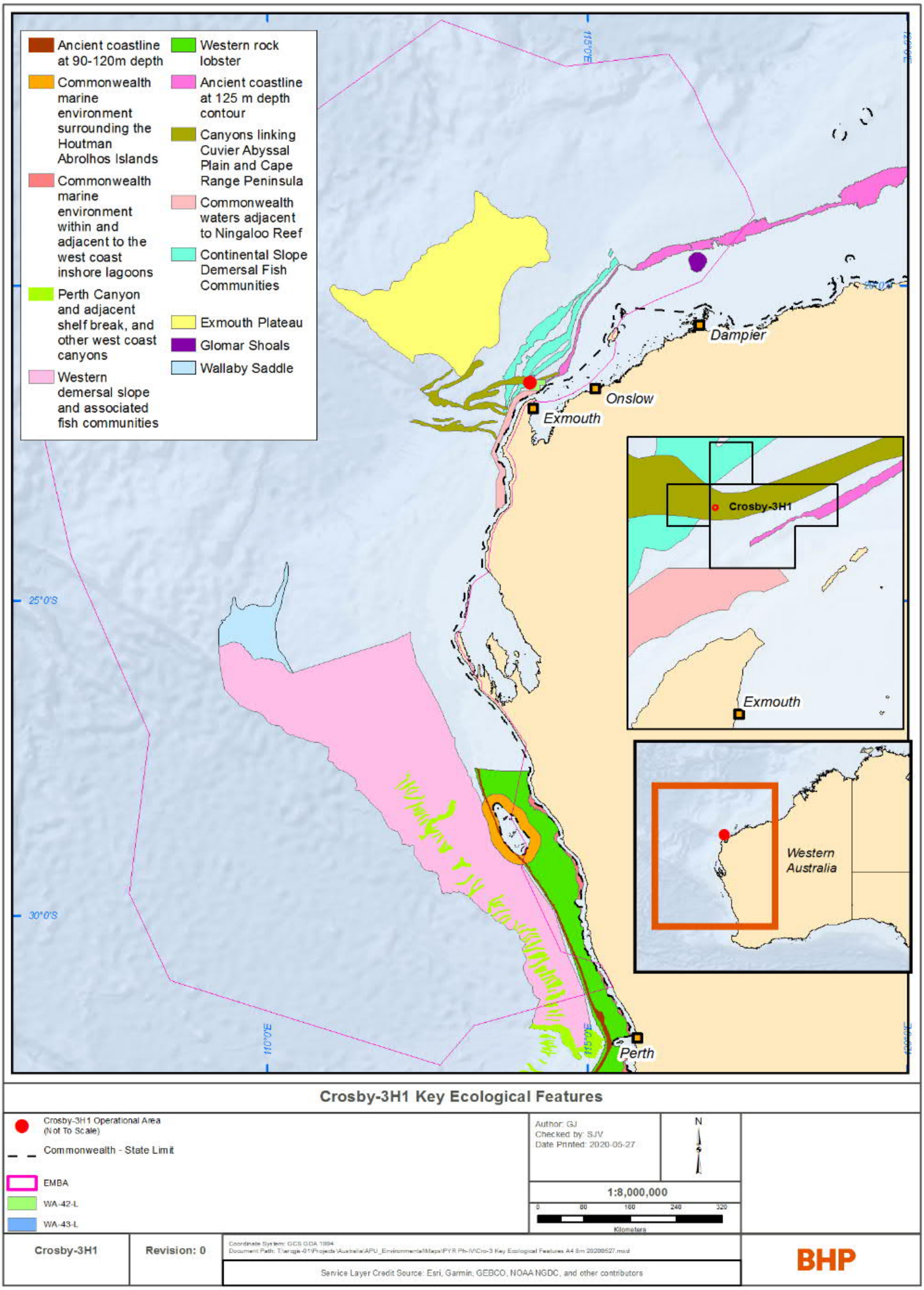


Figure 4-20: Key ecological features within the EMBA

4.10.4 Nationally Important Wetlands

No Nationally Important Wetlands lie within the operational area or wider EMBA.

4.11 Socio-Economic Values and Sensitivities

4.11.1 Commonwealth Heritage

The Commonwealth Heritage List is a list of places of the historic, indigenous and natural heritage value which are entirely within Commonwealth land or in Commonwealth waters, or owned, leased, or managed by the Commonwealth Government. No Commonwealth Heritage Places occur within the operational area and two natural Commonwealth Heritage Places were identified in the wider EMBA:

- The Ningaloo Marine Area – Commonwealth Waters: encompasses the entire Commonwealth component of the Ningaloo Australian Marine Park. Environmental values are discussed in previous Section 4.5.2 and Section 4.10.1.
- HMAS Sydney II and HSK Kormoran Shipwreck Sites, details are described in previous Section 4.5.3.

4.11.2 Cultural Heritage

Indigenous Heritage

Indigenous people have a strong on-going association with the region that extends from the beginning of human settlement in Australia some 50,000 years ago (DEWHA, 2008a). The close, long standing relationship between Aboriginal peoples and the coastal and marine environments of the area is evident. For example, the extensive and diverse assemblages of rock engravings at the Burrup Peninsula is one of the most significant collections of its type found anywhere in the world.

The Indigenous peoples of the northwest continue to rely heavily on coastal and marine environments and resources for their cultural identity, health and wellbeing, as well as their domestic and commercial economies (DEWHA, 2008a). Although this is generally restricted to coastal waters, fishing, hunting and the maintenance of maritime cultures and heritage through ritual, stories and traditional knowledge continue as important uses of the nearshore region and adjacent areas.

While direct use by Aboriginal people of the deeper offshore waters is limited, many groups continue to have a direct cultural interest in decisions affecting the management of these waters. The cultural connections Aboriginal people maintain with the sea may be affected, for example, by commercial fishing activities and other offshore industries. In addition, some indigenous people are involved in commercial activities such as fishing and marine tourism, and so have an interest in how these industries are managed in offshore waters with respect to their cultural heritage and commercial interests (DEWHA, 2008a).

The Aboriginal Heritage Inquiry System (AHIS) provides information concerning Aboriginal heritage places in WA listed under the *Aboriginal Heritage Act 1972*. The AHIS was used to identify Aboriginal sites and other heritage places in the EMBA. The search results are provided in Appendix E.

Maritime Heritage

A search of the shipwreck database was undertaken to identify any known shipwrecks protected under the *Underwater Cultural Heritage Act 2018*. There are no known historic shipwrecks within the operational area. The Australasian Underwater Cultural Heritage Database[2] identified a number of shipwrecks within the EMBA (Table 4-14).

[2] Australasian Underwater Cultural Heritage Database of the Department of Agriculture, Water and the Environment website (http://www.environment.gov.au/heritage/underwater-heritage/auchd)

Table 4-14: Shipwreck database search results

Region	Number of Shipwrecks
Exmouth Gulf	28
Montebello Islands area	9
North West Cape	10
Onslow area	16
Shark Bay	1
Mid-West (Abrolhos)	52

4.11.3 Commercial Fisheries

A number of Commonwealth and State managed fisheries have boundaries that overlap with the operational area and wider EMBA (Figure 4-21 to Figure 4-22). Table 4-15 provides a summary description of the commercial fisheries and the potential for their operations to be affected by the petroleum activity based on their historic level of activity.

Table 4-15: Commonwealth and State managed fisheries within the EMBA

Fishery	Description	EMBA Presence		Relevant Events within Operational Area and wider EMBA
		Operational Area	Wider EMBA	
Commonwealth Managed Fisheries				
North West Slope Trawl	Fishery operates off NW Australia from 114°E to 125°E, roughly between the 200 m isobath and the outer boundary of the Australian Fishing Zone. Predominantly a scampi fishery using demersal trawl gear with key target species being the Australian scampi. Primary landing ports are Darwin (NT) and Point Samson (WA). There were four active vessels in the 2017-18 fishing season (ABARES, 2019).	x	✓	Fishery has boundaries that overlap the wider EMBA and therefore fishing vessels and activities could be affected from unplanned / emergency events.
Western Deepwater Trawl	Fishery operates off the coast of WA between 115°08'E (in the south) and 114°E (in the north) and closely aligns with the 200 m isobath. Effort in recent years has been localised in the area offshore and slightly south of Shark Bay. This demersal trawl fishery catches more than 50 species; deepwater bugs and ruby snapper made up around 50% of the whole catch in 2017-18 fishing season. Primary landing ports are Carnarvon and Fremantle (WA). There were three active vessels in the 2017-18 fishing season (ABARES, 2019).	x	✓	Fishery has boundaries that overlap the wider EMBA and therefore fishing vessels and activities could be affected from unplanned / emergency events.
Western Tuna and Billfish	Fishery concentrates effort in WA waters south of Carnarvon and off South Australia. Main fishing gear is pelagic longline with key targe species being bigeye and yellowfin tuna, with striped marlin and swordfish.	✓	✓	No active commercial fishing in the operational area in recent years. Fisheries have boundaries that overlap the wider EMBA, although unlikely to be
Western Skipjack Tuna	Historically, most fishing effort has used purse seine gear (98%) and small amount using pole and line effort.	✓	✓	

Fishery	Description	EMBA Presence		Relevant Events within Operational Area and wider EMBA
		Operational Area	Wider EMBA	
	There has been no fishing effort/ catch in the fishery since the 2008-09 season, with effort concentrated off South Australia.			affected by unplanned / emergency events since most effort concentrated in South and SE Australia and/ or south WA.
Southern Bluefish Tuna	Fishery spans the Australian Fishing Zone, although only active in waters offshore South and SE Australia, with most catch taken in the Great Australian Bight by purse seine vessels. Smaller amounts are taken from the longline fisheries mainly off SE Australia. Primary landing port is Port Lincoln (SA). There were 38 vessels (7x purse seine; 31x longline) active in 2017-18 fishing season.	✓	✓	
Small Pelagic	Fishery extends from the Queensland/ NSW border, typically outside 3 nm, around southern Australia to a line at latitude 31º south (near Lancelin). The Fishery targets Australian sardine, blue mackerel, jack mackerel, and redbait using midwater trawl, purse seine and jigging and minor line methods.	x	✓	
State Managed Fisheries				
Mackerel Managed	Fishery extends from the West Coast Bioregion to the WA/NT border. The key target species making up the majority of the catch are Spanish mackerel and broad-barred Spanish mackerel. Uses near-surface trolling gear from vessel in coastal areas around reefs, shoals and headlines. The majority of the catch is taken in the Kimberley area.	✓	✓	Fishery has boundaries that overlap the operational area and wider EMBA. No active fishing in the operational area. Fishery activities could be affected from unplanned / emergency events.
Pilbara Demersal Scale Fisheries (Line)	Permitted to operate anywhere within Pilbara waters, bounded by a line commencing at the intersection of 21°56' S latitude and the high water mark on the western side of the North West Cape on the mainland of WA; west along the parallel to the intersection of 21°56' S latitude and the boundary of the Australian Fishing Zone and north to longitude.	✓	✓	Fishery has boundaries that overlap the operational area and wider EMBA. No active fishing in the operational area. Fishery activities could be affected from unplanned / emergency events.
Pilbara Demersal Scale Fisheries (Trawl and Trap)	The Trawl Managed Fishery operates in the waters north of latitude 21°35'S and between longitudes 114°9'36"E and 120°E. The fishery is seaward of the 50 m isobath and landward of the 200 m isobath. The Trap Managed Fishery lies north of latitude 21°44' S and between longitudes 114°9.6' E and 120°00'E on the landward side of a boundary approximating the 200 m isobath and seaward of a line generally following the 30 m isobath.	x	✓	Fishery has boundaries that overlap the wider EMBA only, and therefore activities could be affected from unplanned / emergency events.
Sea Cucumber	The fishery is permitted to operate throughout WA waters; however, it is primarily based in the northern half of the State from Exmouth Gulf to the NT border. The target species are sandfish and deepwater redfish that are hand-	X	✓	No active commercial fishing in the operational area. Due to the fishing method,

Fishery	Description	EMBA Presence		Relevant Events within Operational Area and wider EMBA
		Operational Area	Wider EMBA	
	harvested principally by diving and a smaller amount by wading.			activity is restricted to shallow coastal waters. Fishery has boundaries that overlap the wider EMBA and therefore activities could be affected from unplanned / emergency events.
Marine Aquarium Fish Managed	This is a dive fishery operating all year throughout all State waters between NT and SA border. During 2017, 11 licences were active in the fishery out of the 12 licences (DPIRD, 2018).	✓	✓	No active commercial fishing in the operational area. Due to the fishing method, activity is restricted to shallow coastal waters. Fishery has boundaries that overlap the wider EMBA and therefore activities could be affected from unplanned / emergency events.
Specimen Shell Managed	The fishery is based on the collection of individual shells for the purposes of display, collection, cataloguing, classification and sale. The main methods are by hand by a small group of divers operating from small boats in shallow coastal waters or by wading along coastal beaches below the high water mark. While the fishery covers the entire Western Australian coastline, there is some concentration of effort in areas adjacent to population centres such as Broome, Exmouth, Shark Bay, Geraldton, Perth, Mandurah, the Capes area and Albany. Fishery has 31 licences with a maximum of 2 divers allowed in the water per licence at any one time and specimens may only be collected by hand.	✓	✓	No active commercial fishing in the operational area. Due to the fishing method, activity is restricted to shallow coastal waters. Fishery has boundaries that overlap the wider EMBA and therefore activities could be affected from unplanned / emergency events.
Pearl Oyster Managed	A quota-based, dive fishery, operating in shallow coastal waters along the North West Shelf. Oysters collected by drift diving or by hand. Target species is the Indo-Pacific, silver-lipped pearl oyster (*Pinctada maxima*).	x	✓	No active commercial fishing in the operational area. Due to the fishing method, activity is restricted to shallow coastal waters. Fishery has boundaries that overlap the wider EMBA and therefore activities could be affected from unplanned / emergency events.
Exmouth Gulf Prawn Managed	Operates in the sheltered waters of the Exmouth Gulf mainly in the western half of the Gulf with the south-eastern sided closed to trawling. Fishery uses twin gear otter trawls to target western king pro fishery uses twin gear otter trawls to target western king prawns (*Penaeus latisulcatus*), brown tiger prawns (*P. eculentus*), endeavour prawns (*Metapenaeus* spp.) and banana prawns	x	✓	Fishery has boundaries that overlap the wider EMBA only, and therefore activities could be affected from unplanned / emergency events.

Fishery	Description	EMBA Presence		Relevant Events within Operational Area and wider EMBA
		Operational Area	Wider EMBA	
	(*P. merguiensis*). The opening and closing dates of the fishery vary each year.			
Onslow Prawn Managed	This is an otter trawl fishery with opening and closing dates that vary from year to year. Different areas of the fishery have different seasons that target western king, brown tiger, endeavour and banana prawns. Fishery jurisdiction covers all WA waters below high water mark between Exmouth Prawn Fishery to the west and Nickol Bay Prawn Fishery to the east.	x	✓	Fishery has boundaries that overlap the wider EMBA only, and therefore activities could be affected from unplanned / emergency events.
West Coast Deep Sea Crustacean Managed	Targets crystal (snow) crabs, giant (king) crabs and champagne (spiny) crabs using baited pots operated in a long-line formation. The boundaries of this fishery include all shelf edge waters on seaward side of the 150 m isobath lying north of latitude 34°24' S (Cape Leeuwin) and west of the Northern Territory border on the seaward side of the 150 m isobath out to the extent of the Australian Fishing Zone.	✓	✓	Fishery has boundaries that overlap the operational area and wider EMBA. and therefore activities could be affected from unplanned / emergency events.
Western Rock Lobster (Zone B)	Fishery operates along WA's coast between Shark Bay and Cape Leeuwin with northern boundary at 21° 44' S latitude. Targets the spiny lobster using baited pots.	x	✓	Fishery has boundaries that overlap the wider EMBA only and therefore activities could be affected from unplanned / emergency events.
Abalone Managed (Area 8)	Three types of abalone – Roe's, greenlip and brownlip – are harvested. Abalone divers operate from small fishery vessels (generally less than 9 m long). The main harvest method is a diver working off a 'hookah' (surface-supplied breathing apparatus) or using scuba equipment, using an abalone 'iron' to prise the shellfish off rocks.	x	✓	Fishery has boundaries that overlap the wider EMBA only and therefore activities could be affected from unplanned / emergency events.
Pilbara Developing Crab	Small trap-based crab fishery targeting blue swimmer crabs in the Pilbara. Fishery jurisdiction is all of WA waters off the NW coast of WA north of 23° 34' S latitude and west of 120° 00' E longitude. Closed areas of the fishery include all waters north of 23° 34' S latitude and west of 115° 06.5' E latitude.	✓	✓	Fishery has boundaries that overlap the operational area and wider EMBA. No active fishing in the operational area. Fishery activities could be affected from unplanned / emergency events.
SW Coast Salmon	Main target species are the WA salmon (*Arripis truttaceus*) and the Australian herring (*A. geogianus*). Located in the West Coast Bioregion, the fishery set beach seine nets from the shore using small boats. Fishers target salmon during the annual autumn salmon run in March/April when large schools form near shore and move around the coast to their spawning area on the lower west coast. Fishery includes WA waters out to the edge of the EEZ, with all fishing taking places in State waters.	✓	✓	Fishery has boundaries that overlap the operational area and wider EMBA. No active fishing in the operational area. Fishery activities could be affected from unplanned / emergency events.
Gascoyne Demersal Scalefish	Targets snapper (*Pagrus auratus*, *Pristipomoides multidens*). A limited number of licensed vessels fish around the Ningaloo	x	✓	Fishery has boundaries that overlap the wider EMBA only and

Fishery	Description	EMBA Presence		Relevant Events within Operational Area and wider EMBA
		Operational Area	Wider EMBA	
	area (Gnaraloo Bay, Coral Bay, Tantabiddi and Exmouth) as well as Denham and Carnarvon. Fishery operates throughout the year with mechanised handlines. Fishery operates between latitudes 23°07'30"S and 26°30'S excluding the inner waters of Shark Bay.			therefore activities could be affected from unplanned / emergency events.
West Coast Demersal Gillnet and Demersal Longline (Inshore Kalbarri area)	Fishery use either gillnets or longlines to target sharks, but also a bycatch of demersal scalefish. Target demersal scale fish and sharks using gillnets and longlines. The offshore area extends south from 23°30'S to 115°30'E between the 250-m depth contour and the 200 nm boundary of the Australian Fishing Zone. Inshore Kalbarri fishing area operates from 26°30'S to 28°S.	x	✓	Portion of the inshore fishery (Kalbarri area) has boundaries that overlap the wider EMBA only and therefore activities could be affected from unplanned / emergency events.
Shark Bay Crab (Zone 1)	Target species is the blue swimmer crab (*Portunus armatus*) using trap and trawl methods. Fishery is divided into 2 zones – Zone 1 Shark Bay operates out to the 150-m isobath excluding the inner waters of the gulfs. The 2016/17 season landed 273.5 tonnes.	x	✓	Fishery has boundaries that overlap the wider EMBA only and therefore activities could be affected from unplanned / emergency events.
Shark Bay Scallop and Prawn	Fishery operates in and adjacent to Shark Bay waters using otter trawl methods to target saucer scallop (*Ylistrum balloti*), western king and brown tiger prawns (*Penaeus latisulcatus, P. esculentus*) and other smaller variety prawns. The 2016/2017 season landed 169 tonnes (prawns) and 64 kg (scallops).	x	✓	Fishery has boundaries that overlap the wider EMBA only and therefore activities could be affected from unplanned / emergency events.

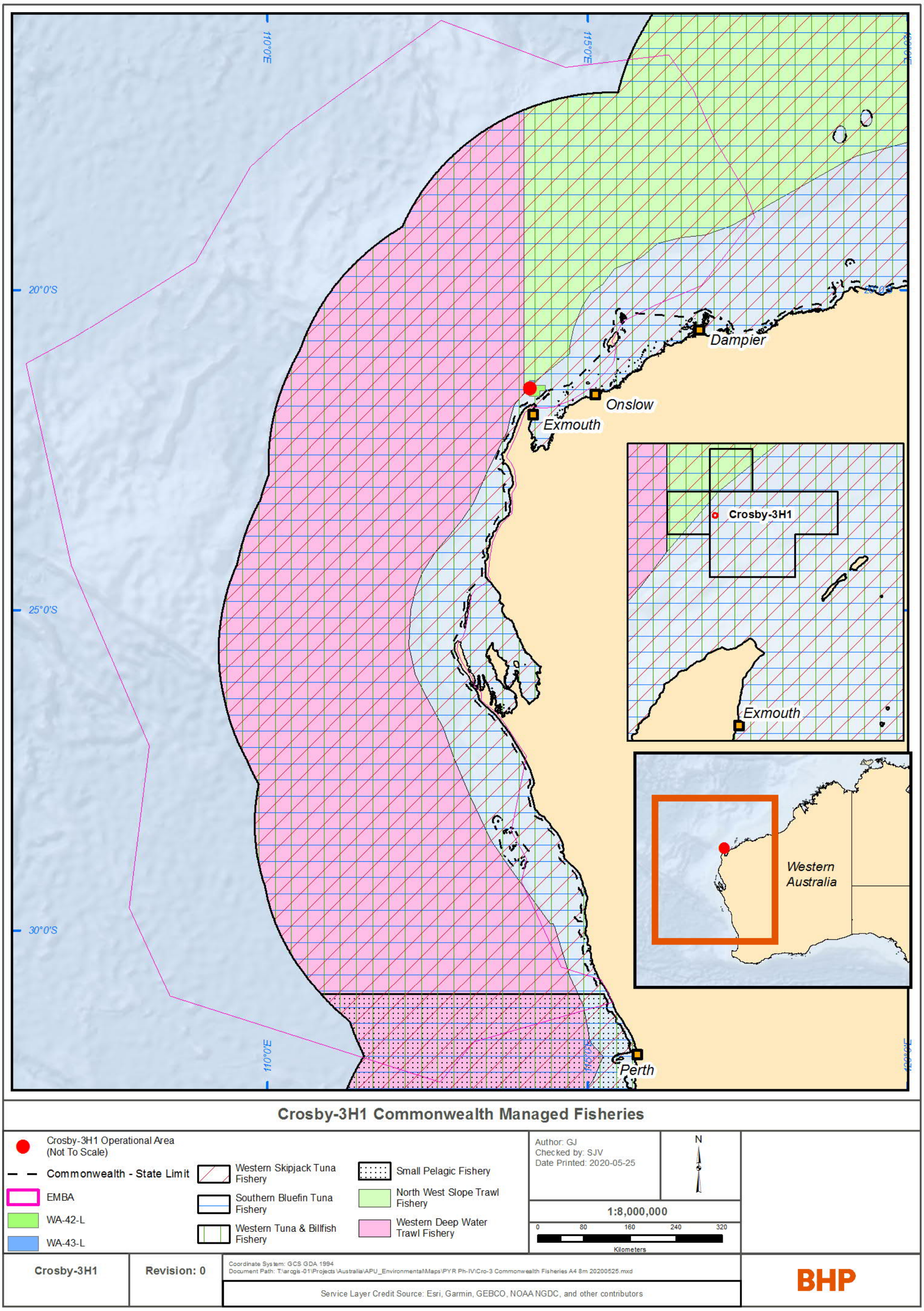


Figure 4-21: Commonwealth managed fisheries within the EMBA

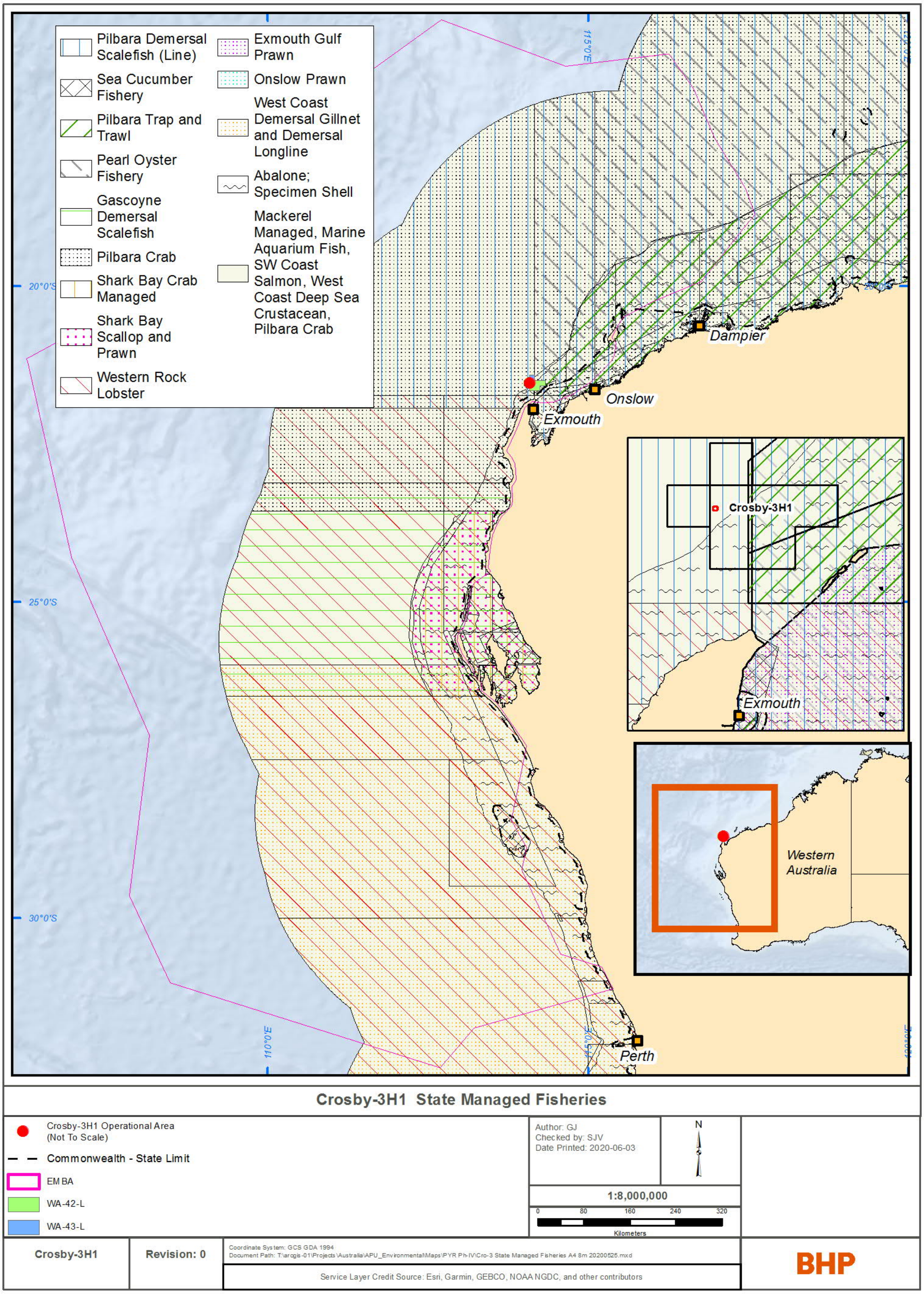


Figure 4-22: State managed fisheries within EMBA

4.11.4 Tourism and Recreation

The nearest population centres to operational area are the towns of Exmouth (~40 km) and Onslow (~100 km). Exmouth has become a significant tourist centre based in large part on the natural resources contained in the Cape Range National Park, Ningaloo Marine Park and adjacent inshore waters. Onslow is a coastal town offering easy access to tourists, vacationers and recreational fishers to the Mackerel Islands, a group of ten islands 22 km offshore.

Visitors partaking in tourism and recreational activities stay at the many coastal parks, camping grounds and caravan parks that the Ningaloo Marine Park has to offer such as at Jurabi, Mangrove Bay, Turquoise Bay and Yardie Creek. Popular tourist locations of interest include the many Sanctuary Zones along the Ningaloo coastline, such as Mangrove Bay, Jurabi Point, Turquoise Bay and Oyster Stacks, where visitors can enjoy bird watching opportunities at Mangrove Bay. The Turtle Centre at Jurabi is a popular tourist attraction and snorkelling is a popular activity for visitors in the numerous embayments such as at Turquoise Bay, and further south at the popular coastal town of Coral Bay. The most popular offshore tourism activities are fishing, diving and whale shark spotting.

Peak tourism occurs from April to October with marine-based activities concentrated around infrastructure such as boat ramps and camping areas (Smallwood, 2009). Marine facilities, including boat launching ramps, jetties, marinas, etc., within the area are limited, with most located along the Exmouth Gulf side of the peninsula including:

- Point Murat naval supply jetty (restricted access);
- Bundegi – facilities include a concrete launching ramp, car park and public toilets; and
- Exmouth Marina – provides launching, mooring, fuelling and supply facilities for commercial fishing, charter fishing, and tourist and commercial/private vessels.

Boat ramps on the Ningaloo side are located at:

- Tantabiddi Creek – facilities include a concrete launching ramp, car park and public toilets; and
- Coral Bay – concrete launching ramp.

Recreational fisheries and charter boat operators are managed by the Western Australian Department of Primary Industries and Regional Development (DPRID). With an estimated 740,000 people fishing recreationally in WA, it makes a significant contribution to the economy and attracts vast numbers of visitors to the region each year. The Ningaloo Marine Park also provides high-quality fishing for species such as spangled emperor, Spanish mackerel and coral trout.

Within the Gascoyne Bioregion, recreational fishing activities make up a significant component of the tourist visits, with Ningaloo Marine Park and the Shark Bay World Heritage Area attracting thousands of tourists and fishers each year. The mix of tropical and temperate conditions in the bioregion reflects the range of fish species found, with in the region of 100 species of fish caught by recreational fishers. To the north of the bioregion, near Exmouth, tropical species such as emperors and mackerel dominate. Mangrove jack and mud crabs are popular target species in the extensive mangrove system in the Exmouth Gulf. The Ningaloo Marine Park also provides high-quality fishing for species such as spangled emperor, Spanish mackerel and coral trout. Farther south, there are temperate species such as western rock lobster, tailor, snapper (pink snapper) and mulloway.

4.11.5 Defence Activities

The Naval Communication Station Harold E. Holt is located on the northwest coast of Australia, 6 km north of the town of Exmouth, WA. The town of Exmouth was built at the same time as the communications station to provide support to the base and to house dependent families of US Navy personnel (GDC, 2020).

The station provides very low frequency radio transmission to US Navy and Royal Australian Navy ships and submarines in the western Pacific Ocean and eastern Indian Ocean. With a transmission power of 1 megawatt, it is the most powerful transmission station in the southern hemisphere (GDC, 2020).

The Royal Australian Air Force Base Learmonth is located on the North West Cape, approximately 30 km south of Exmouth. It is one of the Air Force's three bare bases that can be used for exercises or operational requirements (GDC, 2020).

The operational area is within the North Western Exercise Area and military restricted airspace (R8541A) a designated defence exercise area which encompasses waters and airspace off the North West Cape (Figure 4-23). When activated by a 'Notice to Airmen', the restricted airspace can operate down to sea level.

4.11.6 Commercial Shipping

The Australian Maritime Safety Authority (AMSA) has established a network of shipping fairways off the north coast of Western Australia (AMSA, 2012). The shipping fairways are intended to reduce the risk of collision between transiting vessels and offshore infrastructure. The fairways are intended to direct large vessels such as bulk carriers and LNG ships trading to the major ports into pre-defined routes to keep them clear of existing and planned offshore infrastructure. Use of the new fairways is strongly recommended but not mandatory.

The operational area lies outside of these declared and charted shipping fairways (Figure 4-24). The nearest shipping route heading northeast is approximately 45 km from the operational area.

4.11.7 Oil and Gas Activities

The NWS is Australia's most prolific oil and gas production area, largely responsible for WA accounting for 66% of the country's oil production, 76% of the country's condensate production and 37% of the country's gas production in 2013 (APPEA, 2014).

Oil and gas activities in close proximity to the operational area include:

- BHP's Pyrenees Development (*Pyrenees Venture* FPSO) within WA-42-L (the same permit area as the Crosby-3H1 well);
- Woodside's Vincent Development (*Maersk Ngujima-Yin* FPSO) in production licence WA-38-L, approximately 12 km of the operational area;
- Santos' Ningaloo Vision Development (*Ningaloo Vision* FPSO) in production licence WA-35-L, approximately 15 km north of the operational area.

Other oil and gas activities in the region include production areas located on Barrow, Thevenard and Varanus Islands.

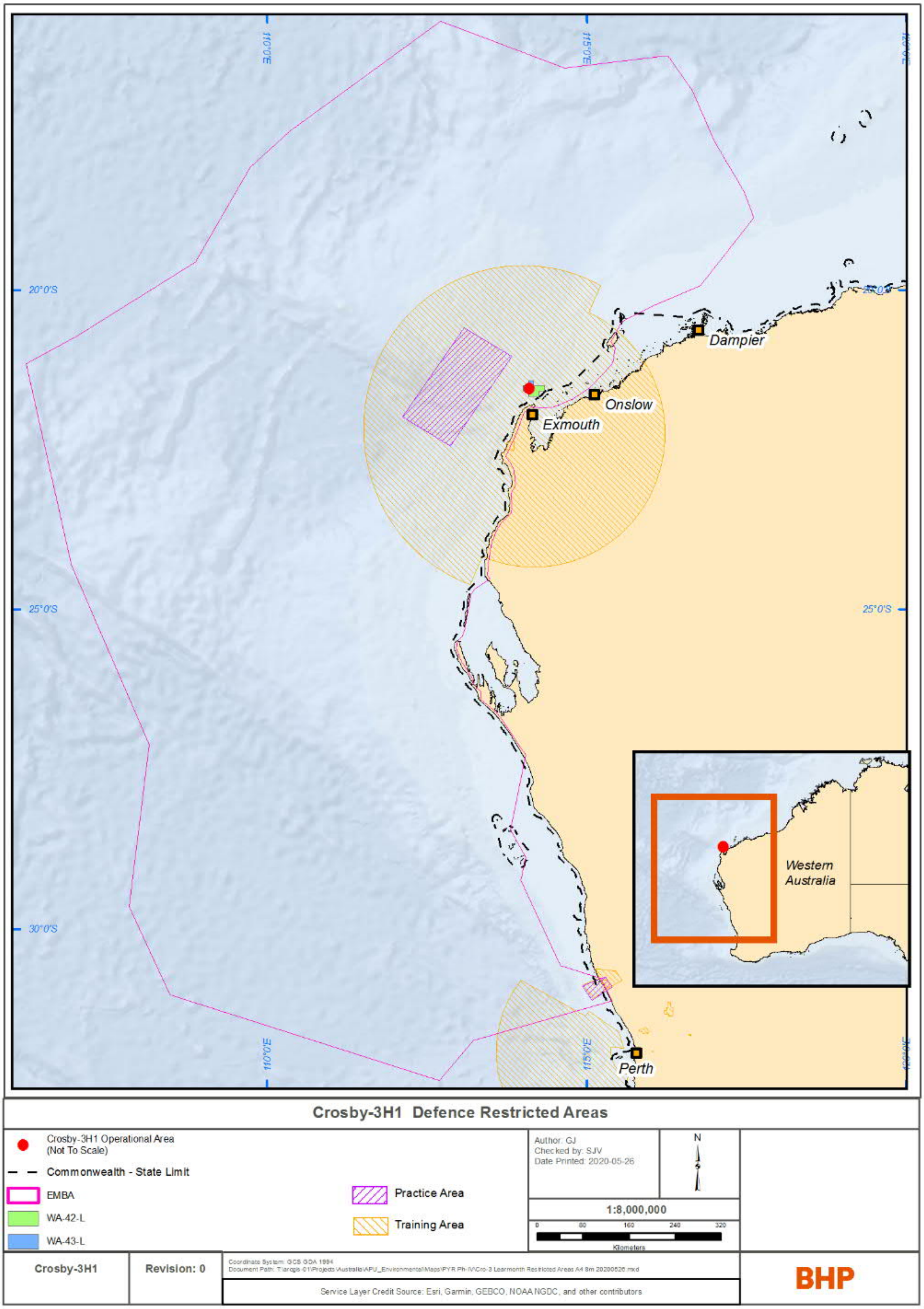


Figure 4-23: Defence activities within the EMBA

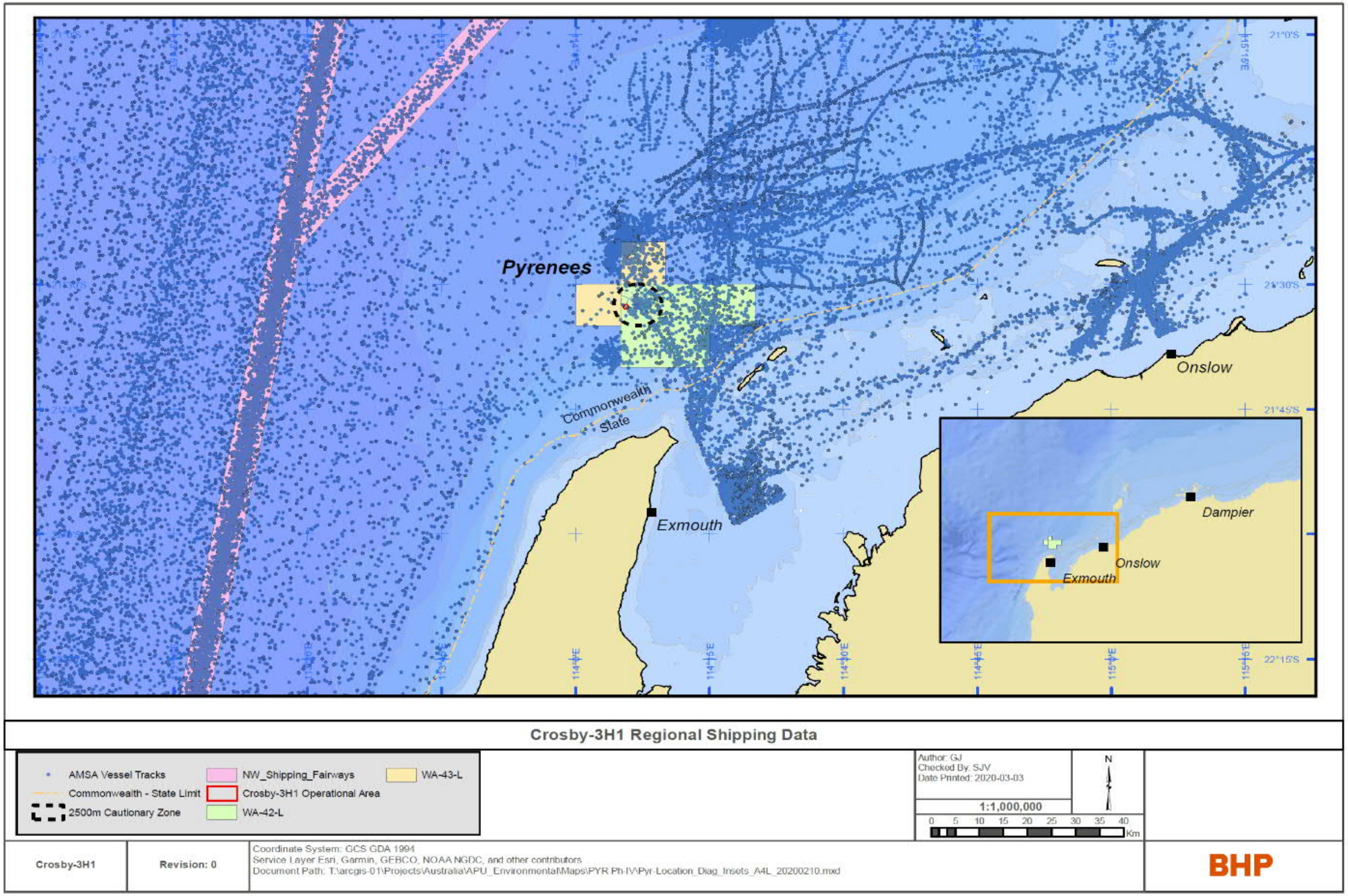


Figure 4-24: Vessel tracking data in the region (Nov 2019 – Jan 2020)

5 Stakeholder Consultation

In accordance with requirements of Regulations 11A and 14(9) of the Environment Regulations, BHP has consulted with interested and relevant stakeholders during the preparation of this EP.

BHP's approach to stakeholder consultation aims to demonstrate to relevant persons that the environmental impacts and risks of an activity are being appropriately managed. BHP is committed to ongoing engagement and consultation with stakeholders during all project stages.

BHP has consulted broadly with relevant stakeholders regarding this petroleum activity, including sharing information with stakeholders and responding directly to enquiries. Stakeholders were consulted regarding the activities covered in this EP via several forms of engagement commencing in February 2020, including:

- BHP's Crosby-3H1 Light Well Intervention Stakeholder Information Fact Sheet distributed to identified stakeholders in February and May 2020; and
- Exmouth Community Reference Group (CRG) meeting held on 12 March 2020.

BHP has considered all stakeholder responses and assessed the merits of responses received. The process adopted to assess any objections and claims is outlined in Section 5.2. A summary of BHP's responses to is provided in Table 5-2.

BHP considers that consultation with relevant stakeholders has been adequate to inform the development of this EP. BHP has a process for ongoing stakeholder engagement and any concerns raised by stakeholders subsequent to the EP submission will be duly considered and addressed.

5.1 Community Consultation History

The Exmouth Community Reference Group (CRG) was established in 2004 to facilitate consultation in relation to BHP's multiple assets in the North West Cape region. The CRG forum aims for proactive and regular interaction to promote open and inclusive communication with relevant stakeholders. Meetings are held regularly (typically quarterly) and participants are given an update summary of BHP's current petroleum and upcoming activities and invited to raise any concerns or issues. Meeting agendas are prepared and circulated in advance of meetings, minutes are recorded, and feedback sought from stakeholders. The BHP Corporate Affairs toll-free 1800 number and email address are made available to stakeholders.

The latest Exmouth CRG meeting was held on 12 March 2020 and included an overview of BHP's proposed Crosby-3H1 LWI activities. A copy of the presentation is provided in Appendix F.

In addition to CRG consultation, targeted consultation has been undertaken for the EP, with identified stakeholders provided with information about the proposed activities and given adequate opportunity to evaluate and convey how it may impact on functions, interests and activities. It also provided opportunity for additional stakeholders identified during the consultation process to be contacted, with a commitment to assess any new concerns or claims as part of ongoing consultation.

5.2 Stakeholder Engagement Process

5.2.1 Stakeholder Identification

Regulation 11A(1) of the Environment Regulations states that in the course of preparing an environment plan, or revision to an environment plan, the titleholder must consult with each of the following categories of relevant persons:

(a) *each Department or agency of the Commonwealth to which the activities to be carried out under the environment plan, may be relevant;*

(b) *each Department or agency of a State or the Northern Territory to which the activities to be carried out under the environment plan, or the revision of the environment plan, may be relevant;*

(c) *the Department of the responsible State Minister, or the responsible Northern Territory Minister;*

(d) *a person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the environment plan, or the revision of the environment plan;*

(e) *any other person or organisation that the titleholder considers relevant.*

Relevant persons were identified based on BHP's existing relationships and relevant persons identified in previous EP consultations in relation to the Pyrenees Development, together with desktop stakeholder identification and analysis. BHP has engaged with key stakeholders through the EP preparation including:

- Commonwealth and State departments and agencies;
- Local Government;
- Other petroleum operators;
- Commercial fisheries, including representative associations and individual licence holders/operators within both Commonwealth and State managed fisheries that overlap the operational area; and
- Non-governmental organisations.

As part of BHP's general stakeholder identification process, the Department of Primary Industries and Regional Development (DPIRD) current State of Fisheries Report was reviewed to understand catch effort, fishing method and water depths of those managed fisheries with boundaries that overlap the operational area, to determine if the fishery was to be considered a relevant persons to be consulted.

Identified stakeholders and an assessment of their relevance under the Environment Regulations for the purposes of consultation for this petroleum activity are listed in Table 5-1.

Table 5-1: Stakeholders engaged with for the proposed activity

Stakeholder	Relevant to Activity	Rationale
Commonwealth Government Department or Agency		
Australian Border Force	Yes	Maintain the integrity of Australia's internal borders including customs and immigration
Australian Fisheries Management Authority (AFMA)	Yes	AFMA is the Commonwealth government agency responsible for the efficient management and sustainable use of Commonwealth fish resources from three nautical miles out to the extent of the Australian Fishing Zone.
Australian Hydrographic Office (AHO)	Yes	The AHO is Commonwealth government agency responsible for the publication and distribution of nautical charts and other information related for the safety of ships navigating in Australian waters including the distribution of Notice to Mariners.
Australian Maritime Oil Spill Centre (AMOSC)	Yes	AMOSC operates the Australian oil industry's major oil spill response facility.
Australian Maritime Safety Authority (AMSA)	Yes	AMSA is Australia's national agency responsible for maritime safety and navigation and legislated responsibility for oil pollution response in Commonwealth waters.
Department of Agriculture, Water and the Environment (DAWE) – Fisheries	Yes	Department's Fisheries Branch has primary policy responsibility for promoting the biological, economic and social sustainability of Australian fisheries. The DAWE (Fisheries) is the

Stakeholder	Relevant to Activity	Rationale
		relevant agency where the activity has the potential to negatively impact fishing operations and/or fishing habitats in Commonwealth waters.
Department of Agriculture, Water and the Environment (DAWE) – Biosecurity (vessels, aircraft and personnel)	Yes	Department's Biosecurity Branch has inspection and reporting requirements to ensure that all conveyances (vessels, installations and aircraft) arriving in Australian territory comply with international health regulations and that any biosecurity risk is managed.
Department of Defence (DoD); RAAF Aeronautical Information Service	Yes	The department is the responsible agency for the defence of Australia and its national interests. DoD is a relevant agency where the proposed activity may impact operational requirements; encroach on known training areas and/or restricted airspace, or when nautical products or other maritime safety information is required to be updated.
Department of Industry, Science, Energy and Resources	Yes	The Department is responsible for consolidating the Government's efforts to drive economic growth, productivity, and competitiveness by bringing together industry, energy, resources and science.
Director of National Parks (DNP)	Yes	The DNP is the statutory authority responsible for the administration and management of the Australian Marine Parks under the EPBC Act.
Fisheries Research and Development Corporation (FRDC)	Yes	FRDC is a statutoty authority that manages research and development investment by the Australian Government and the Australian fishing and aquaculture sectors.
WA Government Department or Agency		
Department of Biodiversity, Conservation and Attractions (DBCA)	Yes	The Department is a relevant State agency responsible for the management of State marine parks and reserves and protected marine fauna and flora.
Department of Mines, Industry Regulation and Safety (DMIRS)	Yes	Department responsible for the management of offshore petroleum in the adjacent State waters.
Department of Premier and Cabinet (Minister Papalia - Minister for Tourism; Racing and Gaming; Small Business; Defence Issues; Citizenship and Multicultural Interests)	Yes	WA Cabinet Minister with responsibilities that include WA's tourism interests.
Department of Primary Industries and Regional Development (DPIRD)	Yes	DPIRD is responsible for managed WA State fisheries. The operational area intersects with State managed fisheries.

Stakeholder	Relevant to Activity	Rationale
Department of Transport (DoT)	Yes	The Department is the control agency for marine pollution emergencies in State waters.
Industry Representative Organisations		
Australian Petroleum Production and Exploration Association (APPEA)	Yes	APPEA is the peak national body representing Australia's oil and gas exploration and production industry.
Fishing Bodies / Industry Representative Organisations		
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	Yes	ASBTIA is the peak body representing the Australian Southern Bluefin Tuna industry.
Commonwealth Fisheries Association (CFA)	Yes	Represents the interests of commercial fishing industry in Commonwealth-regulated fisheries.
Pearl Producers Association (PPA)	Yes	PPA is the peak industry representative body for the Australian pearl oyster (*Pinctada maxima)* pearling industry licensees in WA.
Recfishwest	Yes	Recfishwest is the peak body representing recreational fishers in WA.
Western Australian Fishing Industry Council (WAFIC)	Yes	WAFIC is the peak industry body representing the interests of the WA commercial fishing, pearling and aquaculture sector.
Commonwealth Fisheries		
North West Slope Trawl	No	Operational area does lie within boundary of fishery.
Small Pelagic	No	Operational area does lie within boundary of fishery.
Southern Bluefin Tuna	No	Fishery spans the Australian Fishing Zone around Australia, with boundaries that intercept the operational area; however fishing effort concentrated in South and SE Australian.
Western Skipjack Tuna	No	Fishery has boundaries that intercept the operational area; however there has been no fishing effort/ catch in the fishery since the 2008-09 season, with effort concentrated off South Australia.
Western Tuna and Billfish Fishery	No	Fishery has boundaries that intercept the operational area; however effort concentrated in WA waters south of Carnarvon and off South Australia.
Western Deep Water Trawl	No	Operational area does lie within boundary of fishery.

Stakeholder	Relevant to Activity	Rationale
State Fisheries		
Commercial fisheries with boundaries overlapping or close to the planned petroleum operational area and with licence holders' activities or interests that may be affected by the planned petroleum activity.		
Mackerel Managed Fishery – Pilbara (Area 2)	Yes	Based on a review of DPIRD current State of Fisheries Report, the fishery boundary overlaps the proposed operational area and is therefore potentially impacted by the activity.
Pilbara Demersal Scalefish Fishery: • Pilbara Line Fishery	Yes	Based on a review of DPIRD current State of Fisheries Report, the fishery boundary overlaps the proposed operational area and is therefore potentially impacted by the activity.
West Coast Deep Sea Crustacean Fishery	Yes	Based on a review of DPIRD current State of Fisheries Report, the fishery boundary overlaps the proposed operational area and is therefore potentially impacted by the activity.
Commercial fisheries with boundaries overlapping or close to the planned petroleum operational area, but licence holders' activities or interests are not expected to be affected by the planned petroleum activity.		
Marine Aquarium Fish Managed	No	Not affected by planned activities. Licence holders not consulted during the development of the EP; however, fishery's interest considered in the development of the EP. Licence holders to be informed in the event of an unplanned emergency oil pollution event.
Pilbara Developing Crab	No	
Sea Cucumber Managed	No	
SW Coast Salmon	No	
Specimen Shell Managed	No	
Commercial fisheries with boundaries intercepting the wider EMBA (based on low exposure values for hydrocarbons), but do not overlap the proposed petroleum operational area.		
Abalone Managed (Area 8)	No	Licence holders not consulted during the development of the EP; however, fishery's interest considered in the development of the EP. Licence holders to be informed in the event of a unplanned large scale emergency oil pollution event.
Exmouth Gulf Prawn Managed	No	
Gascoyne Demersal Scalefish	No	
Onslow Prawn Managed	No	
Pearl Oyster Managed	No	
Pilbara Demersal Scalefish Managed: • Pilbara Trap • Pilbara Trawl	No	
Shark Bay Crab Managed	No	
Shark Bay Scallop & Prawn	No	
West Coast Demersal Gillnet & Demersal Longline	No	
Western Rock Lobster (Zone B)	No	

Stakeholder	Relevant to Activity	Rationale
Neighbouring Operators		
Santos	Yes	Adjacent Titleholder
Woodside Energy	Yes	Adjacent Titleholder
Other Stakeholders		
Cape Conservation Group	Yes	Exmouth-based community and volunteer conservation group with an interest in conservation of the North West Cape.
Exmouth Game Fishing Club	Yes	Recreational game and sport fishing club based in Exmouth.

5.2.2 Stakeholder Consultation Activities

BHP's consultation for this EP included the wide distribution of a Fact Sheet and follow up email correspondence. The information provided included the timing and duration of the activity, the mitigation measures for relevant impacts and risks, BHP's policies and experience, and contact details to facilitate providing feedback to BHP.

Recent stakeholder engagement and consultation activities informing this EP include:

- Exmouth CRG meeting on 12 March 2020 (refer to previous Section 5.1);
- Email communication to relevant stakeholders that detailed the information on the proposed activity and invited comment (refer Covering Email and Fact Sheet in Appendix F);
- Email and postal correspondence to commercial fisheries and fishing licence holders within State managed fisheries targeted to the fishing industry;
- Consideration of all responses from stakeholders received prior to submission of the EP revision, providing additional information where requested.

All stakeholder engagement records are maintained by BHP Corporate Affairs.

5.2.3 Assessment of Stakeholder Objections and Claims

A summary of the stakeholder consultation undertaken for this EP, including responses received, BHP's assessment of all comments received and how each of the responses has been addressed in the EP is provided in Table 5-2. Full transcripts between BHP and stakeholders are provided in a confidential submission to NOPSEMA.

No objections or significant concerns were raised by stakeholders during consultation in the preparation of this EP.

Table 5-2: Stakeholder consultation summary

Organisation	Summary of Stakeholder and Titleholder Correspondence, and Any Objections and Claims Made	Assessment of Stakeholder Objections and Claims
Commonwealth Departments / Agencies		
Australian Border Force	The department was provided the *Crosby-3H1 Light Well Intervention* Fact Sheet by email on 14 February 2020 and the updated Fact Sheet by email on 21 May 2020. No response received to date.	No response has been received by Australian Border Force at the time of submission of the EP. BHP will address any comments from this stakeholder should they arise in the future.
Australian Fisheries Management Authority(AFMA)	AFMA was provided the *Crosby-3H1 Light Well Intervention* Fact Sheet by email on 14 February 2020 and the updated Fact Sheet by email on 21 May 2020. No response received to date.	No response has been received by AFMA at the time of submission of the EP. BHP will address any comments from this stakeholder should they arise in the future.
Australian Hydrographic Office (AHO)	The AHO was provided the *Crosby-3H1 Light Well Intervention* Fact Sheet by email on 14 February 2020 and the updated Fact Sheet by email on 21 May 2020. AHS replied on the 17 February 2020 and the 21 May 2020 with the following response: 1. Please accept this email as acknowledgement that your email has been received by the AHO. The data you have supplied will now be registered, assessed, prioritised and validated in preparation for updating our Navigational Charting products. These adhere to International and Australian Charting Specifications and standards. These standards may result in some data generalisation or filtering due to the scale of existing charts, proximity to other features, and the level of risk a reported feature presents to mariners.	No further action required.
Australian Maritime Oil Spill Centre (AMOSC)	AMOSC was provided the *Crosby-3H1 Light Well Intervention* Fact Sheet by email on 21 May 2020. No response received to date.	No response has been received by AMOSC at the time of submission of the EP. BHP will address any comments from this stakeholder should they arise in the future.
Australian Maritime Safety Authority (AMSA)	AMSA was provided the *Crosby-3H1 Light Well Intervention* Fact Sheet by email on 14 February 2020. AMSA responded on the 18 February 2020 providing the following advice: 1. The Master should notify AMSA's Joint Rescue Coordination Centre (JRCC) for promulgation of radio-navigation warnings at least 24-48 hours before operations commence. AMSA's JRCC will require the vessel details, satellite communications details, area of operation, requested clearance from other vessels and any other information that may contribute to safety at sea. JRCC will also need to be advised when operations start and end. 2. BHP should contact the Australian Hydrographic Office (AHO) no less than four working weeks before operations, with details relevant to the operations. The AHO will promulgate the appropriate Notice to Mariners (NTM), which will ensure other vessels are informed of your activities. 3. To obtain a vessel traffic plot showing Automatic Identification System (AIS) traffic data for your area of interest, please visit AMSA's spatial data gateway and Spatial@AMSA portal to download digital data sets and maps. BHP responded to AMSA on 1 April March 2020 advising their comments have been addressed in the drafting of the EP, which will be available on the NOPSEMA website on submission. Further, based on the current environment and to provide the business maximum flexibility on the execution timing of the project, BHP will shortly be re-issuing the Fact Sheet to communicate revision of the activity such that it may occur at any time of year AMSA was provided with the updated *Crosby-3H1 Light Well Intervention* Fact Sheet by email on 21 May 2020. AMSA responded on the 22 May 2020 providing the same information they provided on 18 February 2020.	No further action required.
Department of Agriculture, Water and the Environment (DAWE) – Biosecurity (vessels, aircraft and personnel)	The department was provided the *Crosby-3H1 Light Well Intervention* Fact Sheet by email on 21 May 2020. The Department of Agriculture responded on 28 May 2020 providing the following advice regarding the Australian Government's biosecurity requirements. In summary, the department advised: 1. If your project is a vessel or installation operating outside Australian waters (more than 12nM outside the Australian Territory Sea), then there are no Australian Government biosecurity requirements. 2. However if your vessel intends to port for provisioning or equipment or any other reason then note that all vessels must provide pre-arrival reporting. https://www.agriculture.gov.au/biosecurity/avm/vessels 3. If you project is an installation or a vessel that intends to travel between an Australian port and an installation for any reason, then note the following. Your intended operating practices may expose domestic conveyances (support vessels and aircraft) to interactions with the survey vessel which may pose an unacceptable level of biosecurity risk. Where domestic conveyances become exposed through interactions with persons, goods or conveyances outside Australian territory they automatically become subject to biosecurity control upon their return. If the department concludes that the level of biosecurity risk associated with the survey vessel is low, within the meaning of the Biosecurity (Exposed Conveyances – Exceptions from Biosecurity Control) Determination 2016 (the Determination), an exposed conveyance may be eligible for an exception from biosecurity control. 4. For exposed conveyances to be assessed as low risk, the offshore installation must demonstrate that it meets the requirements set out in the Determination. To have risk status assessed, offshore installation projects must apply to the department at least one month prior to project commencement. The department will work with installation representatives to assess the biosecurity risk of the installation and associated support conveyances (vessels and aircraft). Note: To be eligible, an exposed conveyance must meet all circumstances as outlined in section 6 of the Determination. 5. Please review the department's Offshore Installations webpage and associated Offshore Installations Biosecurity Guide which provides specific biosecurity information for operators of offshore installations and notify the department where your project which may have conveyance interactions with Australian territory, or to discuss a biosecurity assessment.	No further action required. BHP has addressed relevant matters raised by the Department of Agriculture in the following section of the EP: • Section 8.9 – Introduction of Invasive Marine Species.

Organisation	Summary of Stakeholder and Titleholder Correspondence, and Any Objections and Claims Made	Assessment of Stakeholder Objections and Claims
	6. Please also review Australian pre-arrival reporting using MARS, ballast water and biofouling requirements. 7. Please respond with advice and clarify your project activities once you have read the biosecurity requirements.. BHP responded to department on 4 June 2020 providing the following response: Thank you for your email on behalf of the Department of Agriculture (Biosecurity) in response to BHP's Stakeholder Fact Sheet in relation to BHP's proposed Crosby-3H1 Light Well Intervention (LWI) activity. To provide further context of the activity with regards to vessel movements, BHP will be engaging a LWI Vessel from Singapore. The vessel will then mobilise between Dampier and the Crosby-3H1 Operational Area to perform the activities described in the Fact Sheet. BHP has the following response to your comments provided by email: 1. The International Convention on the Control of Harmful Anti-fouling Systems on Ships (IMO, 2001), prohibits the use of harmful organotins in antifouling paints used on ships and establishes a mechanism to prevent the potential future use of other harmful substances in anti-fouling systems. BHP is committed to ensuring that the anti-fouling systems of the procured vessel will not have used harmful organotins and will maintain the appropriate documentation to ensure this is achieved. 2. The Australian Ballast Water Management Requirements, as defined under the Biosecurity Act 2015, stipulate that Ballast water exchange or treatment of ballast water is undertaken using an approved ballast water treatment system. BHP is committed to ensuring compliance with the Ballast Water Management requirements and will maintain all appropriate ballast water exchange records maintained to verify compliance. 3. The procured LWI vessel will be managed as per the BHP Introduced Marine Species Management Procedure. LWI vessel will therefore complete an IMS risk assessment prior to mobilisation to the operational area, in addition to pre-arrival reporting in accordance with the Biosecurity Act 2015. The IMS risk assessment assigns a final risk category of low, moderate, uncertain or high to vessels based on a range of information including last port of call, age of anti-fouling coating etc. If a risk category of moderate, uncertain or high is scored, a range of management options are available including inspections, cleaning or treatment of internal seawater systems. The IMS risk assessment will be reviewed by BHP Environmental staff prior to vessel being deployed to the field. BHP is committed to ensuring that the procured vessel is compliant with the Introduced Marine Species Management Procedure and will maintain all appropriate records to verify compliance.	
Department of Agriculture, Water and the Environment (DAWE) – Fisheries	The department was provided the updated *Crosby-3H1 Light Well Intervention* Fact Sheet on 21 May 2020. The department responded on the 2 June 2020 providing the following advice: The department thanked BHP for the updated Fact Sheet regarding changes to the Crosby-3H1 activity. The department has noted this information. The department remains interested to be informed of future developments relating to this project. Please also ensure that the Australian Fisheries Management Authority and relevant fishing associations operating in Commonwealth fisheries are also consulted throughout the activity. BHP responded to DAWE – Fisheries on 2 June 2020 with the following: BHP thanked the department for their email. BHP confirmed that the Australian Fisheries Management Authority and relevant fishing associations operating in Commonwealth fisheries (including the Commonwealth Fisheries Association, Pearl Producers Association, and the Australian Southern Bluefin Tuna Association) have also been invited to comment and sent the Crosby-3H1 Stakholder Fact Sheet.	No further action required.
Department of Defence; RAAF Aeronautical Information Service	The department was provided the *Crosby-3H1 Light Well Intervention* Fact Sheet by email on 14 February 2020 and an updated Fact Sheet on 21 May 2020. No response received to date.	No response has been received at the time of submission of the EP. BHP will address any comments from this stakeholder should they arise in the future.
Department of Industry, Science, Energy and Resources (previously the Department of Industry, Innovation and Science)	The department was provided the *Crosby-3H1 Light Well Intervention* Fact Sheet by email on 14 February 2020 and an updated Fact Sheet on 21 May 2020. No response received to date.	No response has been received by the department at the time of submission of the EP. BHP will address any comments from this stakeholder should they arise in the future.
Fisheries Research and Development Corporation (FRDC)	The FRDC was provided the *Crosby-3H1 Light Well Intervention* Fact Sheet by email on 14 February 2020 and an updated Fact Sheet on 21 May 2020. No response received to date.	No response has been received by the FRDC at the time of submission of the EP. BHP will address any comments from this stakeholder should they arise in the future.
State Government Departments		
Department of Biodiversity, Conservation and Attractions (DBCA)	The department was provided the *Crosby-3H1 Light Well Intervention* Fact Sheet by email on 14 February 2020 and an updated Fact Sheet on 21 May 2020. The department responded on the 17 February 2020 providing the following advice: 1. There are a number of ecologically important areas including marine parks and island conservation reserves located in the vicinity of the proposed operations, including the Ningaloo Marine Park and Muiron Islands Marine Management Area and Nature Reserve. Based on the information you have provided it appears that there is potential for these areas to be affected by BHP's operations if there is a substantial hydrocarbon release and subject to particular weather or other environmental conditions. 2. Given the ecological importance of areas potentially affected by a hydrocarbon release from the proposed activities, it is considered important that the baseline values and state of the potentially affected environment are appropriately understood and documented prior to any activities commencing that pose a significant risk of impacting these areas. DBCA would like to have confidence that BHP has appropriate baseline survey data on the important ecological values of these areas and any current contamination if present within the area of potential impact of spills (as identified through BHP's modelling). Following desktop review and risk assessment, and if not already undertaken as part of BHP's ongoing operations in the area, BHP should also collect appropriate baseline abundance and distribution data for any threatened and specially protected marine fauna species in the area of potential impact, including information on the key habitats these species use for activities like foraging, breeding and aggregating. If baseline information is not available,	No further action required.

Organisation	Summary of Stakeholder and Titleholder Correspondence, and Any Objections and Claims Made	Assessment of Stakeholder Objections and Claims
	BHP should thoroughly assess what baseline information is required commensurate with the level of risk associated with the proposed activities, and identify suitable sources/methods to attain that information such that BHP can ensure that any impacts on ecological values and recovery of these values can be monitored and remediated. DBCA undertakes monitoring in marine parks and reserves and publishes monitoring reports which are available on the department's website. However, BHP should be aware that this monitoring is targeted to inform DBCA's values and objectives relating to marine park management and is not necessarily suitable to provide all baseline information required for oil spill risk assessment and management planning. DBCA encourages BHP to ensure it attains all information required to implement a Before-After, Control-Impact (BACI) framework in planning its management response. This may include independently monitoring and collecting data where required or identifying other data sources. 3. In developing its Environmental Plan, DBCA also recommends that BHP refer to the Commonwealth Department of Agriculture, Water and the Environment's *National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds* as a best-practice industry standard for managing potential impacts of light pollution on marine fauna. 4. In the event of a hydrocarbon release, it is requested that BHP notify DBCA's Pilbara regional office as soon as practicable. Note however, that DBCA will not implement an oiled wildlife management response on behalf of a petroleum operator except as part of a whole of government response mandated by regulatory decision makers, and any advice or assistance from DBCA, at any scale, will occur on a full cost recovery basis. BHP should also commit to the monitoring and clean-up of any DBCA interests affected by an oil spill in consultation with DBCA. 5. BHP should refer to the Department of Transport's (DoT) web content regarding marine pollution, and the Offshore Petroleum Industry Guidance Note of September 2018 titled *Marine Oil Pollution: Response and Consultation Arrangements*. These documents provide information on the Western Australian emergency management arrangements for marine oil pollution incidents in State waters, petroleum titleholders' obligations under those arrangements, and the DoT's expectations as the jurisdictional authority for such incidences. BHP responded on 4 June 2020 with the following comments in response to DBCA's email: 1. Baseline Data BHP has operated a number of facilities within the area North-West of Onslow since 1994. Over this time, a resource atlas has been developed for the area that includes a shoreline assessment of environmental sensitivities. This assessment involved the segmentation of the shorelines to facilitate prioritisation of resources and response strategies in the unlikely of an oil spill. Further details of the shoreline types and characteristics along with descriptions of environmental sensitivities are contained in "Environmental Sensitivities Exmouth Region" (AOHSE-ER-0021-0008) and the Joint Carnarvon Basin Operators North West Cape Sensitivity Mapping (June 2012). BHP has also funded collection of extensive baseline datasets on benthic habitats in the Ningaloo Marine Park using hyperspectral data, which has aided in the baseline understanding of coral, macro-algae and seagrass habitats. In 2015, BHP and CSIRO formed a strategic marine research partnership, Ningaloo Outlook, to increase the ecological understanding of the Ningaloo Coast World Heritage area's deep and shallow reefs and the reef's shark, whale shark and turtle populations. This Industry-Science Research Partnership has invested $5.4 million over five years (2015 to 2020) to gather new knowledge on the reef and its important ecological values. Information can be found at: https://research.csiro.au/ningaloo/ 2. Light Pollution Guidelines for Wildlife BHP has considered the Commonwealth Department of Environment and Energy's National Light Pollution Guidelines for Wildlife as a best-practice industry standard for managing potential impacts of light pollution on marine fauna. Lighting impacts and risks to marine fauna are considered in the Crosby-3H1 Environment Plan. Lighting management is such that is provides the required level of safe working conditions and for marine navigation requirements. BHP is satisfied that routine light emissions from the Light Well Intervention vessel and the short duration of the activity (approximately up to 14 days) presents a low risk of disturbance to marine fauna in the vicinity of the operational area. 3. Incidents and Emergency Response BHP acknowledges the Department's information with respect to reporting and responding to oil spills. 4. Department of Transport BHP's Crosby-3H1 Environment Plan reflects the Department of Transport's (DoT) marine pollution response arrangements as per the September 2018 Offshore Petroleum Industry Guidance Note (IGN). BHP will consult with the DoT as per the IGN.	
Department of Mines, Industry Regulation and Safety (DMIRS)	The department was provided the *Crosby-3H1 Light Well Intervention* Fact Sheet by email on 14 February 2020 and an updated Fact Sheet on 21 May 2020. No response received to date.	No response has been received by DMIRS at the time of submission of the EP. BHP will address any comments from this stakeholder should they arise in the future.
Department of Premier and Cabinet (Minister Papalia - Minister for Tourism; Racing and Gaming; Small Business; Defence Issues; Citizenship and Multicultural Interests)	The department was provided the *Crosby-3H1 Light Well Intervention* Fact Sheet by email on 14 February 2020. BHP received generic automated response on 14/02/2020 stating: This is an automatic message acknowledging that your correspondence to the Hon Paul Papalia CSC MLA, Minister for Tourism; Racing and Gaming; Small Business; Defence Issues; Citizenship and Multicultural Interests, has been received. Please be assured that your correspondence will be actioned as appropriate. The Department was provided with the updated *Crosby-3H1 Light Well Intervention* Fact Sheet by email on 21 May 2020. No response received to date.	No further response has been received by the stakeholder at the time of submission of the EP. BHP will address any comments from this stakeholder should they arise in the future.
Department of Primary Industries and Regional Development (DPIRD)	The department was provided the *Crosby-3H1 Light Well Intervention* Fact Sheet by email on 14 February 2020 and an updated Fact Sheet on 21 May 2020. No response received to date.	No response has been received by DPIRD at the time of submission of the EP. BHP will address any comments from this stakeholder should they arise in the future.
Department of Transport (DoT)	The DoT was provided the *Crosby-3H1 Light Well Intervention* Fact Sheet via email on 14 February 2020. The DoT responded on 25 February 2020 providing the following advice:	

Organisation	Summary of Stakeholder and Titleholder Correspondence, and Any Objections and Claims Made	Assessment of Stakeholder Objections and Claims
	If there is a risk of a spill impacting State waters from the proposed activities, please ensure that the department is consulted as outlined in the Department of Transport Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (September 2018) which can be accessed here - https://www.transport.wa.gov.au/mediaFiles/marine/MAC_P_Westplan_MOP_OffshorePetroleumIndGuidance.pdf BHP responded to the DoT on 1 April 2020 stating the following: BHP acknowledges the Department's requirements and confirm they will be taken into consideration in the drafting of the EP and OPEP. Based on the current environment and to provide the business maximum flexibility on the execution timing of the project, BHP will shortly be re-issuing the Fact Sheet to communicate revision of the activity such that it may occur at any time of year. The DoT was provided with the updated *Crosby-3H1 Light Well Intervention* Fact Sheet via email on 29 May 2020, along with a copy of the *Crosby-3H1 Light Well Intervention OPEP* and information on the Crosby-3H1 activity as outlined in the Department of Transport Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (September 2018).	No further response has been received by DoT at the time of submission of the EP. BHP will address any comments from this stakeholder should they arise in the future.
Director of National Parks (DNP)	The DNP was provided the *Crosby-3H1 Light Well Intervention* Fact Sheet by email on 14 February 2020 and an updated Fact Sheet on 21 May 2020. The DNP responded on the 6 March 2020 providing the following advice: 1. The DNP noted that planned activities do not overlap any Australian Marine Parks (AMPs), with operational area ~13 km from Ningaloo Marine Park and ~17 km from Gascoyne Marine Park - therefore no authorisation requirements from the Director of National Parks (DNP) required. 2. The DNP referred BHP to the Guidance Note published by NOPSEMA regarding matters to consider in EP preparation in relation to petroleum activities that may affect AMPs, as well as the NW Marine Parks Network Management Plan 2018. 3. The DNP do not require further notification of the activity unless the activity changes and results in overlap with or new impact to an AMP. 4. For oil/gas pollution incidences which occur or likely to impact an AMP, the DNP should be made aware as soon as possible. Notification should be provided to the 24-hr Marine Compliance Duty Officer. BHP responded to the DNP on 1 April 2020 stating the following: Thank you for your email on behalf of the DNP in response to BHP's Stakeholder Fact Sheet in relation to the proposed Crosby-3H1 Light Well Intervention (LWI) activity. BHP acknowledges your feedback and confirm DNP's feedback will be taken into consideration in the drafting of the Environment Plan. Based on the current environment and to provide the business maximum flexibility on the execution timing of the project, BHP will shortly be re-issuing the Fact Sheet to communicate revision of the activity such that it may occur at any time of year. As this activity change will not result in an overlap with or a new impact to a marine park, we will not issue the updated Fact Sheet to the DNP, as per your email. The DNP responded on the 3 June 2020 in response to receiving the updated Fact Sheet stating as per the correspondence sent on 6 March 2020, as this activity does not overlap with an AMP we require no further notification of progress on this matter. BHP responded to the DNP on 3 June 2020 thanking DNP for their emails and advising DNP would not receive further notification of progress on the proposed petroleum activity.	No further action required.
Other Operators		
Santos	Santos was provided the *Crosby-3H1 Light Well Intervention* Fact Sheet by email on 14 February 2020 and an updated Fact Sheet on 21 May 2020. No response received to date.	At the time of submission of the EP, no response has been received by Santos. BHP will address any comments from this stakeholder should they arise in the future.
Woodside Energy	Woodside was provided the *Crosby-3H1 Light Well Intervention* Fact Sheet by email on 14 February 2020 and an updated Fact Sheet on 21 May 2020. No response received to date.	At the time of submission of the EP, no response has been received by Woodside. BHP will address any comments from this stakeholder should they arise in the future.
Other Groups / Organisations		
Cape Conservation Group (CCG)	The CCG was provided the *Crosby-3H1 Light Well Intervention* Fact Sheet by email on 14 February 2020 and an updated Fact Sheet on 21 May 2020. CCG responded on 14 February 2020 requesting further explanation on what well intervention activities are. BHP responded on 6 March with the following information: Well intervention, also sometimes called well workover are terms commonly used for maintenance or remedial treatment to an existing production well for the purpose of restoring, prolonging or enhancing the production of hydrocarbons. Generally, well workover activities are conducted using a moored rig to re-enter the well, whereas well intervention operations are most often conducted using a vessel. For the Crosby-3H1 well, a dynamically positioned vessel will be used and will position itself at the well location, and using single-strand or multi-strand wires/ cables lowered from the vessel, enter the well to run and deploy/retrieve tools and flow-control equipment. CCG responded on 18 May 2020 requesting a more detailed description or a video that would help understand the process and purpose. BHP responded on 26 May with the following: BHP would be more than happy to set up a webex call to provide CCG with further information and the opportunity to ask questions. While there is no public comment period on the EP, it will be made available in full on the NOPSEMA website. BHP has arranged a telecom meeting with CCG to be held w/c 8th June 2020.	At the time of submission of the EP, BHP has arranged a telecom meeting with CCG to take place w/c 8th June 2020. BHP will address any comments from this stakeholder should they arise in the future. No further action required.

Organisation	Summary of Stakeholder and Titleholder Correspondence, and Any Objections and Claims Made	Assessment of Stakeholder Objections and Claims
Exmouth Game Fishing Club	The Exmouth Game Fishing Club was provided the *Crosby-3H1 Light Well Intervention* Fact Sheet by email on 14 February 2020 and an updated Fact Sheet on 21 May 2020. No response received to date	At the time of submission of the EP, no response has been received by the stakeholder. BHP will address any comments from this stakeholder should they arise in the future.
Fishing Bodies / Industry Representative Organisations		
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	ASBTIA was provided the *Crosby-3H1 Light Well Intervention* Fact Sheet by email on 14 February 2020 and an updated Fact Sheet on 21 May 2020. No response received to date.	At the time of submission of the EP, no response has been received by ASBTIA. BHP will address any comments from this stakeholder should they arise in the future.
Commonwealth Fisheries Association (CFA)	The CFA was provided the *Crosby-3H1 Light Well Intervention* Fact Sheet by email on 14 February 2020 and an updated Fact Sheet on 21 May 2020. No response received to date.	At the time of submission of the EP, no response has been received by CFA. BHP will address any comments from this stakeholder should they arise in the future.
Pearl Producers Association (PPA)	The PPA was provided the *Crosby-3H1 Light Well Intervention* Fact Sheet by email on 14 February 2020 and an updated Fact Sheet on 21 May 2020. No response received to date.	At the time of submission of the EP, no response has been received by PPA. BHP will address any comments from this stakeholder should they arise in the future.
Recfishwest	Rechfishwest was provided the *Crosby-3H1 Light Well Intervention* Fact Sheet by email on 14 February 2020 and an updated Fact Sheet on 21 May 2020. No response received to date.	At the time of submission of the EP, no response has been received by Recfishwest. BHP will address any comments from this stakeholder should they arise in the future.
Western Australian Fishing Industry Council (WAFIC)	WAFIC was provided the *Crosby-3H1 Light Well Intervention* Fact Sheet on 14 February 2020 and an updated Fact Sheet on 21 May 2020. WAFIC responded on 17 February 2020 providing the following comments: WAFIC appreciates commercial fishing focused stakeholder consultation information and understands the very short duration of the activity on a pre-existing site. WAFIC requested further clarity around if the activity is taking place in a pre-existing exclusion zone or a new temporary exclusion zone. WAFIC requested all future communications with licence holders clearly defines cautionary zones – noting that “commercial fishers can transit, anchor in or fishing in cautionary zones as long it is safe to do so”. BHP responded on 31 March 2020 stating the following: The 500-m operational area for the proposed LWI activity lies within a pre-existing cautionary zone marked on navigation charts surrounding the Pyrenees Facility and in-field subsea infrastructure. For the duration of the LWI activity (up to 14 days), there will be the establishment of a 500-m safety exclusion zone around the LWI vessel. Prior to the commencement of the activity, notification of the activity location, duration and safety exclusion zone will be communicated to enable the generation of navigational warnings (Notice to Mariners and AusCoast warning broadcasts). Based on the current environment and to provide the business maximum flexibility on the execution timing of the project, BHP will shortly be re-issuing the Fact Sheet to communicate revision of the activity such that it may occur at any time of year. The updated Fact Sheet includes further clarity on the existing cautionary zone and the establishment of a safety exclusion zone around the LWI vessel. WAFIC responded on 31 March 2020 as follows: Thanking BHP for the reply and overall update especially with regard to the clarity around the pre-existing cautionary zone and the temporary exclusion zone for the short duration of the activity. WAFIC acknowledged that BHP will be reconfirming this information with commercial fishers included revised activity timing. WAFIC highlighted their fee-for-service work for consultation with commercial fishing licence holders on behalf of Operators. WAFIC acknowledged receipt of the updated Fact Sheet issued on 21 May 2020.	No further action required. BHP has addressed the matters raised by WAFIC in the following section of the EP: • Activity notifications. Refer to Section 7.3 – Physical Presence.
Commercial Fisheries – State Managed		
Western Australian Fisheries: - Mackerel Managed - Pilbara Demersale Scale (Line) Fishery - West Coast Deep Sea Crustacean	Licence holders were provided with hard copies (by post) of the *Crosby-3H1 Light Well Intervention* Fact Sheet (Fishing Sector focused) and cover letter on 15 May 2020.	At the time of submission of the EP, no responses have been received. BHP will address any comments from these stakeholders should they arise in the future.

5.3 Ongoing Consultation

Stakeholder consultation will be ongoing and BHP will work with stakeholders to address any future concerns if they arise throughout the validity of this EP. Should any new stakeholders be identified, they will be added to the stakeholder database and included in all future correspondence as required.

BHP’s commitments to ongoing consultation include:

- Continued quarterly Exmouth CRG meetings.
- Responding in a timely manner to all stakeholder and community contact regarding the proposed Crosby-3H1 LWI activities.
- Stakeholders who raise objections and claims following EP submission will be responded to directly, and should any concerns raised have not already been addressed in the EP, these will be assessed in the same manner as all risks identified by BHP.

6 Environmental Risk Management Framework

BHP has established a risk management governance framework with supporting processes and performance requirements that provide an overarching and consistent approach for the identification, assessment and management of risks. BHP policies have been formulated to comply with the intent of the Risk Management Policy and be consistent with the AS/ISO 31000-2018 Risk Management Principles and Guidance.

An integrated risk assessment and impact process was utilised to identify the most appropriate management strategy and relevant controls for each source of risk to ensure the impacts or risks are acceptable to BHP and reduced to ALARP (Figure 6-1). This process includes the incorporation of stakeholder consultation, and legal and environmental monitoring data on the relevant environmental impacts.

6.1 Evaluation of Impacts and Risks

A formal impact and risk assessment was completed for each environmental aspect and source of risk for the petroleum activity described in Section 3 using the Environmental Hazard Identification (ENVID) workshop process. The primary objective of the impact and risk assessment was to develop an understanding of the impact and risk, demonstrate its reduction to ALARP and demonstrate its acceptability to BHP. It provided definition on the decisions made during the ENVID process, taking into account the detailed impact assessment for the sources of hazard, the controls chosen to reduce or prevent the impact or risk and why some controls were not chosen. This also involved consideration of the sources of risk, their positive and negative consequences and the likelihood that those consequences may occur.

The ENVID process considered both planned (routine and non-routine) and unplanned (accidents/incidents) impacts with variation on how each of these impacts or risks was assessed through to ALARP and acceptability.

The ENVID assessment was conducted as a workshop with a range of personnel from different disciplines including Subsea, Production and Completions Engineering, Risk and HSE. Decisions made within the ENVID included:

- Confirmation of the sources of hazard identified;
- Identification of all potential management controls and their acceptance through an ALARP process;
- Allocation of likelihood rating for an unplanned source of hazard;
- Severity rating for all sources of hazard; and
- Final acceptability of the impact or risk to BHP using the acceptability criteria.

The outcome of the assessment process illustrated in Figure 6-1 is displayed in Sections 7 and 8 using a series of summary tables, detailed impact and risk descriptions, and impact and risk conclusions. All environmental aspects and their respective sources of hazard are as follows:

- Overview of the source of risk;
- Environmental impact assessment;
- Demonstration of ALARP;
- Demonstration of acceptability; and
- Environmental performance outcomes (EPO), environmental performance standards (EPS) and Measurement Criteria (MC).

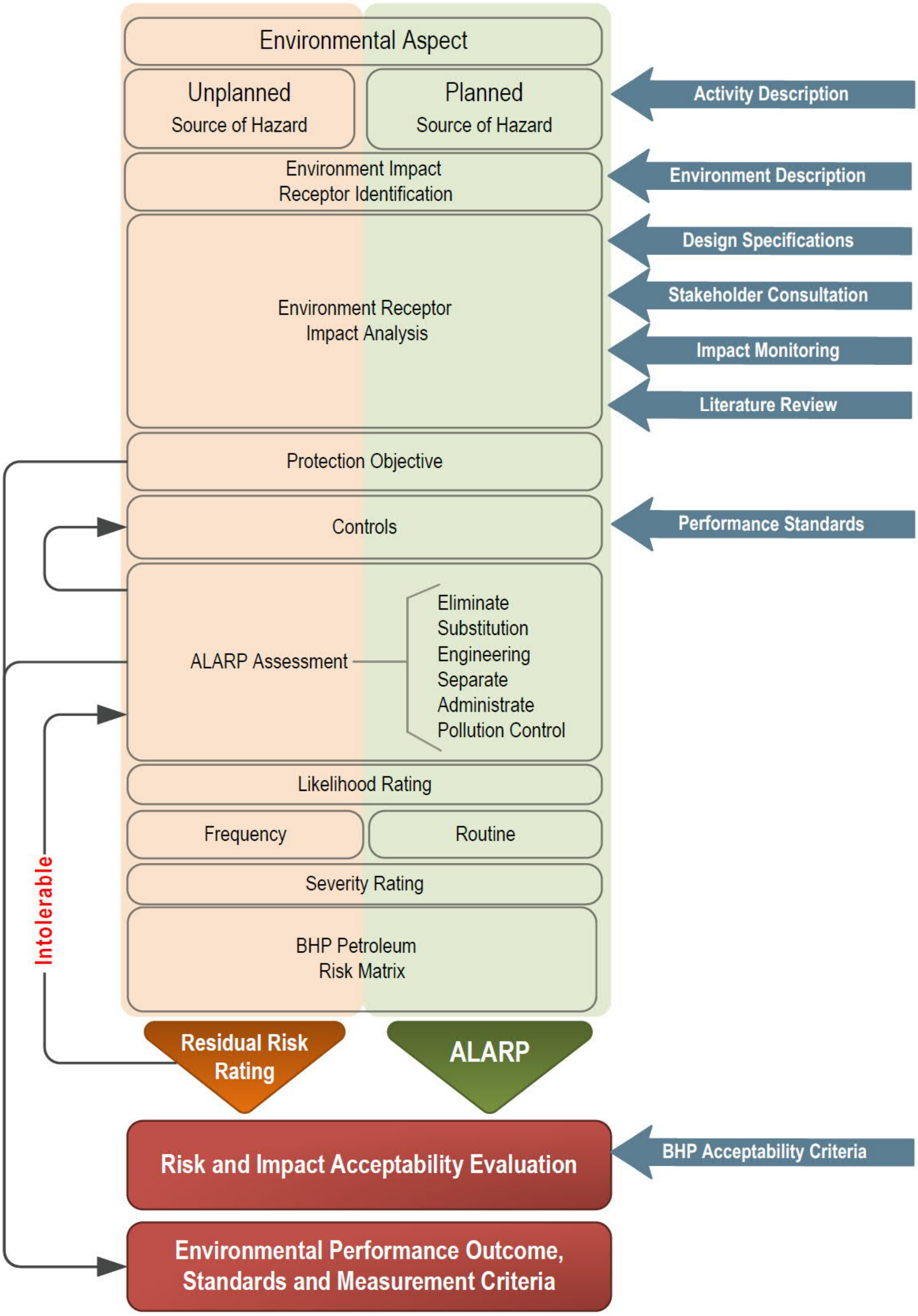


Figure 6-1: Environment Plan integrated impact and risk assessment

6.1.1 Environmental Impact Assessment

The environmental impacts were based on the environmental receptors identified in Section 4 with the impact descriptions developed in an initial screening process that identified the specific receptor that may be impacted. Further quantitative or qualitative definition of the impact was then completed to ensure an understanding of the impact (planned or unplanned) to confirm that the severity of the risk and impact was correctly assigned during the evaluation process.

6.1.2 Demonstration of ALARP

Regulation 10A(b) of the Environment Regulations requires demonstration that the environmental impacts and risks of the activity will be reduced to as low as reasonably practicable (ALARP).

Determining whether risks have been reduced to ALARP requires an understanding of the nature and cause of the risk to be avoided and the sacrifice (in terms of safety, time, effort and cost) involved in avoiding that risk. The hierarchy of decision tools (from lowest risk to highest risk) has been adapted from the UKOOA Framework for Risk Related Decision Support (Oil & Gas UK, 2014) is:

- Codes and standards;
- Good oilfield practice;
- Professional judgement;
- Risk-based analysis;
- BHP values; and
- Societal values.

A summary of the application of these decision tools and protocols in relation to the different categories of risk is presented in Table 6-1.

Table 6-1: Summary of risk ratings, decision-making tools and decision-making protocols

Risk Rating	Decision-Making Tool	Decision-Making Protocol
Tolerable	Comparison to codes and standards, good oilfield practice and professional judgement are used to determine risk acceptability.	If the environmental impact (for planned activities) was found to be "Low" or the environmental risk (for unplanned events) was found to fall with the "Tolerable" zone and the control measures are consistent with applicable standards and 'good oilfield practice' then no further action is required to reduce the impact or risk further. However, if a control measure that would further reduce the impact or risk is readily available, and the cost of implementation is not disproportionate to the benefit gained, then it is considered 'reasonably practicable" and should be implemented.
ALARP Zone	In addition to comparisons with codes and standards, good oilfield practice and professional judgement, risk-based analyses are used to determine risk acceptability.	If the environmental impact (for planned activities) was found to be "Minor" or the environmental risk (for unplanned events) of the hazard has been found to fall within the "ALARP Zone" then an iterative process to identify alternative/additional control mechanisms will be conducted to reduce the risk to the "Tolerable" zone. However, if the risk associated with a hazard cannot be reasonably reduced to the "Tolerable" zone without grossly disproportionate sacrifice (e.g. cost, time, resources and safety); then the mitigated environmental risk is considered to be ALARP and Tolerable.
Intolerable	All of the above decision-making tools apply combined with consideration of BHP corporate values and societal values.	If the environmental impact (for planned activities) was found to be "Serious" or more severe or environmental risk of the hazard has been found to fall within the "Intolerable" zone then the source of hazard will need additional barriers and is not acceptable to BHP in the current condition. Work to reduce the level of risk should be assessed against the precautionary principle with the burden of proof requiring demonstration that the risk has been reduced to the ALARP Zone before the activity can commence.

The ALARP assessment process primarily considers good engineering plus industry practice and legal requirements as key factors affecting the acceptability of a risk. Other factors such as physical constraints, stakeholder perceptions, asset protection and the interaction between environmental and safety risk is also considered as part of the overall decision-making process.

The risk assessment approach described above implies a level of proportionality wherein the principles of decision-making applied to each particular hazard are proportionate to acceptability of environmental risk of that hazard. The decision-making principles for each level risk are based on the precautionary principle (as defined in the EPBC Act) and provide assurance that the environmental impacts and risks are reduced to ALARP and of an acceptable level.

All environmental risks and associated sources of hazard in this EP have been assessed through a tailored ALARP assessment that presents all identified controls in a hierarchal framework. All of the risks associated with the petroleum activity correspond to Type A Decisions according to the Oil & Gas UK *Guidelines on Risk*

Related Decision Making (Oil and Gas, 2014), which indicates they do not represent anything new or unusual, the risks are well understood, the adopted control measures represent established good oilfield practice and there are no conflict with BHP corporate values or major stakeholder implications.

The ALARP process undertaken considers all possible controls for both planned and unplanned impacts and risks, analysis of their risk reduction (prevent or mitigate) proportional to the benefit gained and their final acceptance as a control or rejection and reasoning as to why.

The hierarchy of controls applied in this EP are defined below and are in order of preference and illustrated in Figure 6-2:

- Eliminate – Remove the source preventing the impact, i.e. eliminate the hazard;
- Substitution – Replace the source preventing the impact;
- Engineering – Introduce engineering controls to prevent or control the source having an impact;
- Separate – Separate the source from the receptor preventing impact;
- Administrate – Procedures, competency and training implemented to minimise the source causing an impact;
- Pollution Control – Implement a pollution control system to reduce the impact;
- Contingency Planning – Mitigate control reducing the impact; and
- Monitoring – Program or system used to monitor the impact over time.

The general preference is to accept controls that are ranked in the Tier 1 categories of Eliminate, Substitute, Engineering and Separate as these controls provide a preventive means of reducing the likelihood of the hazard occurring. Tier 2 categories reduce the potential consequence of the impact or risk. This ranking of controls was considered during the determination of ALARP and the impact and risk acceptance process.

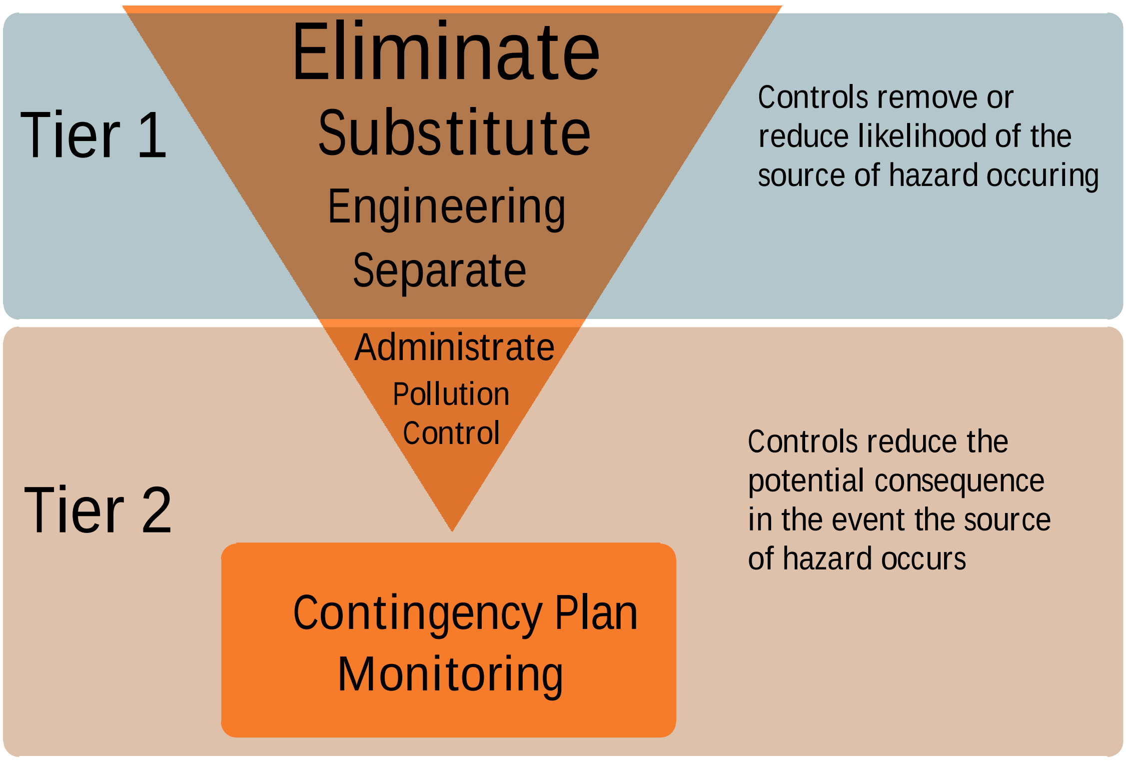


Figure 6-2: Hierarchy of control framework

The controls associated each of the risks for planned activities and unplanned events of the activity, along with those for the response strategies proposed in the unlikely event of an oil spill, were assessed taking into consideration the potential environmental benefit gained if the control was implemented compared with the practicability of its implementation. If the control had high effectiveness (Availability, Functionality, Reliability, Survivability, Independence/Compatibility) and were practicable to implement, i.e. there was no disproportionate cost/time/safety/effort sacrifice, then the control was adopted. Similarly, if the controls were not practicable, i.e. the cost, time and effort to implement the control were grossly disproportionate to the benefit gained, then the control was rejected.

6.1.1 Planned Activities Assessment

All planned activities were assessed as being a routine impact and defined as such in the ENVID. The description and degree of impact formed the basis for the severity rating applied with a quantitative assessment of impact conducted where possible to ensure the impact was well understood and clearly categorised on the severity table. Where this was not possible, a robust qualitative assessment was completed and the severity rating assigned during the ENVID process in accordance with the BHP HSE Risk Matrix, which is consistent with the BHP Our Requirements Risk Management Severity Table (Table 6-2) taking into account any of the mitigative controls assigned. All planned activities do not have an allocated residual risk rating and are treated and reduced to ALARP.

6.1.2 Unplanned Event Risk Assessment

Risk ranking of unplanned events is the product of the consequence of an event (severity) and the likelihood of that event occurring. Risk analysis involved an assessment of the predicted impacts that would occur taking into account existing mitigative control measures.

Likelihood and potential severity ratings were assigned in accordance with the BHP HSE Risk Matrix PHSE-03-PO1 (Table 6-2), which allowed the risk of individual events to be categorised in a methodical and structured process. This was completed based upon judgement by the ENVID assessment team with detailed potential impact descriptions used to ensure a robust and comprehensive decision.

The likelihood rating is based on the frequency of the source of hazard actually occurring with all preventative controls taken into consideration.

The potential severity rating was determined based on the potential impact that may occur once the source of hazard had occurred taking into account any mitigative controls in place to reduce the impact.

Table 6-2: BHP risk matrix used for rating planned and unplanned activities

Likelihood	Severity Level				
	1	2	3	4	5
Highly Likely	30	90	300	900	3000
Likely	10	30	100	300	1000
Probable	3	9	30	90	300
Unlikely	1	3	10	30	100
Highly Unlikely	0.3	0.9	3	9	30

Table 6-3: BHP severity level definitions

Severity Page #11	Descriptor	Severity Factor
5	6 or more fatalities or 6 or more life shortening illnesses; or Severe impact to the environment and where recovery of ecosystem function takes 10 years or more; or Severe impact on community lasting more than 12 months or a substantiated human rights violation impacting 6 or more people; or Severe impact on company reputation, investment attractiveness, legal rights or compliance, social value proposition or ability to access opportunities at a global level; or US$2 billion or more[2].	1000
4	1-5 fatalities or 1-5 life shortening illnesses; or Serious impact to the environment, where recovery of ecosystem function takes between 3 and up to 10 years; or Serious impact on community lasting 6-12 months or a substantiated human rights violation impacting 1-5 persons; or Serious impact on company reputation, investment attractiveness, legal rights or compliance, social value proposition or ability to access opportunities at a national level; or Between US$250 million and up to US$2 billion[2].	300
3	Life altering or long term/permanent disabling injury or illness to one or more persons; or Substantial impact to the environment, where recovery of ecosystem function takes between 1 and up to 3 years; or Substantial impact on community lasting 2-6 months; or Substantial impact on company reputation, legal rights or compliance, social value proposition, or ability to access opportunities at a sub national level (state, territory, province); or Between US$50 million and up to US$250 million[2].	100
2	Non-life altering or short-term disabling injury or illness to one or more persons; or Measureable but limited impact to the environment, where recovery of ecosystem function takes less than 1 year; or Measureable but limited community impact lasting less than one month; or Measureable but limited impact on company reputation, legal rights or compliance, or social value proposition at a local level (region, city, town); or Between US$2 million and up to US$50 million[2].	30
1	Low level impact resulting in first aid only; or Minor, temporary impact to the environment, where the ecosystem recovers with little intervention; or Minor, temporary community impact that recovers with little intervention; or Minor, temporary impact on company reputation, legal rights or compliance, or social value proposition; or Less than US$2 million[2].	10

Table 6-4: BHP likelihood definitions

Uncertainty	Frequency	Likelihood factor
Highly Likely	Likely to occur within a 1 year period.	**3**
Likely	Likely to occur within a 1 - 5 year period.	**1**
Probable	Likely to occur within a 5 - 20 year period.	**0.3**
Unlikely	Likely to occur within a 20 - 50 year period.	**0.1**
Highly Unlikely	Not likely to occur within a 50 year period.	**0.03**

6.1.3 Demonstration of Acceptability

Regulation 10A(c) of the OPGGS (Environment) Regulations 2009 requires demonstration that the environmental impacts and risks of the activity will be of an acceptable level.

The criteria used to assess the acceptability of an environmental impact or risk to BHP are listed in Table 6-5.

Table 6-5: Environmental risk acceptability criteria

Criteria	Question	Demonstration
Codes and Standards	Is the impact or risk being managed in accordance with relevant legislation, Ministerial Conditions or standards?	Controls based on legislative requirements, standards or Ministerial Conditions must be accepted.
Ecologically Sustainable Development (ESD)	Is the proposed impact consistent with the principles of ESD?	BHP undertakes petroleum activities in a manner that is consistent with the APPEA Principles of Conduct, which endorses continuous improvement in ways that protect people and the environment through the responsible management of petroleum activities and their impacts. BHP considers that adherence to these principles aligns with the principles of ESD.
Internal Context		
BHP Charter and HSEC Management System Compliance	Is the proposed impact consistent with the requirements of BHP Our Requirements, Petroleum HSE Standard (PET-HSE00-HX-STD-00001) and HSEC Management Systems?	The impact or risk must be in compliance with the BHP Charter and HSEC management systems.
Professional Judgement	Is the impact or risk being managed in accordance with industry best practice?	The impact or risk must be managed through implementation of controls that are considered to be industry best practice.
ALARP	Are there any further reasonable and practicable controls that can be implemented to further reduce the impact or risk?	The residual risk must be demonstrated to be ALARP. ALARP of key controls will be continually re-evaluated through the life of the activity and not only during EP development.
External Context		
Environmental Best Practice	Are controls in place to manage the impacts and risk to the environment that are commensurate with the nature and scale of any environmental sensitivities of the receiving environment?	The environmental performance outcomes, performance standards and measurement criteria that determine whether the outcomes and standards have been achieved are commensurate with the environmental significance of the receiving environment.
Stakeholder Views	Do stakeholders have any concerns, if so, have controls been implemented to manage them?	Stakeholder consultation must be completed prior to commencement of activity and any concerns to be addressed.

6.2 Environmental Performance Outcomes, Environmental Performance Standards and Measurement Criteria

Regulation 10A(d) of the Environment Regulations requires the EP provides appropriate environmental performance outcomes, environmental performance standards and measurement criteria.

An objective of the EP is to ensure that all activities are carried out in accordance with appropriate environmental performance outcomes and standards. This requires (among other things) that appropriate measurement criteria for demonstrating that the performance outcomes and performance standards have been met are defined within the EP. In determining the nature of the outcomes, standards and measurement criteria the following requirements have been considered:

- OPGGS (Environment) Regulations r.13(4) (a), (b) and (c);
- NOPSEMA Guidance Note N04750-GN1344 Rev 0 on Environment Plan Content Requirements (s.3.5, 3.6 and 4);
- ISO 14001:2004(E), s.3.9, s.3.12; and
- ISO 14001:2004 Requirements with Guidance for Use. s.4.3.3, s.4.5.1.

Establishing outcomes and standards is a process of taking into account legal requirements and the environmental risks (described in risk assessment presented Section 6 and Section 7) and considering available control options (Section 6 and Section 7), and the views of interested parties (Section 11). The resulting outcomes and standards must be measurable where practicable and consistent with BHP Our Requirements.

6.2.1 Environmental Performance Outcomes

Environmental Performance Outcomes were developed during the ENVID process to ensure protection of the environment from the impact or risk and to ensure ongoing performance and measurability of the controls. All environmental risks are required to have at least one associated environmental performance outcome. These were developed using the below criteria:

- Specific to the source of hazard;
- Indicate how the environmental impact will be managed (e.g. minimise or prevent);
- Contain a statement of measurable performance (where applicable);
- Contain a timeframe for action (where applicable); and
- Consistent with legislative and HSE requirements.

6.2.2 Environmental Performance Standards

An environmental performance standard is a statement of performance required of a system, an item of equipment, a procedure or functional responsibility, which is used as a basis for managing environmental risk, for the duration of the activity.

There is a specific link between the environmental standards, the environmental performance outcomes and control measures; each outcome has one or more standards defining the performance requirement that needs to be met to achieve the outcome and any control measure (identified during the risk assessment process) that is critical to reducing risks to ALARP will have a corresponding performance standard.

Performance Standards can be broad ranging and can be taken from many sources, however, they have one fundamental similarity - the standard is specific, measurable, and achievable. Example performance standard sources are below:

- BHP Charter;
- BHP HSE Framework;
- BHP HSE Controls;
- BHP Engineering Standards and Procedures;
- BHP Critical Equipment or Non-Equipment Performance Standards;
- Legislation and Regulations; and
- Industry Guidelines and Standards.

6.2.3 Environmental Measurement Criteria

Measurement criteria have been developed for each environmental performance outcome and standard as a means of measuring assurance that the performance outcome and standard will be continually met throughout the vessel-based activities.

The measurement criteria are focused on providing evidence of environmental performance against outcomes for all aspects that can have an impact on the environment and providing assurance of compliance with a standard, process or procedure identified as necessary for ensuring that environmental impacts and risks are reduced to an acceptable level and to ALARP.

7 Impact and Risk Assessment: Planned Activities

This Section of the EP presents the environmental impact and risk assessment and environmental performance outcomes, environmental performance standards and measurement criteria for the vessel-based LWI activities based on the methodology described in Section 6.

7.1 Risk Assessment and Evaluation

The purpose of this Section is to address the requirements of Regulations 13(5), 13(6) and 13(7) by providing an assessment and evaluation of all the identified risks and impacts associated with the petroleum activity and associated control measures that will be applied to reduce the impacts and risks to ALARP and an acceptable level.

The environmental aspects and sources of risk identified during the ENVID process were divided into planned activities (i.e. routine operations) and unplanned (i.e. incidents) events. This Section presents the impact and risk assessed for the six planned activities identified for the petroleum activity. Section 8 presents the impact and risk assessment for the unplanned events. Table 7-1 provides a summary of the impact and risk analysis for the six aspects associated with the planned events. The following sub-sections provide a comprehensive risk and impact assessment for each of the planned events, and subsequent control measures to be implemented to reduce the risk and impacts to ALARP and acceptable levels.

Table 7-1: Summary of the environmental risk and impact analysis for planned activities

EP Section	Aspect	Value Potentially at Risk / Impact										Risk Assessment & Evaluation			
		Environmental							Socio-Economic						
Planned Activities		Marine Sediment	Water Quality	Air Quality	Ecosystems / Habitat	Marine Species	Marine Protected Areas	Key Ecological Feature	Commercial Fisheries	Shipping Activities	Tourism and Recreation	Severity Factor	Likelihood Factor	Residual Risk	Acceptability
7.3	**Physical presence**														
	Timing of activity and location of LWI vessel								x	x		10	N/A	-	Tolerable
7.4	**Light emissions**														
	LWI vessel operations					x						10	N/A	-	Tolerable
7.5	**Noise emissions**														
	LWI vessel operations					x						10	N/A	-	Tolerable
7.6	**Routine and non-routine atmospheric emissions**														
	LWI vessel operation			x								10	N/A	-	Tolerable
	Venting of hydrocarbon gas		x	x								10	N/A	-	Tolerable
7.7	**Routine and non-routine discharges**														
	Routine discharges from LWI vessel: • Sewage • Grey water • Desalination brine • Cooling water • Deck drainage • Bilge water • Putrescible (food) waste		x									10	N/A	-	Tolerable
	Routine and non-routine discharges during LWI activities:		x			x						10	N/A	-	Tolerable

EP Section	Aspect	Value Potentially at Risk / Impact										Risk Assessment & Evaluation			
		Environmental							Socio-Economic						
Planned Activities		Marine Sediment	Water Quality	Air Quality	Ecosystems / Habitat	Marine Species	Marine Protected Areas	Key Ecological Feature	Commercial Fisheries	Shipping Activities	Tourism and Recreation	Severity Factor	Likelihood Factor	Residual Risk	Acceptability
	• Hydraulic control fluid • Greases • Calcium wash • Well kill fluids														
7.8	**Waste management**														
	Waste generated by miscellaneous vessel activities: • General (non-hazardous) waste • Hazardous waste											10	N/A	-	Tolerable

7.2 Environmental Risks Excluded from the Scope of the Environment Plan

Several environmental risks were considered during the ENVID as not applicable within or outside of the operational area and hence were not considered to be within the scope of this Environment Plan.

7.2.1 Physical Presence – Interference with Tourism and Recreational Related Third Parties

No tourism or recreational activities are expected in the permit area given its remote location, lack of natural subsea features and water depth. Impacts and risks from the physical presence of the LWI vessel to tourism or recreational activities were therefore considered non-credible.

7.2.2 Transit of the LWI Vessel

This EP covers risks associated with the LWI vessel within the operational area. During transit to and from the operational area, the vessel will be governed by the relevant marine legislation.

7.3 Physical Presence

7.3.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Acceptability
Physical presence	Presence of the LWI vessel and timing of the activity.	Interference with or displacement of other marine users (e.g. commercial shipping, commercial fishing and/ or other third party vessels).	10	N/A	-	Tolerable

7.3.2 Source of Risk

In order to undertake the well intervention activities, the LWI vessel will be on station above the Crosby-3H1 well within the operational area. The LWI activities will be short in duration, with the LWI vessel expected to be on location in the production licence area for up to 14 days, contingent on weather conditions or unforeseen circumstances. The LWI vessel will be continually operating 24-hours a day, seven days a week for the duration of the activity.

The physical presence of the LWI vessel in the operational area has the potential to cause interference with or displacement of other marine users, including commercial shipping and commercial fishing. The operational area lies within a cautionary area associated with the Pyrenees Development (refer to Figure 3-1). In addition, a 500-m Petroleum Safety Zone (PSZ) exclusion zone around the LWI vessel will be established for the duration of the activity.

7.3.3 Environmental Impact Assessment

Interference with Commercial Shipping

There are no recognised shipping routes in or near the operational area, with the nearest shipping fairway designated by AMSA located over 57 km to the northwest (Figure 4-24). Analysis of shipping traffic data indicates that commercial vessels do use the general area, with most vessels associated with the oil and gas industry. The use of the shipping fairways is strongly recommended by AMSA, but is not mandatory and the International Regulations for Preventing Collisions at Sea 1972 applies to all vessels navigating within or outside the shipping fairways.

The Crosby-3H1 well intervention activities are short in duration and the potential for disruption to other marine users is expected to be limited to temporary displacement of vessels should there be a requirement to make any slight modification to their course. The potential impact associated with interference with commercial shipping is considered to be low.

Displacement of Commercial Fishing

Three Commonwealth managed fisheries and six state managed fisheries have boundaries that overlap the operational area (Section 4.11.3). Potential impacts to commercial fisheries are a temporary loss of access to fishing grounds when the LWI vessel is on station in the operational area, which could potentially result in reduced catches.

An analysis of the current fishery closures, depth range of activity, historical fishing effort data, fishing methods (Table 4-15) and consultation feedback (Section 5) revealed that there is a low potential for active commercial fisheries in the operational area. The area affected (500 m safety exclusion zone around the LWI vessel) represents only a very small area available to commercial fishing activities. The potential impact is predicted to be low as a result of the exclusion of commercial fishing activity from a relatively small area and for a very short duration.

7.3.4 Demonstration of ALARP

A summary of the ALARP process undertaken for the environmental aspect is presented below. This process was completed as outlined in Section 6.1.2 and included consideration of all controls, analysis of the risk reduction proportional to the benefit gained and final acceptance or justification if the control was not considered suitable (refer Table 7-3). The result of this ALARP assessment contributes to the overall acceptability of the impact or risk.

Table 7-2: Physical presence – ALARP assessment summary

Hierarchy of Control	Control Measure	Accept/ Reject	Reason	Performance Standard
Eliminate	None identified	N/A	N/A	-
Engineer	Navigation (including lighting, compass/radar), bridge and communication equipment will be compliant with appropriate marine navigation and vessel safety requirements.	Accept	Legislative requirements to be followed reduce the likelihood of interference with other marine users. The control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 7.3.1**
Separate	Establishment of a 500-m safety exclusion zone around the LWI vessel.	Accept	Control is based on legislative requirements and must be accepted; reduces likelihood interference with other marine users. The control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 7.3.2**
Administrate	Notification of details (e.g. location, duration, etc.) of well intervention activities to AMSA which triggers issue of Maritime Safety Information (MSI) notifications and to the Australian Hydrographic Service	Accept	Notifications provides other marine users with information regarding activities or hazards and will include details of relevant vessel. Controls based on BHP requirements must be accepted. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 7.3.3**

Hierarchy of Control	Control Measure	Accept/ Reject	Reason	Performance Standard
	(AHS) which will issue a 'Notice to Mariners".			
	SIMOPs Plan will be controlled through Permit to Work System.	Accept	SIMOPS Plan will prevent interactions with offtake vessels operating from the *Pyrenees Venture* FPSO. Controls based on BHP requirements must be accepted. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice	**PS 7.3.2**
	Establish and maintain a Community Engagement Program by regular meetings with the Community Reference Group (CRG).	Accept	Controls based on BHP requirements must be accepted. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 7.3.4**
	Consultation with relevant stakeholders.	Accept	Control is legislative requirement. The control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 7.3.5**
Additional Control Measures Considered				
Separate	Establish and maintain a smaller safety exclusion zone (e.g. 100 m)	Reject	A reduction in the size of the safety exclusion zone would see an increase in the collision risk, therefore no benefit.	-
Substitute	Manage the timing of the activity to avoid peak marine user periods (e.g. fishing).	Reject	The area that other marine users are excluded from is of limited size (500-m radius around the LWI vessel) when compared to the area available to other marine users. In conjunction with low fishing effort in the area, as confirmed through stakeholder consultation, altering the timing of the activity is not deemed necessary or considered to be an effective control.	-

ALARP Summary

The risk assessment and evaluation has identified a range of controls that when implemented are considered to manage the impacts and risks of the physical presence of the LWI vessel on other marine users. The well intervention activities cannot occur without the presence of the LWI vessel on location. Additional controls considered but rejected are provided in Table 7-2. For example, consideration was given to reducing the safety exclusion zone; however, this would reduce the disturbance by an immeasurable small fraction at the cost of greatly increased risk of vessel collision.

Based on the impact and risk assessment completed, BHP considers the control measures described are appropriate to reduce the potential for disruption and interference with other marine users associated with the physical presence of the LWI vessel. As no additional reasonable control measures were identified, while also providing the required level of safety to prevent interactions with other marine users, the impacts and risks are considered reduced to ALARP.

7.3.5 Demonstration of Acceptability

BHP considers a range of factors when determining that a level of impact and risk to the environment is broadly acceptable, as summarised in Table 7-3.

Table 7-3: Demonstration of acceptability for physical presence

Acceptability Criteria	Acceptability Criteria	Demonstration
Codes and Standards	Is the impact or risk being managed in accordance with relevant Australian or International legislation, Ministerial Conditions or standards?	Impacts and risks associated with the physical presence of the LWI vessel will be managed in accordance with relevant legislation (e.g. *Navigation Act 2012*), and codes and standards (e.g. MARPOL, Marine Orders).
Ecologically Sustainable Development (ESD)	Is the proposed impact consistent with the principles of ESD?	BHP undertakes petroleum activities in a manner that is consistent with its Charter values and Code of Business Conduct. In determining the level of acceptability of the physical presence of the LWI vessel in the field, and guided by the Charter value of Sustainability, BHP has identified, assessed and controlled risks associated with this activity to minimise environmental impacts. BHP considers that this approach is consistent with the principles of ESD.
Internal Context		
BHP Charter and HSEC Management System compliance	Is the proposed impact or risk consistent with the requirements of BHP Our Requirements, Petroleum HSE Standard (PET-HSE00-HX-STD-00001) and HSEC Management Systems?	The physical presence of the LWI vessel will be in compliance with BHP policies and management systems and will be consistent with activities authorised for areas adjacent to a World Heritage Area (WHA).
Professional judgement	Is the impact or risk being managed in accordance with industry best practice?	BHP will establish and maintain a 500-m safety exclusion zone around the LWI vessel. Controls identified in this plan are consistent with industry best practice and guidelines. Accepted controls that will be implemented are provided in Table 7-2.
ALARP	Are there any further reasonable and practicable controls that can be implemented to further reduce the impact or risk?	All reasonable and practicable controls have been assessed (Table 7-2), additional controls were considered but were found not to be justifiable in further reducing the impacts and risks of physical presence without a gross disproportionate sacrifice. BHP considers that the residual risk of physical presence has been demonstrated to be ALARP.
External Context		
Environmental best practice	Are controls in place to manage the impacts and risk to the environment that are commensurate with the nature and scale of any environmental sensitivities of the receiving environment?	The environmental performance outcomes, performance standards and measurement criteria that determine whether the outcomes and standards have been achieved are commensurate with the environmental significance (i.e. a WHA) of the receiving environment.
Stakeholder views	Do stakeholders have concerns / issues, and if so, have controls been implemented to manage their concerns / issues?	Stakeholders have been consulted about the petroleum activity (Section 5) and no stakeholder concerns have been raised regarding this aspect.

Acceptability Summary

The area affected represents only a very small area available for shipping and fishing activity. Given the activity does not take place in any designated shipping fairways and with limited fishing activity in the operational area, the effect of the physical presence of the LWI vessel on other marine users is considered to be acceptable on the basis of a negligible level of impact. The environmental impact assessment determined that there would be no significant impacts other than short-term and localised displacement to commercial fishers and to some local marine vessel traffic. All relevant controls were considered as part of the ALARP assessment, and as no other reasonable additional controls were identified that would further reduce the impacts and risks of physical presence without a gross disproportionate sacrifice, the impacts and risks are considered ALARP. BHP undertakes regular consultation with relevant stakeholders about its operations/ activities providing them with sufficient and reasonable opportunities to raise any new concerns or issues for the duration of this activity.

BHP is satisfied that when the accepted controls are implemented that the impact and residual risk of physical presence of the LWI vessel to other marine users is considered 'ALARP' and that adherence to the performance standards will manage the impacts and risks to an acceptable level.

7.3.6 Environmental Performance Outcome, Performance Standards and Measurement Criteria

Environmental Performance Outcome	Environmental Performance Standard	Measurement Criteria
No unplanned interactions between the LWI vessel and other marine users.	**PS 7.3.1** ***Navigation Act 2012*; International Convention of the Safety of Life at Sea (SOLAS) 1974; Marine Order - Part 30: Prevention of Collisions, Issue 8; Marine Order 21, Issue 8 (Safety of Navigation and Emergency Procedures); and International Convention of Standards of Training, Certification and Watch-keeping for Seafarers (STCW95):** Navigation (including lighting, compass/radar), bridge and communication equipment will be compliant with appropriate marine navigation and vessel safety requirements. Automatic Identification System (AIS) is fitted and maintained in accordance with Regulation 19-1 of Chapter V of SOLAS. Crew undertaking vessel bridge-watch will be qualified in accordance with International Convention of STCW95, AMSA Marine Order -Part 3: Seagoing Qualifications or certified training equivalent.	Vessel audit and inspection records demonstrate compliance with standard maritime orders and equipment.
	PS 7.3.2 **BHP Petroleum HSE Standard (PET-HSE00-HX-STD-00001):** Establishment of a 500-m safety exclusion zone around the LWI vessel. SIMOPs Plan prepared to manage vessel interactions during petroleum activity.	Breaches of vessel access within 500 m safety exclusion zone recorded in Marine Log Book and reported via Incident Report Form and documented in Environmental Performance Report.
		Safety Zone Entry Checklist completed, dated and signed for all entries into the 500-m safety exclusion zone.
		Permit to Work (PTW) for all activities within the safety zone approved and signed by the Ultimate Work Authority to ensure SIMOPs issues addressed.
	PS 7.3.3 Prior to commencement of activity, notification of details (e.g. location, duration, 500-m safety exclusion zone, etc.) of well intervention activities to AMSA which triggers issue of Maritime Safety Information (MSI) notifications and to the Australian Hydrographic Service (AHS) which will issue a 'Notice to Mariners'.	Records demonstrate notifications to AMSA and AHS advising of details of well intervention activities including 500-m safety exclusion zone.

Environmental Performance Outcome	Environmental Performance Standard	Measurement Criteria
	PS 7.3.4 **BHP Stakeholder Engagement Management Plan (WA) (AOEA-CR-0001) - Community Engagement Program:** The Community Reference Group (CRG) will be advised of, and updated of the proposed LWI activities and timing.	Meeting minute records maintained of CRG meetings, which includes summary of proposed LWI activities.
	PS 7.3.5 BHP consultation with relevant stakeholders to advise of well intervention activities.	Stakeholder communication recorded in database demonstrating assessment of stakeholder feedback received and BHP response.

7.4 Light Emissions

7.4.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Acceptability
Light emissions	Artificial light on-board LWI vessel	Light emissions (light spill/ glow) from external lighting on the LWI vessel causing alterations to normal marine behaviour.	10	N/A	-	Tolerable

7.4.2 Source of Risk

During the activity, artificial lighting on the LWI vessel will be required on a 24-hour basis. This safety and navigational lighting on the LWI vessel will generate light glow and direct illumination of surface waters surrounding the vessel. Most external lighting is directed towards working areas such as the main decks, although spot lighting may also be used on an as-needed basis e.g. SID and ROV deployment and retrieval. Lighting is required for safety and navigational purposes, and cannot be eliminated.

External lighting for deck operations typically consist of bright white (metal halide, halogen, fluorescent) lights. Lighting is designed to ensure adequate illumination for safe working conditions. Typical light intensity values are 5 to 10 lux for walkways, 50 lux for working areas and approximately 100 lux for high intensity light areas. Light intensity diminishes with inverse of distance squared (I received = I/r^2). Figure 7-1 presents a simple calculation of diminishment of received light with distance assuming 100 lamps on the vessel of low, medium and high intensity each acting additively. It can be seen that light received is diminished to about the equivalent of light that would be received from a full moon within about 200 m from the vessel and to that of a moonless clear night within about 1,500 m for low intensity lights and 3,000 m for high intensity lights.

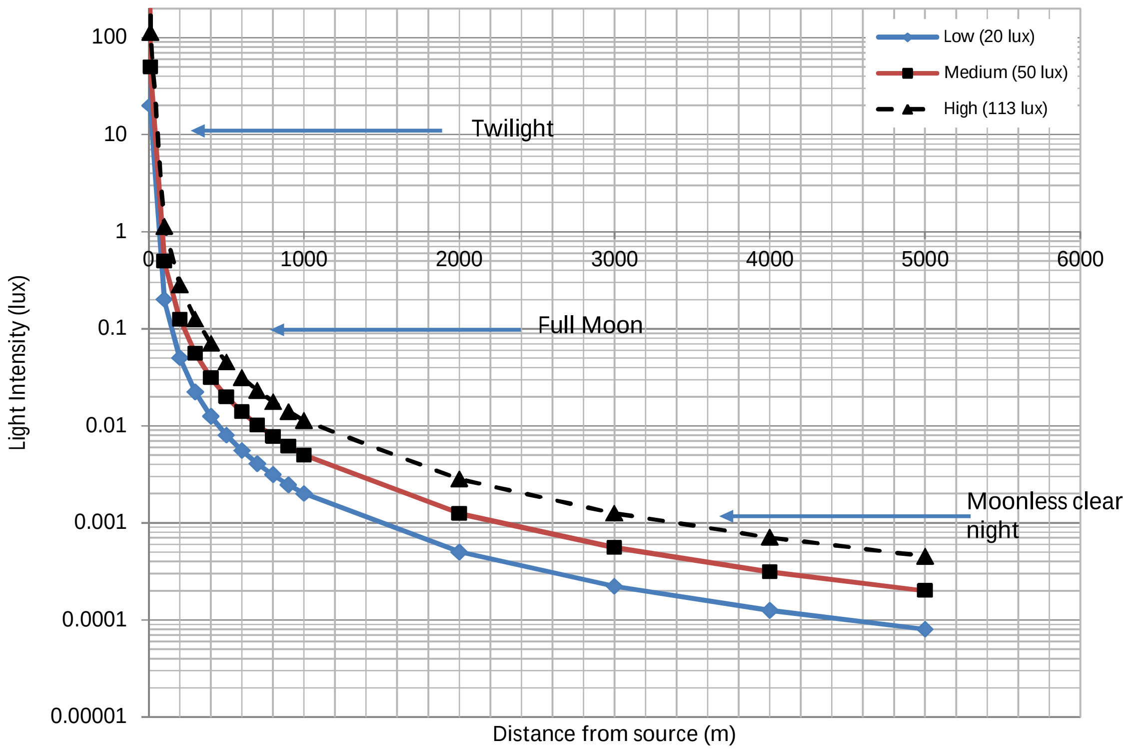


Figure 7-1: Diminishment of light with distance from source assuming 100 lamps of low, medium and high intensity

7.4.3 Environmental Impact Assessment

Artificial lighting has the potential to affect marine fauna that use visual cues for orientation, navigation, or other purposes, resulting in behavioural responses that can alter foraging and breeding activity. The species with greatest sensitivity to light are marine turtles, seabirds and fish.

Potential impacts to marine fauna from artificial lighting may include:

- Disorientation, or attraction or repulsion to the light;
- Disruption to natural behaviour patterns and cycles; and
- Indirect impacts such as increased predation risks through attraction of predators.

These potential impacts are dependent on:

- Wavelength and intensity of the lighting, and the extent to which the light spills into important wildlife habitat (e.g. foraging, breeding and nesting);
- The timing of light spill relative to the timing of habitat use by marine fauna sensitive to lighting effects; and
- The physiological sensitivity and resilience of the fauna populations that are at risk of potential effects.

Fish and Zooplankton

Fish and zooplankton may be directly or indirectly attracted to light. Experiments using light traps have found that some fish and zooplankton species are attracted to light sources (Meekan *et al*., 2001), with traps drawing catches from up to 90 m (Milicich *et al.*, 1992). Lindquist *et al*. (2005) concluded from a study that light fields around oil and gas activities resulted in an enhanced abundance of clupeids (herring and sardines) and engraulids (anchovies), both of which are known to be highly photopositive.

The concentration of organisms attracted to light results in an increase in food source for predatory species and marine predators are known to aggregate at the edges of artificial light halos. Shaw *et al.* (2002), in a similar light study, noted that juvenile tunas (Scombridae) and jacks (Carangidae), which are highly predatory, may have been preying upon concentrations of zooplankton attracted to the light fields around oil and gas activities. This could potentially lead to increase predation rates compared to unlit areas.

Light spill from the LWI vessel onto the surrounding surface waters, particularly during night-time activities, is likely to result in aggregations of zooplankton and fish around the vessel as they are attracted to the light and increased food availability. However, the operational area does not contain any significant feeding, breeding or aggregation areas for important fish species. Owing to the short duration of the activity, the potential for increased predation activity is unlikely to result in a significant impact on the plankton or fish communities. As such, effects are expected to be highly localised with no discernible consequences at the population level.

Seabirds and Migratory Shorebirds

Studies conducted between 1992 and 2002 in the North Sea confirmed that artificial light was the reason that seabirds were attracted to and accumulated around illuminated offshore infrastructure (Marquenie *et al*., 2008) and that lighting can attract seabirds from large catchment areas (Wiese *et al*., 2001). Availability of roosting refuge at sea and increased food availability may be the most important reasons why seabirds are attracted to offshore oil and gas infrastructure (Wiese *et al*., 2001). Either seabirds may either be attracted by the light source itself or indirectly as structures in deep water environments tent to attract marine life at all trophic levels, creating food sources and shelter for seabirds (Surman, 2002; Wiese *et al*., 2001). The light from vessels may also provide enhanced capability for seabirds to forage at night (Burke *et al*. 2005). Studies in the North Sea indicate that migratory birds are attracted to lights on offshore platforms when travelling within a radius of 3–5 km from the light source (Marquenie *et al*., 2008). Beyond this distance, it is assumed that light source strengthen were not sufficient to attract birds away from their preferred migration route.

Negative potential impacts to seabirds and migratory shorebirds attracted by artificial lighting can include disorientation causing collision, entrapment, stranding, grounding and interference with navigation (being drawn off course from usual migration routes) (DoEE, 2020). These behavioural responses may cause injury and/ or death. Seabird mortalities from collisions have been found to be correlated to conditions of poor visibility (cloud, fog or rain) and proximity to nearby seabird colonies (Black, 2005).

During the well intervention activities, it is possible a small number of seabirds and migratory shorebirds may be attracted to the LWI vessel, including the migratory wedge-tailed shearwater (for which a foraging BIA overlaps the operational area). However, this is not expected to result in impacts to birds beyond a temporary change in behaviour, and with no discernible consequences at the population level.

Marine Turtles

The attraction of marine turtles to light has been well documented. Adult marine turtles may avoid nesting on beaches that are brightly light (Witherington, 1992; Price *et al*., 2018) and adult and hatchling turtles can be disorientated and unable to find the ocean in the presence of direct light or sky glow (Witherington, 1992; Lorne & Salmon, 2007; Thums *et al*., 2016; Price *et al*., 2018).

Hatchlings

On emerging from the nests on natal beaches, hatchlings use visual cues to head towards the sea. Under natural conditions, turtles predominantly hatch at night and use light cues to orient away from elevated, darker, landward silhouettes and orient toward the open, lower, brighter horizon above the sea surface (Salmon *et al*., 1992). Artificial lighting on beaches is strongly attractive to hatchlings and disrupts their orientation on the shore in two ways. The hatchlings may crawl towards the lights (‘misorientation’) or they may be incapable of crawling in any direction (‘disorientation’) (Lorne & Salmon, 2007). As a result, the hatchlings may crawl for hours without reaching the sea, in increasing energy expenditure and become exhausted and dehydrated. A prolonged beach crawl also increases their exposure to predators (Witherington & Martin, 2003).

While the detrimental effects caused by light pollution during the journey of hatchlings from the nest to the water’s edge are well recognised, the impact of artificial light on their behaviour once they reach the water is unknown. Once hatchlings enter the sea, they swim to offshore waters, orientating using wave direction and an internal magnetic compass (Lohmann & Lohmann, 1992; Salmon & Wyneken, 1994). However, artificial light has been shown to affect their in-water swimming behaviour (Thums *et al*., 2016). If light pollution disrupts the orientation and swimming behaviour of hatchlings, it can cause them to linger or become disorientation in the near shore environment, increasing the chances of mortality from predators.

The operational area overlaps inter-nesting habitat critical to the survival of flatback turtles, which is also a BIA (refer to Section 4.5.6). The potential effect of turtle hatchlings being attracted to the LWI vessel is mitigated by the distance from nesting beaches (over 20 km from the Muiron Islands; and 27 km from North West Cape), which means that the LWI vessel would not be visible from ground level at any of the known turtle nesting beaches. Disorientation of hatchling turtles in response to artificial lighting from the LWI vessel is there considered not credible.

Adults

Spending most of their lives in the ocean, adult females nest above the high-tide mark on sandy tropical and subtropical beaches, predominantly at night (Witherington & Martin, 2003). They rely on visual cues to select nesting beaches and orient on land. Artificial lighting on or near beaches has been shown to disrupt nesting behaviour. Lighting may affect the location where turtles emerge onto the beach, the success of nest construction, whether the nesting attempts are abandoned, and even the directness of paths as adult females return to the sea (Witherington & Martin, 2003). Beaches with artificial light, such as coastal urban development, and lighted piers and roadways typically have lower density of nesting females than dark beaches (Salmon, 2003; Witherington & Martin, 2003). However, many do nest on light shores and in doing so, the lives of their hatchlings are at risk, as discussed previously.

Five marine turtle species were identified as potentially occurring in the operational area (previous Table 4-6). The operational area overlaps inter-nesting habitat critical to the survival of flatback turtles, which is also a BIA (refer to Section 4.5.6). It is possible that individual turtles may be encountered traversing the operational area during the well intervention activities, however considering the water depths of the operational area (nearly 200 m), and distance to nesting beaches (over 20 km from the Muiron Islands; and 27 km from North West Cape), large numbers of inter-nesting adults are not expected. The short duration of the activity is such that behavioural impacts to marine turtles from light emissions on the LWI vessel are considered negligible.

Species Recovery Plans, Conservation Management Plans and Approved Conservation Advice

BHP has considered information contained in recovery plans, approved conservation advice and threat abatement plans (refer to previous Table 4-7). This includes the Recovery Plan for Marine Turtles in Australia (DoEE, 2017) as well as the recently published National Light Pollution Guidelines (DoEE, 2020).

The overarching objective of the Recovery Plan for Marine Turtles in Australia is to reduce detrimental impacts on Australian populations of marine turtles and hence promote their recovery in the wild. All six species of marine turtle that occur in Australian waters are listed as threatened under the EPBC Act. Marine turtles are long-lived, slow to mature and are subject to a number of threats. Light pollution is identified as a high-risk threat in the Recovery Plan for Marine Turtles because artificial light can disrupt critical behaviours such as adult nesting and hatchling orientation following their emergence from nests, sea finding and dispersal, and can reduce the reproductive viability of turtle stocks. Minimising light pollution such that artificial light within or adjacent to habitat critical to the survival of marine turtles is managed such that marine turtles are not displaced from these habitats (DoEE, 2017).

The operational area intercepts an inter-nesting BIA and inter-nesting habitat critical to the survival of flatback turtles (all waters within a 60 km radius of nesting areas on Thevenard Island, the Muiron Islands and Pilbara coast). The operational area is too distant from nesting beaches to disrupt nesting behaviour of adult turtles or sea-finding behaviour in hatchlings. The nearest nesting habitat (the Muiron Islands) to the operational area is >20 km southeast. As such, impacts to adults and hatchlings are not predicted.

As there are no safe alternatives to the use of artificial lighting on the LWI vessel, and as lighting will be restricted to that required to provide safe working and navigational requirements, it is considered minimised to ALARP. In summary, BHP considers the proposed activity is not inconsistent with recovery plan for marine turtles.

7.4.4 Demonstration of ALARP

A summary of the ALARP process undertaken for the environmental aspect is presented below. This process was completed as outlined in Section 6.1.2 and included consideration of all controls, analysis of the risk reduction proportional to the benefit gained and final acceptance or justification if the control was not considered suitable (refer Table 7-4). The result of this ALARP assessment contributes to the overall acceptability of the impact or risk.

Table 7-4: Light emissions – ALARP assessment summary

Hierarchy of Control	Control Measure	Accept/ Reject	Reason	Performance Standard
None	No controls – Light emissions are considered to be as low as reasonably practicable.			-
Additional Control Measures Considered				
Substitute	Limit or exclude night-time operations.	Reject	Would increase the duration of the activity (almost double), thereby increasing other hazards/ impacts such as air emissions, waste generation, physical presence, vessel collision risk, etc.	-
Engineer	Reduction of lighting effects by manipulation of the wavelength/ colour of lighting.	Reject	Utilised in land-based operations to reduce the incidence of hatchlings being attracted to light sources in areas near to turtle nesting beaches (for example Barrow Island). However light from the LWI vessel will not be visible at the beaches therefore manipulation of light wavelength / colour would not make any discernible difference to the already insignificant risk of turtle hatchlings being attracted to the vessel.	-
Isolate	Reduce usage of light in periods of peak sensitive receptors (e.g. turtle nesting/ hatching).	Reject	To ensure lighting meets health and safety requirements, lighting is required throughout the day and night for the duration of the well intervention activities. Limiting lighting usage to only during periods when sensitive receptors are absent would be non-conformant with health and safety requirements.	-

ALARP Summary

There are no safe alternatives to the use of artificial lighting on the LWI vessel. Lighting is required for the safe conduct of operations and for various sea safety requirements. The WA EPA environmental assessment guideline for protecting marine turtles from light impacts (EPA, 2010) notes that the starting point for design should be to locate developments sufficiently far from the coast to ensure that lights are not visible from nesting beaches or the adjacent sea. The more recently published National Light Pollution Guidelines for Wildlife (DoEE, 2020) includes provision of a 20 km buffer as a nominal distance at which artificial light impacts should be considered with respect to marine turtle hatchlings emerging from nesting beaches.

The illumination of deck work areas is normal maritime oilfield practice and necessary for safe operations. No additional reasonable control measures were identified, while also providing the required level of safe working conditions. No sensitive receptors such as turtle nesting beaches or breeding bird / roosting habitat are located within the operational area. The operational area is >20 km from the nearest nesting beaches on the Muiron Islands. On this basis, no effects of lighting on sensitive receptors are predicted.

7.4.5 Demonstration of Acceptability

BHP considers a range of factors when determining that a level of impact and risk to the environment is broadly acceptable, as summarised in Table 7-5.

Table 7-5: Demonstration of acceptability for light emissions

Acceptability Criteria	Acceptability Criteria	Demonstration
Codes and Standards	Is the impact or risk being managed in accordance with relevant Australian or International legislation, Ministerial Conditions or standards?	Impacts and risks associated with light emissions from the LWI vessel will be managed in accordance with relevant legislation (e.g. *Navigation Act 2012*), and codes and standards (e.g. Marine Orders and International Convention of the Safety of Life at Sea (SOLAS) 1974).
Ecologically Sustainable Development (ESD)	Is the proposed impact consistent with the principles of ESD?	BHP undertakes petroleum activities in a manner that is consistent with its Charter values and Code of Business Conduct. In determining the level of acceptability of the light emissions of the LWI vessel in the field, and guided by the Charter value of Sustainability, BHP has identified, assessed and controlled risks associated with this activity to minimise environmental impacts. BHP considers that this approach is consistent with the principles of ESD.
Internal Context		
BHP Charter and HSEC Management System compliance	Is the proposed impact or risk consistent with the requirements of BHP Our Requirements, Petroleum HSE Standard (PET-HSE00-HX-STD-00001) and HSEC Management Systems?	Light emissions associated with the activity will be in compliance with BHP policies and management systems and will be consistent with activities authorised for areas adjacent to a World Heritage Area (WHA).
Professional judgement	Is the impact or risk being managed in accordance with industry best practice?	Controls identified in this plan are consistent with industry best practice and guidelines. Accepted controls that will be implemented are provided in Table 7-4.
ALARP	Are there any further reasonable and practicable controls that can be implemented to further reduce the impact or risk?	All reasonable and practicable controls have been assessed (Table 7-4), additional controls were considered but were found not to be practicable in further reducing the impacts and risks of light emissions without a gross disproportionate sacrifice. BHP considers that the residual risk of light emissions has been demonstrated to be ALARP.
External Context		
Environmental best practice	Are controls in place to manage the impacts and risk to the environment that are commensurate with the nature and scale of any environmental sensitivities of the receiving environment?	The environmental performance outcomes, performance standards and measurement criteria that determine whether the outcomes and standards have been achieved are commensurate with the environmental significance (i.e. a WHA) of the receiving environment. The potential risks and impacts are consistent with relevant species recover plans, conservation management plans and published guidelines, including but not limited to: • Recovery Plan for Marine Turtles in Australia 2017-2027; • National Light Pollution Guidelines for Wildlife 2020.

Acceptability Criteria	Acceptability Criteria	Demonstration
Stakeholder views	Do stakeholders have concerns / issues, and if so, have controls been implemented to manage their concerns / issues?	Stakeholders have been consulted about the petroleum activity (Section 5) and no stakeholder concerns have been raised regarding this aspect.

Acceptability Summary

Illumination of working areas on the LWI vessel is necessary for safe working practices, as determined as part of a Vessel Safety Case assessment under the OPGGS Act requirements. Navigational lighting is also required to satisfy AMSA's Prevention of Collision Convention (Marine Order 30, Issue 7) requirements.

Lights are not normally directed outwards from the vessel except when necessary for safe operations outboard, such as deployment/retrieval of equipment. Light emissions from the LWI vessel will not result in an impact greater than a localised and temporary disturbance to fauna in the vicinity of the operational area with no lasting effect and no discernible consequences at the population level. All relevant controls were considered as part of the ALARP assessment, and as no other reasonable additional controls were identified that would further reduce the impacts and risks of light emissions without a gross disproportionate sacrifice, the impacts and risks are considered ALARP. BHP undertakes regular consultation with relevant stakeholders about its operations/ activities providing them with sufficient and reasonable opportunities to raise any new concerns or issues for the duration of this activity.

BHP is satisfied that routine light emissions from the LWI vessel and the short duration of the activity (approximately up to 14 days) represent a low residual risk that is broadly acceptable.

7.4.6 Environmental Performance Outcome, Performance Standards and Measurement Criteria

Not applicable as light emissions are considered to be as low as reasonably practicable.

7.5 Noise Emissions

7.5.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Acceptability
Underwater noise emissions	Generation of underwater noise from the LWI vessel during normal operations.	Underwater sound emitted to the marine environment causing interference to marine mammals.	10	N/A	-	Tolerable

7.5.2 Source of Risk

Throughout the well intervention activities, low intensity underwater noise of a continuous and intermittent nature will be generated. The main potential sources of underwater noise are produced from the operation of the vessel engines, propeller cavitation, thrusters and the operation of on-board machinery/ engines. Sound generated from these activities will contribute to and exceed ambient underwater noise level which range from 80 dB re 1 µPa in calm conditions and low wind to 120 dB re 1 µPa under high wind and rain (Richardson *et al.*, 1995).

Vessel noise varies the size, speed and engine type and the activity being undertaken. The LWI vessel will use a DP system to manoeuvre into position at the Crosby-3H1 well and hold position. The use of the DP system avoids the need for anchoring when undertaking works in close proximity to subsea infrastructure. Noise generated from the DP thrusters will be the dominant source of underwater noise during the well intervention activities. A vessel using DP thrusters can produce sound at levels between 108 and 182 dB re 1µPa at 1m at dominant frequencies between 50 Hz and 7 kHz (McCauley, 1998; Simmonds *et al*., 2004).

McCauley (1998) measured underwater broadband noise equivalent to approximately 182 dB re µPa at 1 m from a vessel holding station in the Timor Sea. Under normal operating conditions when the vessel is idling, vessel noise would be detectable only over a short distance. The noise from a vessel holding its position using bow thrusters and strong thrust from its main engines may be detectable above background noise levels during calm weather conditions, for 20 km (McCauley, 1998) or more from the vessel although this range of audibility will be reduced under noisier (windier) background conditions.

7.5.3 Environmental Impact Assessment

Receptor Sensitivity and Noise Exposure Criteria

Noise has the potential to adversely affect marine fauna and in extreme cases cause physiological harm. Underwater noise generated by anthropogenic activities may impact on marine fauna by the following, presented in decreasing order of effect:

- Mortality or potential mortal injury – physical injury that may result in death of an animal through damage to internal organs:
- Physical impairment / injury to hearing organs:
    - Permanent threshold shift (PTS) – a permanent loss of hearing sensitivity. Recovery is not expected to occur.
    - Temporary threshold shift (TTS) – a temporary reduction in the ability of an animal to perceive sound. Recovery to pre-exposure levels is expected to occur.
    - Masking/ interference of biologically important sounds e.g. for communication, for navigation, and predator/ prey detection.
- Behavioural disturbance – typically short-term behavioural changes such displacement from biologically important habitat areas (such as feeding, resting, breeding, calving and nursery sites), avoidance, surfacing, etc. Behaviour expected to return to normal following cessation of noise.
- Indirect impacts, for example:
    - Impacts on other trophic levels (e.g. predator/ prey species displacement or depletion).
    - Reduced reproductive success.

Initial studies of underwater noise pollution focussed on megafauna and particularly marine mammals (Richardson *et al*., 1995; Southall *et al*., 2007; Theobald *et al*., 2009), but in recent years effects have been discovered in other taxa at lower trophic levels, including various fish species (Hastings & Popper, 2005; Popper *et al*., 2014), crustaceans (Tidau & Briffa, 2016) and zooplankton (McCauley *et al*., 2017).

The proximity at which physical and behavioural effects from a vessel holding station may commence for whales, turtles and fish has been determined by reference to published information on sensitivity and a combination of measured and calculated noise attenuation and is summarised in Table 7-6. There are no currently recognised thresholds/methods for reliably assigning a generic distance for masking effect. The potential for acoustic masking by vessel noise is influenced by numerous confounding factors, including the juxtaposition of the vessel to the animals that are communicating, changes in ambient noise levels, the strength, duration and wavelengths (frequency) of the species' calls, the ability of the species to directionalise sounds, the ability of the species to discriminate frequencies/intensities of sounds, the distance between calling animals, the overlap in vessel and call frequencies, etc.

The nature of underwater noise levels expected to be generated by LWI vessel involving transient and relatively low intensity broadband noise, suggests that the potential for masking effects is likely to be limited to relatively close proximity to the noise source. Given that whales in the area that might be communicating would mostly be actively moving (migrating) through the area and hence unlikely to remain within any potential zone of masking for an extended period, it is unlikely that significant disruptions to communications that might result in adverse impacts to any species would occur.

Table 7-6: Predicted range within which physical and behavioural effects (including avoidance) may commence for whales, turtles and fish

	Whales	Marine Turtles	Fish
Physical Injury	Zero to 10 m	Zero to 1 m	-
Temporary Threshold Shift	Zero to 100 m	Zero to 10 m	Zero to 10 m
Behavioural	Zero to 3,000 m	Zero to 300 m	Zero to 50 m

Impact thresholds for fauna groups were derived from scientific literature and published guidelines, including:

- Technical guidance for assessing the effects of anthropogenic sound on marine mammal hearing: underwater acoustic thresholds for onset of permanent and temporary threshold shifts (NMFS, 2018).
- Sound exposure guidelines for fishes and sea turtles (Popper *et al*., 2014).

Marine Mammals (Cetaceans):

Marine mammals that may occur within the operational area are provided in Section 4.5.6 and include low frequency (baleen whales e.g. sei, blue, humpback whales) and mid-frequency (dolphins and toothed whales e.g. orca and sperm whales). Of these species, the pygmy blue and humpback whales are expected to be the most frequently encountered particularly during annual migrations, given the overlap of the operational area with distribution and migratory corridor BIAs. Other cetacean species identified as potentially occurring in the operational area (Table 4-6) are expected to be limited to individuals infrequently traversing the operational area.

Sound is very important to marine mammals and extensive research has been undertaken to understand the potential impacts of anthropogenic noise, with reviews by Richardson *et al*. (1995); Nowacek *et al*. (2007); Southall *et al*. (2007 and 2019); and Erbe *et al*. (2018). Underwater noise can interfere with key life functions of marine mammals (e.g. foraging, mating, nursing, resting and migration) by impairing hearing sensitivity, masking acoustic signals, eliciting behaviour responses, or causing physiological stress. Severity of the impacts typically decreases with the increase in distance from the sound source. Closer to the noise source, injuries such as tissue or organ damage (e.g. a permanent loss of hearing called permanent threshold shift (PTS); refer to Southall *et al*., 2007) may be found. If hearing loss recovers with time, it is termed a temporary threshold shift (TTS).

Marine mammals can be grouped based on how different species group use and hear sound differently. Underwater noise exposure criteria (also termed impact criteria or noise thresholds) can then be weighted for each broad species group to emphasise noise frequencies that a group may be particularly vulnerable to. This approach is described by Southall *et al.* (2007). The noise exposure criteria for continuous (non-impulsive) underwater noise (e.g. marine vessels, machinery operation, vibratory pile driving) and impulsive noise sources (e.g. explosives, seismic air guns) are presented in Table 7-7 and Table 7-8 respectively. The approach of Southall *et al*. (2007) recognises that even if the initial received levels are not great enough to cause injury, harmful effects can result from lower level sounds which last for a longer duration.

Southall *et al*. (2007) conducted a comprehensive review of data published describing behaviour of marine mammals in response to sound, with the onset of behavioural disturbance to cetacean species reported at sound levels as low as 120 dB re 1 µPa. This may result in subtle responses such as changing in diving and breathing patterns, but that avoidance was generally not observed until sound levels reached more than 160 dB re 1 µPa (Southall *et al*., 2007). The zone of responsiveness to sound is expected to be smaller than the zone of audibility because an animal will not likely respond to a sound that is barely detectable. Measured indicators of disturbance include changes in swim direction and speed, dive duration, surfacing duration and interval, and respiration and changes in vocalisation. The US National Marine Fisheries Service propose a behavioural response threshold of 120 dB re 1 µPa for continuous noise sources and 160 dB re 1 µPa for impulsive noise sources (NMFS, 2018).

Noise generated by the LWI vessel is not predicted to exceed the permanent injury threshold levels for continuous (non-impulsive) noise sources (shown in Table 7-7), and therefore permanent injury to protected cetacean species is not anticipated. However, noise generated by the LWI vessel may exceed thresholds that could result in short-term behavioural responses in cetaceans, resulting in temporary avoidance of the area.

Table 7-7: Continuous noise sources: marine mammal injury and disturbance thresholds for various functional hearing groups

Functional Hearing Group	Generalised Hearing Range	TTS Threshold (received level)	PTS Threshold (received level)	Behavioural Disturbance Threshold
Low-frequency cetaceans (baleen whales e.g. blue, fin, sei, right, humpback, minke, Bryde's)	7 – 35,000 Hz	179 dB re 1 µPa^{2}s	199 dB re 1 µPa^{2}s	120 dB re 1 µPa
Mid-frequency cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 – 160,000 Hz	178 dB re 1 µPa^{2}s	198 dB re 1 µPa^{2}s	120 dB re 1 µPa
High-frequency cetaceans (true porpoises, river dolphins)	275 – 160,000 Hz	153 dB re 1 µPa^{2}s	173 dB re 1 µPa^{2}s	120 dB re 1 µPa

Table 7-8: Impulsive noise sources: marine mammal injury and disturbance thresholds for various functional hearing groups

Functional Hearing Group	Generalised Hearing Range	TTS Threshold (received level)	PTS Threshold (received level)	Behavioural Disturbance Threshold
Low-frequency cetaceans (baleen whales e.g. blue, fin, sei, right, humpback, minke, Bryde's)	7 – 35,000 Hz	168 dB re 1 µPa^{2}s	183 dB re 1 µPa^{2}s	160 dB re 1 µPa
Mid-frequency cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 – 160,000 Hz	170 dB re 1 µPa^{2}s	185 dB re 1 µPa^{2}s	160 dB re 1 µPa
High-frequency cetaceans (true porpoises, river dolphins)	275 – 160,000 Hz	140 dB re 1 µPa^{2}s	155 dB re 1 µPa^{2}s	160 dB re 1 µPa

Marine Turtles

Five marine turtle species were identified as potentially occurring in the operational area (previous Table 4-6). The operational area overlaps inter-nesting habitat critical to the survival of flatback turtles, which is also a BIA (refer to Section 4.5.6). It is possible that individual turtles may be encountered traversing the operational area during the well intervention activities, however considering the water depths of the operational area (nearly 200 m), and distance to nesting beaches (over 20 km from the Muiron Islands; and 27 km from North West Cape), large numbers of inter-nesting adults are not expected.

Data on hearing by marine turtles is very limited. Turtles have been shown to respond to sounds in the low frequency range, with indications that they have the greatest hearing sensitivity in the frequency range of 100-900 Hz (Ketten & Bartol, 2005). There is no direct evidence of mortality or potential permanent injury to marine turtles from continuous noise sources such as vessels (Popper *et al*., 2014). However, few studies have investigated the threshold level necessary for behavioural effects. Early work by Lenhardt (1994) observed caged marine turtles show avoid responses to low frequency tones. O'Hara and Wilcox (1990) reviewed the use of noise as acoustic deterrents. They found that airguns with a source level of approximately 220 dB re 1µPa at 1m (measured in the 25 to 1,000 Hz range) were effective as a deterrent for a distance of about 30 m. Moein *et al*. (1994) also used airguns to investigate means to repel loggerhead turtles. Avoidance was observed at 175 dB re 1µPa at 1m exposure. McCauley *et al*. (2000) found behavioural avoidance at 155 to 164 dB re 1 μPa^2s with observed behavioural responses of caged marine turtles including rising to the surface and altered swimming patterns.

During the well intervention activities, noise generated by the LWI vessel is predicted to result in temporary disturbance to marine turtles in the vicinity of the vessel. At most, this will be a behavioural response such as a change in diving behaviour and avoidance of the area. Impacts to marine turtles are not considered significant based on the short duration of the activity, the distance from the closest nesting habitat (over 20 km away, as such high numbers of turtles are not predicted), and as marine turtles are at low risk of potential mortality or permanent injury from continuous noise sources such as vessels (Popper *et al*., 2014).

Fish, Sharks and Rays

There is a wide range of susceptibility to noise among fish. The primary factor likely to influence susceptibility is the presence or absence of a swim bladder. Generally, fishes with a swim bladder will be more susceptible than those without this organ. Many adult fishes, including the elasmobranchs (sharks, rays and sawfish) do not possess a swim bladder and so are not susceptible to swim bladder-induced trauma. The threshold criteria for PTS and recoverable injury has been calculated by Popper *et al*. (2014) to be between 207 and 213 dB re 1 µPa (peak sound pressure levels) depending on the presence or absence of swim bladders, and the threshold criteria for TTS is 186 dB re 1 μPa^2s (cumulative sound exposure level). Given there is no exposure criteria for sharks and rays, the same criteria can be adopted, although sharks and rays do not possess a swim bladder, instead having oil-filled livers.

Most pelagic fish are expected to exhibit avoidance behaviour and swim away when noise reaches levels which may cause physiological effects. Available evidence suggests that behavioural change for some fish species may be no more than a nuisance factor. These behavioural changes are localised and temporary, with displacement of pelagic or migratory fish populations having insignificant repercussions at a population level (McCauley, 1994).

Species Recovery Plans, Conservation Management Plans and Approved Conservation Advice

BHP has considered information contained in recovery plans, conservation management plans and approved conservation advice (refer to previous Table 4-7).

The Recovery Plan for Marine Turtles in Australia (DoEE, 2017) highlights noise interference from anthropogenic activities as a threat to turtles. The Recovery Plan refers to vessel noise and the operation of some oil and gas infrastructure as sources of chronic (continuous) noise in the marine environment, exposure of which may lead to avoidance of important turtle habitat. Five species of turtle may occur within the operational area. Of those, the flatback turtle has an inter-nesting BIA and inter-nesting habitat critical to the survival of the species (all waters within a 60 km radius of nesting on Thevenard Island, the Muiron Islands and Pilbara coast). The Recovery Plan does not list noise pollution as a threat to the Pilbara stock of flatback turtles, but does specify the following priority action: ‘Manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to the survival’.

The operational area also intercepts BIAs for humpback whales (migration) and pygmy blue whales (distribution) (refer to Figure 4-6 and discussed further in Section 4.5.6). The Conservation Management Plan for the Blue Whale (DoE, 2015a) and the Conservation Advice for Humpback Whale (TSSC, 2015c) highlight anthropogenic noise as a threat. The operational area is not within a humpback whale calving, resting, foraging area, or a confined migratory pathway.

Based on the noise levels likely from the well intervention activities, turtles and whales transiting or in the vicinity of the operational area, may avoid the immediate area around the vessel. However underwater noise levels are expected to be localised, with possible effects to turtles and whales limited to, at worst, short-term avoidance behaviour. Infrequent, localised and temporary avoidance of a small area within the operational area will not affect the conservation status of turtles or whales that transit the operational area, or compromise the objectives or recovery actions that form the basis of the Management Plans and Conservation Advice.

Noise emissions are considered to be as low as reasonably practicable whilst vessel navigation/safety and activity requirements. With controls in place, the potential impacts of noise emissions were assessed as low, consistent with the relevant requirements of Conservation Management Plans/Approved Conservation Advice documents and acceptable.

7.5.4 Demonstration of ALARP

A summary of the ALARP process undertaken for the environmental aspect is presented below. This process was completed as outlined in Section 6.1.2 and included consideration of all controls, analysis of the risk reduction proportional to the benefit gained and final acceptance or justification if the control was not considered suitable (refer Table 7-9). The result of this ALARP assessment contributes to the overall acceptability of the impact or risk.

Table 7-9: Noise emissions – ALARP assessment summary

Hierarchy of Control	Control Measure	Accept/ Reject	Reason	Performance Standard
Eliminate	None identified	N/A	N/A	-
Separate	None identified	N/A	N/A	-
Engineer	None identified	N/A	N/A	-
Administrate	Vessel Safety Case requires machinery is certified and maintained.	Accept	Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 7.5.1**
Additional Control Measures Considered				
Substitute	Vessel to use anchors to maintain position rather than DP.	Reject	Would complicate and increase risk of works in proximity to subsea infrastructure. Anchoring will cause seabed disturbance. Given the low risk of impacts associated with underwater noise, and short duration of activity, the increased risks/ impacts outweigh the marginal environmental benefit.	-
	Manage the timing of the activity to avoid sensitive periods (e.g. whale migration, turtle inter-nesting).	Reject	Would reduce the risk of impacts from noise emissions during environmentally sensitive periods. The risks to all listed marine fauna cannot be reduced due to variability in timing of environmentally sensitive periods and unpredictable presence of some species. Given the low risk of impacts associated with underwater noise, and short duration of activity, the financial and environmental costs of managing the timing of the activity to avoid sensitive periods at the location is deemed grossly disproportionate to the low environmental benefit.	-

ALARP Summary

The risk assessment and evaluation has identified control measures that when implemented are considered to manage the impacts and risks of the noise emissions from the LWI activities. The LWI activities cannot occur without the LWI vessel on location, which generates noise. With the appropriate controls outlined here, which are consistent with guidelines and represent international best practice, the risk and impact of noise emitting activities and sources of noise affecting marine fauna is considered to be reduced to ALARP. With no reasonable additional/alternative controls identified that would further reduce the impacts and risks without grossly disproportionate sacrifice, the impacts and risks associated with noise emissions are considered ALARP.

7.5.5 Demonstration of Acceptability

BHP considers a range of factors when determining that a level of impact and risk to the environment is broadly acceptable, as summarised in Table 7-10.

Table 7-10: Demonstration of acceptability for noise emissions

Acceptability Criteria	Acceptability Criteria	Demonstration
Codes and Standards	Is the impact or risk being managed in accordance with relevant Australian or International legislation, Ministerial Conditions or standards?	Impacts and risks associated with noise emissions from the LWI vessel will be managed in accordance with relevant BHP Petroleum Controls.
Ecologically Sustainable Development (ESD)	Is the proposed impact consistent with the principles of ESD?	BHP undertakes petroleum activities in a manner that is consistent with its Charter values and Code of Business Conduct. In determining the level of acceptability of the noise emissions of the LWI vessel in the field, and guided by the Charter value of Sustainability, BHP has identified, assessed and controlled risks associated with this activity to minimise environmental impacts. BHP considers that this approach is consistent with the principles of ESD.
Internal Context		
BHP Charter and HSEC Management System compliance	Is the proposed impact or risk consistent with the requirements of BHP Our Requirements, Petroleum HSE Standard (PET-HSE00-HX-STD-00001) and HSEC Management Systems?	Noise emissions associated with the activity will be in compliance with BHP policies and management systems and will be consistent with activities authorised for areas adjacent to a World Heritage Area (WHA).
Professional judgement	Is the impact or risk being managed in accordance with industry best practice?	Controls identified in this plan are consistent with industry best practice and guidelines. Accepted controls that will be implemented are provided in Table 7-9.
ALARP	Are there any further reasonable and practicable controls that can be implemented to further reduce the impact or risk?	All reasonable and practicable controls have been assessed (Table 7-9), additional controls were considered but were found not to be practicable in further reducing the impacts and risks of noise emissions without a gross disproportionate sacrifice. BHP considers that the residual risk of physical presence has been demonstrated to be ALARP.
External Context		
Environmental best practice	Are controls in place to manage the impacts and risk to the environment that are commensurate with the nature and scale of any environmental sensitivities of the receiving environment?	The environmental performance outcomes, performance standards and measurement criteria that determine whether the outcomes and standards have been achieved are commensurate with the environmental significance (i.e. a WHA) of the receiving environment. The potential risks and impacts are consistent with relevant species recover plans, conservation management plans and published guidelines, including but not limited to: • Recovery Plan for Marine Turtles in Australia 2017-2027

Acceptability Criteria	Acceptability Criteria	Demonstration
		• Conservation Advice for the Humpback Whale • Conservation Management Plan for the Blue Whale
Stakeholder views	Do stakeholders have concerns / issues, and if so, have controls been implemented to manage their concerns / issues?	Stakeholders have been consulted about the petroleum activity (Section 5) and no stakeholder concerns have been raised regarding this aspect.

Acceptability Summary

The impact and risk assessment determined that noise emissions from the LWI vessel represents a low residual risk rating that it unlikely to result in a potential impact greater than minor and temporary disruption to a small proportion of the faunal populations and no impact to biologically important behaviour (e.g. migratory whales or inter-nesting turtles).

Timing of the LWI activities to avoid periods of marine fauna sensitivity (e.g. whale migration and turtle inter-nesting) has been considered. The benefit that may accrue from avoiding periods of peak whale density is considered to be negligible based on the observation that even with all the oil and gas development (and associated vessel movements) occurring in the Exmouth Basin over the last ten years, the humpback whale population (Stock IV) has grown at an estimated 10% per year to the point where IUCN have removed humpback whales from the threatened category. A study by Bejder *et al.* (2015) showed that the population abundance of eastern and western Australian humpback whales has recovered to more than approximately 50% of their pre-whaling abundance. Moreover, these authors go on to argue that based on meeting the eligibility criteria for removing a species from any category in the list of threatened species under the EPBC Act, the available scientific evidence does not support the listing of humpback whale populations on the EPBC Act list of Threatened species. It is therefore considered that the potential cost of additional control of varying the timing of LWI activities to avoid peak whale abundance is a grossly disproportionate effort to the negligible benefit that may accrue.

The behavioural effects that may arise are not considered likely to cause significant effects at the population level, as defined by the EPBC Act Significance Guidelines. The operational area is not known to provide significant feeding or breeding areas for marine mammals, turtles or fish, and consequently will not displace any animals from these critical activities, nor will it cause significant disruption to migratory pathway or population groups. The impact of noise on marine fauna is 'Tolerable' on the basis of insignificant impacts on predicted. Given the control measures in place for the management of noise and the short duration of each activity (up to 14 days), the impacts from noise to marine fauna are considered to be acceptable. In summary, all relevant controls were considered as part of the ALARP assessment, and as no other reasonable additional controls were identified that would further reduce the impacts and risks of noise emissions on marine fauna without a gross disproportionate sacrifice, the impacts and risks are considered ALARP. BHP undertakes regular consultation with relevant stakeholders about its operations/ activities providing them with sufficient and reasonable opportunities to raise any new concerns or issues for the duration of this activity.

BHP is satisfied that when the accepted controls are implemented that the impact and residual risk of noise emissions on marine fauna is considered 'ALARP' and that adherence to the performance standards will manage the impacts and risks of noise emissions on marine fauna to an acceptable level.

7.5.6 Environmental Performance Outcome, Performance Standards and Measurement Criteria

Environmental Performance Outcome	Environmental Performance Standard	Measurement Criteria
No injury or mortality to listed Threatened or Migratory MNES species as a result of noise emissions.	**PS 7.5.1** **Vessel Safety Case:** All engines, compressors and machinery on the vessel are maintained via the PMS.	Pre-start inspection shows maintenance has been satisfactorily completed as scheduled.

7.6 Routine and Non-Routine Atmospheric Emissions

7.6.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Acceptability
Atmospheric emissions	Exhaust emissions from vessel engines and generators, and incinerators on vessel.	Localised and temporary reduction in air quality as a result of greenhouse gas (GHG) emissions, non-GHG emissions, particulates and volatile organic compounds (VOCs).	10	N/A	-	Tolerable
	Venting off hydrocarbon gas (subsea or from vessel) during well intervention.	Localised and temporary reduction in air quality (if vented to atmosphere) or water quality (if vented subsea).	10	N/A	-	Tolerable

7.6.2 Source of Risk

Exhaust Emissions and Incineration

The vessel uses marine diesel oil (MDO) to power vessel engines, generators, mobile and fixed plant and equipment and the incinerator. The combustion of fuel and the incineration of waste on-board the vessel will generate emissions of greenhouse gas (GHG), such as carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and non-GHG such sulphur oxides (SO_x) and nitrous oxides (NO_x), particulate material and volatile organic compounds (VOCs).

Venting of Hydrocarbon Gas

During well intervention activities, hydrocarbon gas may be vented subsea or purged back to the LWI vessel for venting to the atmosphere. The volume estimates provided in Table 7-11 are based on existing or planned pressure measurements and well design. The total volume of vented gas is estimated to be <20 m^3. Gas vented subsea from the XT body cavity prior to removal of the ITC may bubble to the sea surface. Gas purged from the production annulus back to the LWI vessel will be vented to the atmosphere.

Table 7-11: Estimated gas volumes vented

Location of Gas Vent	Gas Volume
XT	<1 m^3
Production annulus	<15 m^3

7.6.3 Environmental Impact Assessment

Atmospheric emissions generated during the LWI activities will result in a localised, temporary reduction in air quality in the environment immediately surrounding the discharge point and a negligible contribution to the greenhouse gas emissions. There is potential for human health effects to workers in the immediate vicinity of the release point and this is considered in the vessels' safety case. The closest residential area is Exmouth located approximately 27 km southeast of the operational area. Gaseous emissions under normal circumstances quickly dissipate into the surrounding atmosphere. The impact of atmospheric emissions on marine environment of the region is insignificant.

7.6.4 Demonstration of ALARP

A summary of the ALARP process undertaken for the environmental aspect is presented below. This process was completed as outlined in Section 6.1.2 and included consideration of all controls, analysis of the risk reduction proportional to the benefit gained and final acceptance or justification if the control was not considered suitable (refer Table 7-12). The result of this ALARP assessment contributes to the overall acceptability of the impact or risk.

Table 7-12: Atmospheric emissions – ALARP assessment summary

Hierarchy of Control	Control Measure	Accept/ Reject	Reason	Performance Standard
Substitute	None identified	N/A	N/A	-
Engineer	Pyrenees wells (of which Crosby-3H1 is one) are managed in accordance with the Well Operations Management Plan, to manage the risk of unplanned hydrocarbon releases.	Accept	Control based on legislative requirements must be accepted. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 7.6.1**
	Venting volumes are limited through standard operating procedure and task covered in approved Vessel Safety Case.	Accept	Control based on legislative and BHP requirements, is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 7.6.2**
Separate	None identified	N/A	N/A	-
Administrate	Vessel will comply with MARPOL 73/78 Annex VI and Marine Order 97 (Marine Pollution Prevention – Air Pollution).	Accept	Control is legislative requirement and would marginally reduce likelihood of impacts and risks to air pollution. The control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 7.6.2**
	Vessel engines and other machinery are maintained as per preventative	Accept	Control is required to evaluate performance requirements. Machinery maintenance is part of normal operations to ensure operating in accordance with manufacturers guidelines. The	**PS 7.6.3**

	maintenance system (PMS) to ensure equipment is operating efficiently.		control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	
Additional Control Measures Considered				
Eliminate	No incineration of waste on the LWI vessel	Reject	With no incineration of waste on-board the vessel, waste would need to be stored and this would have an associated health risk. Given the short duration of the activity and therefore the low usage of the on-board incinerator, the minimal risk of impacts associated the increase in health risks outweigh the minimal environment benefit of no incineration.	-
Eliminate	No venting off of hydrocarbon gas	Reject	The venting of gas is necessary for technical and HSE reasons for release of pressure and therefore cannot be eliminated. Given the short duration of the activity and the low gas vent volumes involved, this control would offer negligible environment benefit.	-

ALARP Summary

The risk assessment and evaluation has identified a range of control measures that when implemented are considered to manage the impacts and risks of atmospheric emissions during the LWI activities to a tolerable level. The activities cannot occur without a vessel, and requires fuel to power the vessel, mobile plant and equipment. Fuel usage during the activities cannot be eliminated. Power generation through the combustion of fossil fuels is essential to power equipment and the vessels. The proposed control measures are consistent with relevant Australian and international maritime regulations, and are consistent with good oilfield practice. With no reasonably practicable additional control measures identified that would provide significant net environmental benefit without grossly disproportionate cost or risk to HSE, it is considered that the impacts and risk of atmospheric emissions have been reduced to ALARP.

7.6.5 Demonstration of Acceptability

BHP considers a range of factors when determining that a level of impact and risk to the environment is broadly acceptable, as summarised in Table 7-13.

Table 7-13: Demonstration of acceptability for atmospheric emissions

Acceptability Criteria	Acceptability Criteria	Demonstration
Codes and Standards	Is the impact or risk being managed in accordance with relevant Australian or International legislation, Ministerial Conditions or standards?	Impacts and risks associated with atmospheric emissions will be managed in accordance with relevant legislation, and codes and standards (e.g. MARPOL and Marine Orders).
Ecologically Sustainable Development (ESD)	Is the proposed impact consistent with the principles of ESD?	BHP undertakes petroleum activities in a manner that is consistent with its Charter values and Code of Business Conduct. In determining the level of acceptability of the light emissions of the LWI vessel in the field, and guided by the Charter value of Sustainability, BHP has identified, assessed and controlled risks associated with this activity to minimise environmental impacts. BHP considers that this approach is consistent with the principles of ESD.

Acceptability Criteria	Acceptability Criteria	Demonstration
Internal Context		
BHP Charter and HSEC Management System compliance	Is the proposed impact or risk consistent with the requirements of BHP Our Requirements, Petroleum HSE Standard (PET-HSE00-HX-STD-00001) and HSEC Management Systems?	Atmospheric emissions associated with the activity will be in compliance with BHP policies and management systems and will be consistent with activities authorised for areas adjacent to a World Heritage Area (WHA).
Professional judgement	Is the impact or risk being managed in accordance with industry best practice?	Controls identified in this plan are consistent with industry best practice and guidelines. Accepted controls that will be implemented are provided in Table 7-12.
ALARP	Are there any further reasonable and practicable controls that can be implemented to further reduce the impact or risk?	All reasonable and practicable controls have been assessed (Table 7-12), additional controls were considered but were found not to be practicable in further reducing the impacts and risks of atmospheric emissions without a gross disproportionate sacrifice. BHP considers that the residual risk of atmospheric emissions has been demonstrated to be ALARP.
External Context		
Environmental best practice	Are controls in place to manage the impacts and risk to the environment that are commensurate with the nature and scale of any environmental sensitivities of the receiving environment?	The environmental performance outcomes, performance standards and measurement criteria that determine whether the outcomes and standards have been achieved are commensurate with the environmental significance (i.e. a WHA) of the receiving environment.
Stakeholder views	Do stakeholders have concerns / issues, and if so, have controls been implemented to manage their concerns / issues?	Stakeholders have been consulted about the petroleum activity (Section 5) and no stakeholder concerns have been raised regarding this aspect.

Acceptability Summary

The impact and risk assessment determined that atmospheric emissions from the LWI vessel represents a low residual risk rating. The LWI activities are located in an area where atmospheric emissions will disperse and rapidly assimilate with the surrounding environment and will not result in a potential impact to the environment or human health of greater than minor.

Atmospheric emissions from hydrocarbon combustion for vessel use in Australian waters are permissible under Marine Order 97 (Marine Pollution Prevention – Air Pollution). BHP is satisfied that when the accepted controls are implemented that the impact and residual risk of atmospheric emissions to the environment is considered 'ALARP'. Furthermore, the adopted controls are considered to be consistent with good oilfield practice/ professional judgement and environmental best practice. The atmospheric emissions associated with vessels will comply with all relevant laws, codes and standards, as well as BHP Charter and HSEC Management Systems. All relevant controls were considered as part of the ALARP assessment, and no other reasonable additional controls were identified that would further reduce the impacts and risks of atmospheric emissions without a gross disproportionate sacrifice.

BHP is satisfied that when the accepted controls are implemented that the impacts and residual risk of atmospheric emissions are considered 'ALARP' and that adherence to the performance standards will manage the impacts and risks of atmospheric emissions to an acceptable level.

7.6.6 Environmental Performance Outcome, Performance Standards and Measurement Criteria

<table>
<tr><th>Environmental Performance Outcome</th><th>Environmental Performance Standard</th><th>Measurement Criteria</th></tr>
<tr><td rowspan="2">No unplanned gas emissions as a result of venting from the well.</td><td>PS 7.6.1
Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations, 2011: Accepted Well Operations Management Plan (WOMP) (PYAIMS-PS-0005); Pyrenees Well Integrity Management System (PYAIMS-PS-0005-0002):
Pyrenees wells, of which Crosby-3H1 is one, are managed in accordance with approved WOMP, which includes well integrity management to prevent the risk of unplanned hydrocarbon releases.</td><td>Acceptance letter from NOPSEMA demonstrated WOMP Accepted by regulatory prior to commencement of well intervention activities.</td></tr>
<tr><td>PS 7.6.2
Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations: Accepted Vessel Safety Case:
Venting gas volumes are limited through standard operating procedure and task covered in approved Vessel Safety Case.</td><td>Audit/ vessel inspection records demonstrate standard operating procedure for venting off of hydrocarbon gas volumes and task covered in approved Vessel Safety Case.</td></tr>
<tr><td rowspan="4">Fuel combustion emissions and incineration will be in compliance with MARPOL 73/78 Annex VI and Marine Order requirements to restrict emissions to those necessary to perform the activities.</td><td rowspan="3">PS 7.6.3
Annex VI of MARPOL 73/78 and Marine Order 97 (Marine Pollution Prevention – Air Pollution (as applicable to vessel class), detailing requirements for:
• Current International Air Pollution Prevention (IAPP) Certificate, as appropriate to vessel class.
• Use of low sulphur fuel.
• Equipment containing ozone-depleting substances (ODS) shall be maintained and, in the case of a vessel having rechargeable systems containing ODS, an ODS Record Book shall be maintained on board.
• No discharge of ODS.</td><td>Records demonstrate vessel has a valid International Air Pollution Prevention Certificate (IAPP).</td></tr>
<tr><td>Fuel delivery receipts indicates only low sulphur fuel.</td></tr>
<tr><td>An ODS Record Book (where applicable) is current and maintained.</td></tr>
<tr><td>PS 7.6.4
Contractor has PMS to ensure all engines and power generation equipment, compressors and machinery on the vessel are maintained.</td><td>Pre-start inspection shows maintenance has been satisfactorily completed as scheduled on PMS.</td></tr>
</table>

7.7 Routine and Non-Routine Discharges

7.7.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Acceptability
Routine vessel discharges	Routine planned discharge of sewage, grey water, putrescible (food), desalination brine, cooling water, and deck and bilge water to the marine environment from the LWI vessel.	Localised and temporary reduction in water quality adjacent to the discharge point associated with minor increases in nutrients, salinity, temperature and oily water/ chemical residues.	10	N/A	-	Tolerable
Routine and non-routine discharges during LWI activities	Discharge of control fluids or other chemicals such as hydraulic fluids and greases (and well kill brine as contingency).	Localised and temporary reduction in water quality adjacent to the discharge point associated with hydrocarbon and chemical contaminants causing adverse toxicity effects.	10	N/A	-	Tolerable

7.7.2 Source of Risk

Routine Vessel Discharges

During the activity, the LWI vessel will generate and routinely discharge to the marine environment treated sewage, grey water, putrescible (food) wastes and desalination brine, cooling water, bilge water and deck drainage.

Sewage, Grey Water and Food Waste

The volume of sewage, grey water and food wastes generated by the vessel is directly proportional to the number of persons on-board the vessel. The total volume of sewage and grey water generated by the vessel (if fully manned) is estimated to be in the order of 2 m^3 per day and 30 m^3 per day respectively. Food waste generated is typically 1 L per person per day. This scale of discharge falls within the scope of the Environment Plan Reference Case – Planned Discharge of Sewage, Putrescible Waste and Grey Water (National Energy Resources Australia, 2017).

Desalination Brine Reject from Reverse Osmosis

Potable water is produced on-board the vessel using reverse osmosis (RO) machinery. RO is a membrane-technology filtration method that removes salt molecules and ions from seawater by applying pressure to the solution when it is on one side of a selective membrane. The result is that a brine solution with salinity elevated by approximately 10% is retained on the pressurised side of the membrane and the potable water is allowed to pass to the other side.

Cooling Water

Seawater is used as a heat exchange medium for the cooling of machinery engines on some vessels; others use air cooling. Seawater is pumped on board the vessel, passes through heat exchangers and is subsequently discharged from the vessel with temperature elevation in the order of 2 to 5°C. Seawater used for cooling is dosed with chlorine following intake and discharged with low residual chlorine concentrations that are rapidly diluted by prevailing water currents.

Deck Drainage

No wastes contaminated with hydrocarbons or chemicals will be routinely discharged from the vessel deck drains. Drainage from areas of a high risk of hydrocarbon or chemical contamination will be managed to ensure that it has an oil content of less than 15 ppm prior to overboard discharge or sent to shore for disposal.

Rainfall and wash down of the decks may result in minor quantities of chemical residues, such as detergent, oil and grease entering the deck drainage system and being possibly discharged overboard.

Routine and Non-Routine Discharges During Well Intervention Activities

During the LWI activities there are the following planned discharges to the marine environment of various control fluids and chemicals such as hydraulic fluids and grease, calcium wash, and well kill brine (as contingency).

Subsea Control Fluids

Subsea valves are controlled hydraulically using fluid under pressure to adjust the position of the valve. The operation and testing (opening and closing) of valves on the XT and SID will result in the release of hydraulic control fluids. Volumes released to the marine environment are estimated to be small (<10 ml per valve). Hydraulic fluids are used extensively in the petroleum industry and an industry-standard water-based blend with additives.

Grease

Standard operation of the SID will lead to small volumes of non-toxic grease being released to the environment from grease injection head.

Marine Growth Removal from XT

Marine growth removal from the subsea XT may require the use of calcium wash chemicals (scale dissolvers) to aid in the removal of encrusted calcareous marine growth from connectors on the wellhead.

7.7.3 Environmental Impact Assessment

Routine Vessel Discharges

Sewage, Grey Water and Food Waste

The potential impacts associated with sewage, grey water and food waste discharges from vessels are discussed in detail in the Environment Plan Reference Case (National Energy Resources Australia, 2017).

The impacts and risks from routine discharges are considered to fall within the scope of this description since:

- The volume and types of discharge are consistent with the Reference Case limitations;
- The discharges will not affect a (State or Commonwealth) marine reserve or occur within 3 nm of a World Heritage Property, National Heritage Place, Wetland of International Importance or the Great Barrier Reef Marine Park; and
- The discharges are not inconsistent with management documentation for any EPBC Act listed threatened or migratory species.

Studies of moving vessels have shown very high dispersion rates for effluents (Loerh *et al*., 2006). Given the small discharge volumes, the short duration of activity and the open water location, the potential environmental impact and risk from routine vessel discharges is considered to be low.

These discharges will be quickly dispersed and diluted such that any temporary change in water quality will be limited to the vicinity of the discharge point for a very short time. The operational area is located more than 12 nm from land, which is beyond the distance required by Marine Order 96 (Marine Pollution Prevention – Sewage) 2009 and Marine Order 95 (Marine Pollution Prevention – Garbage) 2013 at which untreated sewage may be discharged.

Brine Reject from Reverse Osmosis

The brine solution will be quickly dispersed and diluted to undetectable levels within a few metres of the discharge point. Given the relatively low volume of discharge, the relatively low increase in salinity and the open ocean environment, the discharge of desalination brine stream is considered to have an insignificant environmental effect.

Cooling Water

When discharged to sea the cooling water will be subject to turbulent mixing and loss of heat to the surrounding waters. The area of detectable increase in seawater temperature is likely to be less than 10 m radius. The impact of cooling water discharge is considered to be insignificant.

Deck Drainage

Due to the small volumes of deck drainage, the very low levels of contaminants likely to be entrained in the discharge and the rapid dilution and dispersal that will result in the open ocean, the environmental effects will be temporary and localised. The discharge of deck drainage is considered to have a negligible environmental effect.

Routine and Non-Routine Discharges During Well Intervention Activities

Subsea Control Fluids and Grease

The release of small volumes of control fluids and grease will result in a temporary and localised reduction in water quality through contamination of the water column in the vicinity of the release source point, resulting in potential adverse toxicity effect to marine biota. Given the low volumes discharged and the limited number of release events, the potential impacts are expected to be very localised with only a slight impact on the marine environment due to rapid dilution.

Marine Growth Removal from XT

The calcium wash chemicals to be used are biodegradable and readily disperse in seawater. The release of calcium wash chemicals will result in a temporary and localised reduction in water quality through contamination of the water column in the vicinity of the release source point, resulting in potential adverse toxicity effect to marine biota. Given the volumes discharged, the potential impacts are expected to be very localised with only a slight impact on the marine environment due to rapid dilution.

Summary

Threatened or Migratory Fauna and Local Fauna

As discussed in the sections above, all planned discharges will have a limited discharge extent localised to the area around the source point, with rapid dilution occurring due to the deep waters, the offshore ocean environment and the volumes of discharges involved. Reduction in water quality will be limited to the operational area with potential adverse effects to marine biota as a result of chemical toxicity.

The operational area overlaps with BIAs for humpback whales, pygmy blue whales, and flatback turtles and as such these species may be encountered within the operational area. Marine fauna within the operational area are likely to be transient, however they may be affected if they come in direct contact with a release (i.e. by passing through the immediate discharge area). If contact does occur with any marine fauna, it will be for a short duration due to rapid dispersion, such that exposure time may not be of sufficient duration to cause a toxic effect. Given the small volumes of discharges, the water depth of release and the rapid dilution, the likelihood of ecological impacts to these marine fauna is considered to be highly unlikely.

BHP has considered information contained in recovery plans, approved conservation advice and threat abatement plans published by the DoEE. The Recovery Plan for Marine Turtles in Australia (DoEE, 2017) identifies chemical discharge as a relevant threat to marine turtles. The proposed activity is not inconsistent with recovery plan for marine turtles, as impacts and risks associated with planned discharges were considered in the Environmental Risk Assessment, and a range of control measures were identified and adopted that align with the intent of the recovery plan, as detailed below.

Protected and Significant Areas

The operational area does not intersect any Commonwealth or State marine parks or KEFs.

Socio-Economic Receptors

No impacts to commercial or recreational fisheries are expected.

7.7.4 Demonstration of ALARP

A summary of the ALARP process undertaken for the environmental aspect is presented below. This process was completed as outlined in Section 6.1.2 and included consideration of all controls, analysis of the risk reduction proportional to the benefit gained and final acceptance or justification if the control was not considered suitable (refer Table 7-14). The result of this ALARP Assessment contributes to the overall acceptability of the impact or risk.

Table 7-14: Routine vessel discharges – ALARP assessment summary

Hierarchy of Control	Control Measure	Accept/ Reject	Reason	Performance Standard
Substitute	None identified	N/A	N/A	-
Engineer	Sewage treatment and discharge equipment on-board to treat sewage and reduce impact to the environment and maintained in good working order.	Accept	Controls based on legislative requirements must be accepted. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice	**PS 7.7.1**
Separate	None identified	N/A	N/A	-
Administrate	Vessel will comply with the MARPOL 73/78 Annex I, IV and V, and Marine Orders (as appropriate to vessel class): Marine Order 91 (Oil). Marine Order 95 (Garbage) Marine Order 96 (Sewage)	Accept	Controls based on legislative requirements must be accepted. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 7.7.2**
	Environmental awareness induction provided to all vessel crew to advise of waste management requirements.	Accept	Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 7.7.3**
	Deck cleaning products planned to be release to sea from the vessel meet the criteria for not being harmful to the marine environment according to MARPOL Annex II.	Accept	Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 7.7.4**
	Chemical selection and assessment process	Accept	All chemicals are reviewed and approved through BHP Hazardous Materials Procedure to ensure suitable for discharge overboard.	**PS 7.7.5**

Hierarchy of Control	Control Measure	Accept/ Reject	Reason	Performance Standard
			Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	
Additional Control Measures Considered				
Eliminate	Wastes stored on-board and transferred to shore for onshore treatment and disposal	Reject	Health and safety risks associated with the storage of wastes on-board. Owing to the short duration of the activity, transfers not practicable and increase the risk of spills/ leaks and risk to personnel during transfer operations. Additional costs involved in transfers disproportionate to the environmental benefit gained given the rapid dilution in offshore waters and low potential impact from discharges.	-

ALARP Summary

The risk assessment and evaluation has identified a range of control measures that when implemented are considered to manage the impacts and risks of planned and routine discharges from the LWI vessel during the activity. The on-board treatment of liquid wastes and their discharge to the marine environment are consistent with the EP Reference Case (National Energy Resources Australia, 2017), all relevant codes and standards and are considered to be the most environmentally sound method of disposal compared to on-board storage and transport back to shore for disposal at suitable waste facilities. With the implementation of appropriate management controls and with no other additional controls or alternatives available that would offer a net environmental benefit, it is considered that the impacts and risk of vessel discharges to the marine environment have been reduced to ALARP.

7.7.5 Demonstration of Acceptability

BHP considers a range of factors when determining that a level of impact and risk to the environment is broadly acceptable, as summarised in Table 7-15.

Table 7-15: Demonstration of acceptability for routine vessel discharges

Acceptability Criteria	Acceptability Criteria	Demonstration
Codes and Standards	Is the impact or risk being managed in accordance with relevant Australian or International legislation, Ministerial Conditions or standards?	Impacts and risks associated with routine vessel discharges will be managed in accordance with relevant legislation (e.g. *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*), and codes and standards (e.g. MARPOL, Marine Orders).
Ecologically Sustainable Development (ESD)	Is the proposed impact consistent with the principles of ESD?	BHP undertakes petroleum activities in a manner that is consistent with its Charter values and Code of Business Conduct. In determining the level of acceptability of the routine vessel discharges of the LWI vessel in the field, and guided by the Charter value of Sustainability, BHP has identified, assessed and controlled risks associated with this activity to minimise environmental impacts. BHP considers that this approach is consistent with the principles of ESD.
Internal Context		
BHP Charter and HSEC	Is the proposed impact or risk consistent with the requirements of BHP Our Requirements,	Routine vessel discharges associated with the activity will be in compliance with BHP policies

Acceptability Criteria	Acceptability Criteria	Demonstration
Management System compliance	Petroleum HSE Standard (PET-HSE00-HX-STD-00001) and HSEC Management Systems?	and management systems and will be consistent with activities authorised for areas adjacent to a World Heritage Area (WHA).
Professional judgement	Is the impact or risk being managed in accordance with industry best practice?	Controls identified in this plan are consistent with industry best practice and guidelines. Accepted controls that will be implemented are provided in Table 7-14.
ALARP	Are there any further reasonable and practicable controls that can be implemented to further reduce the impact or risk?	All reasonable and practicable controls have been assessed (Table 7-14), additional controls were considered but were found not to be practicable in further reducing the impacts and risks of routine vessel discharges without a gross disproportionate sacrifice. BHP considers that the residual risk of routine vessel discharges has been demonstrated to be ALARP.
External Context		
Environmental best practice	Are controls in place to manage the impacts and risk to the environment that are commensurate with the nature and scale of any environmental sensitivities of the receiving environment?	The environmental performance outcomes, performance standards and measurement criteria that determine whether the outcomes and standards have been achieved are commensurate with the environmental significance (i.e. a WHA) of the receiving environment.
Stakeholder views	Do stakeholders have concerns / issues, and if so, have controls been implemented to manage their concerns / issues?	Stakeholders have been consulted about the petroleum activity. Stakeholder concerns have been considered for routine vessel discharges, and no additional controls have been identified.

Acceptability Summary

The acceptability of the treated sewage, grey water and macerated food waste discharges that will be generated during the LWI activities is described in the Reference Case (National Energy Resources Australia, 2017).

For the other vessel discharges, including brine, cooling water, oily water and deck drainage, consideration has been given to the potential cumulative effects of different liquid discharges from multiple sources. The environmental impacts associated with these planned discharges during the LWI activities are considered to have a negligible impact on the marine environment.

BHP is satisfied that when the accepted control measure are implemented that the impact and residual risk of planned of these discharges to the environment is considered ALARP. Furthermore, the adopted control measures are considered to be consistent with good oilfield practice/ professional judgement and environmental best practice. Vessel discharges will comply with all relevant laws, codes and standards, as well as the BHP Charter and HSEC Management Systems. All relevant controls were considered as part of the ALARP assessment, and as no other reasonably practicable additional controls were identified that would further reduce the impacts and risks of vessel discharges without a grossly disproportionate sacrifice; the impacts and risks are therefore considered reduced to ALARP. BHP undertakes petroleum activities in a manner that is consistent with the APPEA Principles of Conduct and hence the principles of ESD. Stakeholders have been consulted about the LWI activities and no concerns regarding this aspect have been raised. BHP undertakes regular consultation with relevant stakeholders about its operations/ activities providing them with sufficient and reasonable opportunities to raise any new concerns or issues for the duration of this activity. On this basis, it is considered that impacts and risks of vessel discharges will be managed to an acceptable level.

7.7.6 Environmental Performance Outcome, Performance Standards and Measurement Criteria

Environmental Performance Outcome	Environmental Performance Standard	Measurement Criteria
Routine vessel discharges are in accordance with Marine Orders	**PS 7.7.1** **Vessel will comply with MARPOL 73/78 Annex I, IV and V, and Marine Orders, as appropriate to vessel class:** Marine Order 91 (Pollution Prevention – Oil) Marine Order 95 (Pollution Prevention – Garbage) Marine Order 96 (Pollution Prevention – Sewage)	Waste records maintained in compliant Garbage Record Book or manifests, including transport, treatment, recycling and disposal.
		Audit and inspection records show waste is managed in accordance with MARPOL Annex V and Marine Order 95.
		Current IOPP certificate in place for vessel in accordance with Marine Order 91.
		Oil Record Book is in place in accordance with Marine Order 91.
		Records demonstrate vessel has valid International Sewage Pollution Prevention (ISPP) Certificate in accordance with MARPOL Annex IV and Marine Order 96.
	PS 7.7.2 Environmental awareness induction provided to all vessel crew to advise of waste management requirements.	Induction attendance records demonstrate that environmental awareness inductions have been conducted for vessel crew, including waste management information.
	PS 7.7.3 Deck cleaning products planned to be released to sea from the vessel meet the criteria for not being harmful to the marine environment according to MARPOL Annex II	Audit and inspection records show deck cleaning products meet MARPOL Annex II requirements.
Planned subsea discharges are ALARP and acceptable	**PS 7.7.4** **BHP Hazardous Materials Acquisition Environmental Supplement (AO-HSE S-0002):** Where Offshore Chemical Notification Scheme (OCNS) rating of D or E or a CHARM rating of Silver or Gold rated chemicals intended for liquid discharge are used, no further control required. If other non-rated chemicals intended for liquid discharge are used, chemical selection procedures described in Hazardous Materials Acquisition Environmental Supplement (AO-HSE S-0002) will be followed.	Documentation showing that chemicals discharged to the marine environment are ranked D or better on OCNS ranked list or Silver or better on CHARM rating.
		Where chemicals are to be discharged to the marine environment are not D/ E rated through OCNS or Gold/ Silver rated through CHARM, then documented evidence to show that Hazardous Material Procedure has been followed.

7.8 Waste Management

7.7.7 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Acceptability
Waste management	Waste (hazardous and non-hazardous) generated during vessel activities	Increase waste to landfill. Additional usage of onshore waste reception facilities	10	N/A	-	Tolerable

7.8.1 Source of Risk

Offshore vessels produce a variety of solid wastes, including domestic and industrial wastes. These include aluminium cans, bottles, paper and cardboard, scrap steel, chemical containers, batteries, and medical wastes. These materials could potentially impact the marine environment if discharged in significant quantities.

Waste is segregated on-board the LWI vessel and stored in designated skips and waste containers. Wastes are segregated into the following categories:

- Non-hazardous waste (or general waste);
- Hazardous waste; and
- Recyclables (further segregation is conducted in line with practices at existing BHP operations in the region).

Non-Hazardous Waste

General non-hazardous waste include general domestic and galley waste and recyclables such as scrap materials, packaging, wood and paper and empty containers. Volumes of non-hazardous waste generated on the vessels are generally low.

Hazardous Waste

Hazardous wastes are defined those wastes that are or contain ingredients harmful to health or the environment. Hazardous wastes likely to be generated on-board the vessel includes oil contaminated materials (e.g. sorbents, filters and rags), chemical containers and batteries. The volumes of hazardous wastes generated are relatively small.

7.8.2 Environmental Impact Assessment

Improper management of wastes may result in pollution and contamination of the environment. There is also the potential for secondary impacts (ingestion and/ or entanglement) on marine fauna that may interact with wastes such as packaging and binding materials, should these enter the ocean.

All waste (hazardous and non-hazardous) generated during the well intervention activities will be transported to and managed appropriately by third parties. Environmental impacts associated with onshore disposal relate to the small incremental increase in waste volumes received at the onshore licensed waste recycling and/or disposal sites. The environmental impacts associated with waste disposal onshore are anticipated to be low because of the minor quantities involved and recycling of some materials.

Accidental loss overboard of single items or units of waste may impact the environment through a reduction in water quality, or present a hazard to marine fauna, depending on the waste involved. Given the small volumes of waste generated and the management in place to prevent loss overboard (e.g. covers on skips/bins), the risk of impact is considered to be low. No significant environmental impacts are anticipated because of the minor quantities involved and the localised area of impact.

7.8.3 Demonstration of ALARP

A summary of the ALARP process undertaken for the environmental aspect is presented below. This process was completed as outlined in Section 6.1.2 and included consideration of all controls, analysis of the risk reduction proportional to the benefit gained and final acceptance or justification if the control was not considered suitable (refer Table 7-16). The result of this ALARP Assessment contributes to the overall acceptability of the impact or risk.

Table 7-16: Waste management – ALARP assessment summary

Hierarchy of Control	Control Measure	Accept/ Reject	Reason	Performance Standard
Eliminate	None identified	N/A	N/A	-
Substitute	None identified	N/A	N/A	-
Engineer	None identified	N/A	N/A	-
Separate	Consider the waste management hierarchy to eliminate, reduce, recycle or reuse in lieu of disposal in the management plan.	Accept	Controls based on legislative requirements must be accepted. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 7.8.1**
Administrate	Develop and implement a waste management plan for managing waste generation, transport and disposal.	Accept	Controls based on legislative requirements must be accepted. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 7.8.1**
	Vessel will comply with the MARPOL 73/78 Annex III and V, and Marine Orders (as appropriate to vessel class): Marine Order 94 (Packaged Harmful Substances). Marine Order 95 (Garbage)	Accept	Controls based on legislative requirements must be accepted. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 7.8.1**
Additional Control Measures Considered				
None identified.				

ALARP Summary

The risk assessment and evaluation has identified a range of control measures that when implemented are considered to manage the impacts and risks of waste management on the LWI vessel during the activity. The generation of solid hazardous and non-hazardous waste is unavoidable. No additional or alternative management procedures have been identified that would reduce the environmental impacts and risks associated with waste management, as such it is considered reduced to ALARP.

7.8.4 Demonstration of Acceptability

BHP considers a range of factors when determining that a level of impact and risk to the environment is broadly acceptable, as summarised in Table 7-17.

Table 7-17: Demonstration of acceptability for waste management

Acceptability Criteria	Acceptability Criteria	Demonstration
Codes and Standards	Is the impact or risk being managed in accordance with relevant Australian or International legislation, Ministerial Conditions or standards?	Impacts and risks associated with waste management will be managed in accordance with relevant legislation (e.g. *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*), and codes and standards (e.g. MARPOL, Marine Orders).
Ecologically Sustainable Development (ESD)	Is the proposed impact consistent with the principles of ESD?	BHP undertakes petroleum activities in a manner that is consistent with its Charter values and Code of Business Conduct. In determining the level of acceptability of waste management, and guided by the Charter value of Sustainability, BHP has identified, assessed and controlled risks associated with this activity to minimise environmental impacts. BHP considers that this approach is consistent with the principles of ESD.
Internal Context		
BHP Charter and HSEC Management System compliance	Is the proposed impact or risk consistent with the requirements of BHP Our Requirements, Petroleum HSE Standard (PET-HSE00-HX-STD-00001) and HSEC Management Systems?	The management of solid waste will be in compliance with BHP policies and management systems and will be consistent with activities authorised for areas adjacent to a World Heritage Area (WHA).
Professional judgement	Is the impact or risk being managed in accordance with industry best practice?	Controls identified in this plan are consistent with industry best practice and guidelines. Accepted controls that will be implemented are provided in Table 7-17.
ALARP	Are there any further reasonable and practicable controls that can be implemented to further reduce the impact or risk?	All reasonable and practicable controls have been assessed (Table 7-17), additional controls were considered but were found not to be practicable in further reducing the impacts and risks of waste management without a gross disproportionate sacrifice. BHP considers that the residual risk of routine vessel discharges has been demonstrated to be ALARP.
External Context		
Environmental best practice	Are controls in place to manage the impacts and risk to the environment that are commensurate with the nature and scale of any environmental sensitivities of the receiving environment?	The environmental performance outcomes, performance standards and measurement criteria that determine whether the outcomes and standards have been achieved are commensurate with the environmental significance (i.e. a WHA) of the receiving environment.
Stakeholder views	Do stakeholders have concerns / issues, and if so, have controls been implemented to manage their concerns / issues?	Stakeholders have been consulted about the petroleum activity (Section 5) and no stakeholder concerns have been raised regarding this aspect.

Acceptability Summary

The disposal of hazardous and non-hazardous solid waste occurs onshore in full accordance with all regulatory requirements. BHP has procedures in place for verifying contractors' management of waste and the storage of wastes on-board vessels and for onshore disposal by waste removal contractors. BHP is satisfied that when the accepted controls are implemented that the impact and residual risk of solid waste management to the environment is considered ALARP. Furthermore, the adopted controls are considered to be consistent with good oilfield practice/ professional judgement and environmental best practice.

The management of solid waste will comply with all relevant laws, codes and standards, as well as BHP Charter and HSEC Management Systems. All relevant controls were considered as part of the ALARP assessment, and as no additional controls were identified, the impacts and risks of solid waste are considered reduced to ALARP.

BHP undertakes petroleum activities in a manner that is consistent with the APPEA Principles of Conduct and hence the principles of ESD. Stakeholders have been consulted about the LWI activities and no concerns regarding this aspect have been raised. BHP undertakes regular consultation with relevant stakeholders about its operations/ activities providing them with sufficient and reasonable opportunities to raise any new concerns or issues for the duration of this activity. On this basis, it is considered that impacts and risks associated with waste management will be managed to an acceptable level.

7.8.5 Environmental Performance Outcome, Performance Standards and Measurement Criteria

Environmental Performance Outcome	Environmental Performance Standard	Measurement Criteria
No unplanned release of hazardous and non-hazardous solid waste to the marine environment. **Waste is managed in accordance with legislate requirements and Vessel Waste Management Plan.**	**PS 7.8.1** **Vessel will comply with MARPOL 73/78 Annex III and V, and the following Marine Orders, as appropriate to vessel class:** Marine Order 94 (Pollution Prevention – Packaged Harmful Substances) Marine Order 95 (Pollution Prevention – Garbage)	Waste records maintained in compliant Garbage Record Book or manifests, including transport, treatment, recycling and disposal.
		Audit and inspection records show waste is managed in accordance with MARPOL 73/78 Annex III and V, and Marine Orders 94 and 95 (as appropriate to vessel class).

8 Environmental Assessment: Unplanned Events

This Section of the EP presents the environmental impact and risk assessment and environmental performance outcomes, environmental performance standards and measurement criteria for the vessel-based LWI activities based on the methodology described in Section 6.

8.1 Risk Assessment and Evaluation

The purpose of this Section is to address the requirements of Regulations 13(5), 13(6) and 13(7) by providing an assessment and evaluation of all the identified risks and impacts associated with the petroleum activity and associated control measures that will be applied to reduce the impacts and risks to ALARP and an acceptable level.

The environmental aspects and sources of risk identified during the ENVID process were divided into planned activities (i.e. routine operations) and unplanned (i.e. incidents) events. Section 7 presents the impact and risk assessment for the planned activities. The seven unplanned events identified are presented below and Table 8-1 provides a summary of the events/risks, environmental aspects affected and the risk assessment and evaluation that are discussed in the following sections.

Table 8-1: Summary of the environmental risk and impact analysis for unplanned events

EP Section	Aspect	Value Potentially at Risk / Impact										Risk Assessment & Evaluation			
		Environmental							Socio-Economic						
Unplanned Events		Marine Sediment	Water Quality	Air Quality	Ecosystems / Habitat	Marine Species	Marine Protected Areas	Key Ecological Feature	Commercial Fisheries	Shipping Activities	Tourism and Recreation	Severity Factor	Likelihood Factor	Residual Risk	Acceptability
8.3	**Hydrocarbon release – Loss of well containment**														
	Hydrocarbon release due to loss of well pressure integrity management		x		x	x	x	x	x	x	x	100	0.03	3	Tolerable
8.4	**Hydrocarbon release – Loss of flowline inventory**														
	Dropped object on flowlines resulting in subsea release of hydrocarbons		x			x						10	0.03	0.3	Tolerable
8.5	**Hydrocarbon release – Vessel collision**														
	Vessel collision resulting in surface release of MDO		x		x	x	x	x	x	x	x	30	0.03	0.9	Tolerable
8.6	**Unplanned discharges – Chemicals and Minor Hydrocarbon Spills**														
	Minor spills/ leaks of chemicals and hydrocarbons		x			x						10	0.1	1	Tolerable
8.7	**Unplanned discharges – Solids**														
	Dropped solid objects overboard from vessel	x	x			x						10	0.1	1	Tolerable
8.8	**Marine fauna interaction**														
	Vessel interactions/ strike with marine fauna					x						10	0.03	0.3	Tolerable
8.9	**Introduction of invasive marine species**														
	Biofouling of vessel and submersible equipment, or through ballast water exchange					x						100	0.03	3	Tolerable

8.2 Worst-Case Spill Scenarios

8.2.1 Scenario Context

Several unplanned events may occur during the well intervention activities, resulting in the potential for large-scale releases of hydrocarbons (i.e. incidents or emergencies). Worst-case credible spill scenarios were identified through the environmental impact and risk assessment process and a series of workshops. The following scenarios were identified:

- Subsea release of hydrocarbons from the Crosby-3H1 production well; and
- Subsea release of hydrocarbons from a flowline resulting from a dropped object; and
- Surface release of marine diesel oil (MDO) from a vessel collision.

Table 8-2 presents the worst-case hydrocarbon spill scenarios identified. Each of these scenarios is discussed further in this Section, along with non-credible scenarios that were discounted.

Table 8-2: Summary of worst-case hydrocarbon spill scenarios

Scenario	Hydrocarbon Type	Worst-case Maximum Spill Volume	Comment	Oil Spill Modelling?	EP Section
Subsea release of crude oil from a loss of containment from the Crosby-3H1 well.	Crosby crude	Crude: 1,930 m^3 (Gas: 2.058 MMscf) over 21 days	Maximum credible volume modelled with highest flow potential based on horizontal lateral 2 (L2) open to flow.	Yes	8.3
Subsea release of crude oil from subsea flowline due to rupture from dropped object.	Ravensworth crude	204 m^3 over 1 hour	Maximum credible volume based on loss of inventory of flowline	No	8.4
Surface release of MDO from fuel tank rupture on LWI vessel due to vessel collision.	Marine diesel oil	186 m^3 over 1 hour	Maximum credible volume based on largest fuel tank capacity on LWI vessel.	Yes	8.5

Loss of Containment – Crude Oil

A 'Loss of Containment' workshop was held on 23 January 2020 to identify the scenarios that could result in a subsea hydrocarbon release to the marine environment during well intervention. The workshop included BHP representatives from Drilling, Subsea, Production Engineering, Projects and HSE departments, and LWI vessel contractor subject matter experts. The workshop covered the following:

- Overview of:
  - The production equipment and current status of the Crosby-3H1 well.
  - Proposed LWI vessel and subsea intervention equipment to be used.
  - Operational steps of the work scope being undertaken.
- A detailed review of each operational step, using barriers diagrams to show the established barriers, and to understand the potential means for a loss of containment.
- An evaluation of the potential scenarios that could lead to a loss of containment for each of the operational steps, and if a release was possible, the relative size of any release.

- Further identification if any scenario was considered credible given the location and preventative and mitigative control measures that would be in place through industry, BHP and vessel contractor standards and practices.
- The steps that would be taken to halt the release and an expected timeline to implement those steps.

The workshop did not risk assess the scenarios. In addition, the establishment of the well barriers from production and initial cleaning of the well were not included in the assessment as no removal of barriers or well intervention will have taken place at that point.

Loss of Containment during Intervention

Reservoir modelling by BHP has demonstrated that the Crosby-3H1 well cannot sustain flow with both laterals open (i.e. prior to installation of the plug). This is because at expected reservoir conditions (pressure, water cut), the lower lateral (L1) is unable to flow against the hydrostatic backpressure without gas lift. The higher pressure L1 over pressures the upper lateral (L2), such that with both laterals open, the well is unable to flow due to the high hydrostatic back pressure in the well. The upper lateral (L2) intersects a marginally lower pressure part of the reservoir, with significantly lower water content, which results in a lower hydrostatic backpressure, and capacity to flow without gas lift.

The workshop ascertained that the worst-case scenario that could result in a subsea hydrocarbon (crude oil) release to the marine environment during well intervention was during wireline operations, and the wireline/slickline breaks or is released/pulled from the toolstring weak-point. This may occur if the tooling becomes stuck downhole (from restrictions or debris), or through operator error when recovering the toolstring into the subsea lubricator. This would most likely occur at restrictions in the well including surface controlled subsurface safety valve (SCSSV), the multi-lateral junction, XT and SID during running of plugs. Any hydrocarbon release would only occur after the plug is installed (with L1 isolated), and there were issues with the establishment of available barriers through:

- Loss of surface control systems resulting in operational failure of the rams and gate valve on the SID; and
- The ROV is unable to launch to close the rams and gate valve on the SID; and
- The SCSSV flapper or SID rams fail to close and seal due to wire obstruction.

If all identified barriers were inoperable or failed, then the check valve in the subsea lubricator would be exposed to wellbore fluids and its failure to check would then open the well to the environment through 0.32" bore above the check valve during E-line operations or 0.12" during slickline operations. The resulting release from the 0.32" bore would be 92 m^3/day (578 bbl/day) of crude oil and 0.098 MMscf/day of gas (Table 8-2 and Table 8-4). The exposure period for potential continuous flow from the reservoir is from installation of the plug (approximately 2 days into the well intervention campaign). The Crosby reservoir is normally, or slightly under pressured and coupled with the highly restrictive nature of the smaller 0.12" orifice means the well would be unable to support continuous flow. Crosby reservoir fluids have a high saturation pressure, which will result in a gas column forming in the tubing above a small oil column. This column will equilibrate to reservoir pressure, building a pressure at the SID higher than the seawater hydrostatic and thus result in a low rate intermittent gas leak.

In summary, a sustained release requires all of the following:

- The lower lateral (L1) to be isolated (i.e. the plug has been installed); AND
- Wire/cable to be broken or pulled from weak-point; AND
- Inability to close the SID BOP rams and gate valve (through obstruction of the toolstring/wire, or loss of controls system, or ROV is unable to launch); AND
- The SCSSV flapper or SID rams fail to close (through obstruction by the toolstring/wire); AND
- The check valve in the subsea lubricator (designed to arrest flow if wire ejected) fails to check.

The impact and risk assessment for this scenario is presented in Section 8.3.

Loss of Containment – Flowline Inventory

During the well intervention activities, the LWI vessel will be operating in the proximity of operationally active subsea infrastructure. Consequently, there is the potential for a dropped object (during lifting) or loss of control of a suspended load to land onto subsea infrastructure and result in damage to (severing/ rupture) to a production flowline or production jumper leading to a subsea release of hydrocarbons (crude oil).

The amount released will be the volume of the flowline/jumper between established barriers on the well. Established barriers on the SID or the XT would not be affected by the dropped object due to their relative potential (i.e. not exposed).

The impact and risk assessment for this scenario is presented in Section 8.4.

Loss of Containment – MDO

During the well intervention activities, the physical presence of the LWI vessel on location presents a collision risk with other passing vessels. The worst-case scenario is a collision resulting in a rupture of the LWI vessel fuel tank causing the release of MDO to the marine environment. A vessel collision could occur due to poor weather, human error or vessel navigation/ equipment failure. Based on a review of the LWI vessel fuel tank plan, the worst-case maximum credible volume of MDO that could be released to the marine environment is conservatively estimated to be 186 m^3.

The impact and risk assessment for this scenario is presented in Section 8.5.

Non-Credible Scenarios

A number of scenarios were considered by BHP during the Loss of Containment Workshop but determined non-credible; these are detailed below. Note: BHP's Loss of Containment Workshop evaluated the potential scenarios that could lead to a loss of containment for each of the operational steps in well intervention, and if a release was possible. The workshop assessment (BHP, 2020b) provides the complete list of scenarios evaluated; those described below relate to potential scenarios that occur only after the plug/straddle was installed (with L1 isolated).

Loss of Containment – Flow through the 2.06" Outlet on Lower SID

During standard wireline operations, a loss of containment through the 2.06" outlet on the lower SID was not considered a credible scenario due to the failure mode requiring following:

- A dropped object causing damage to the 2" outlet pipe. This is not credible as the 2" outlet pipe and the flange are protected within the substantial framework structure of the lower SID.
- Failure of the 2 1/6" API flange or pipework through a material failure or damaged caused during assembly. This is not credible given the history of design, QA management systems and application, along with the pressure testing regime onshore and offshore (before and during deployment).

Other ports that enter the SID body were also considered and discounted based on similar rationale.

Loss of Containment – Venting Residual Gas From XT

After establishing on the Crosby-3H1 well and testing the SID, any trapped pressure in the area beneath the internal tree cap (ITC) and above the tubing hanger is vented via a tree cap test (TCT) line through controls umbilical to remove residual gas from gas lift operations and to allow removal of crown plug in the internal tree cap (ITC). During venting, a failure in the dedicated umbilical line has the potential for a small volume of residual gas/hydrocarbons present within the tree cavity to be released to the marine environment.

This scenario occurs when the SID has been established onto the well with all relevant barriers tested, and the usual production well barriers are still in place, being the ITC, tubing hanger plugs and annulus master valve and wing valve. It should be noted that at this point, BHP's reservoir modelling demonstrates with the plug/straddle not installed in L1, any failure of the systems described would not produce a continuous flow from the well.

8.2.2 Discharge Duration – Loss of Well Containment

As mentioned previously above, one of the aims of the Loss of Well Containment Workshop was to identify the steps that would be taken to halt the release of a worst-case discharge from a loss of well containment and to ascertain an expected timeline to implement those steps. It is important to understand the discharge durations of the multiple options available prior to arriving at the final conservative period of 21 days being required to stem flow, as this information is used in the oil spill modelling (Section 8.2.3).

The estimated times described in Table 8-2 were initially discussed and agreed during the workshop and affirmed with follow-up review as required. The scenarios were separated into two distinct options:

- the LWI vessel is still operable and available for intervention directly to address the situation, or
- the LWI vessel is unavailable and mobilisation of a second vessel with ROV capability is required to address the situation.

Use of the LWI vessel was further separated with consideration given to whether it remained connected to the well via the SID or it had moved away and would need to re-establish fluid communication paths to the well via either the SID or through the gas lift annulus.

Being still connected to the SID offers several short-term options with high chance of success. Priority of methods to use will be detailed in well control procedures:

1. Closure of the SCSSV can be initiated immediately through venting of control pressure maintaining it open – whilst not classed as a full barrier this would, as a minimum, significantly reduce flow if unobstructed.
2. Kill well through bullheading of fluids into reservoir via the already established well service line circulation path. This would involve pumping kill weight fluid as per detailed well kill procedures.
3. Pressure retaining cap: The Loss of Well Containment Workshop identified the most likely point of release on the SID as being the ball check valve in the wireline mandrel/GIH should wire be removed/ejected. In line with capping the well through direct mechanical methods, a specially designed and tested cap will be available on the vessel to be deployed with ROV and placed over the mandrel and locked in place. This will stem any leak emanating from the wireline mandrel/GIH.
4. Kill well through bullheading of fluids into reservoir via an alternative access point, should access through the well service line be unavailable or ineffective. A 2" bore flexible downline will be deployed from the vessel, and connected to the SID establishing new fluid access points to the well:
   - Through an ROV mateable stab into a permanently plumbed 2" hard line and valving on the lower SID, with two alternative flanged access points into the SID and wellbore.
   - Connection of an additional flying lead from the SID pipework into the gas lift line on the production flow base of the well, accessing the wellbore via the crossover valve in the XT or directly into the production annulus.
5. Closure of wireline rams or gate valve through ROV override, should the rams not operate under the normal hydraulic functionality.

These are all classified as short-term solutions, taking half a day or less with high chance of success. This estimated time is based on steps being very closely related to standard operations and with contingency procedures in place.

One final option considered with the LWI vessel still operable and connected to the well is via the tree cap test (TCT) line. This is accessed through the umbilical and XT controls pipework via a small diameter bore which enters the annulus side of the XT. The longer duration involved with this well kill route is due to the low pump rates achievable given bore size.

The longest durations to halt any continuous flow were calculated in the workshop to be 14 and 21 days (Table 8-2).

The 14-day duration considers the requirement to mobilise a second vessel to the field, including the fitting of an ROV along with a launch and recovery system, on the assumption that the existing LWI vessel is incapacitated and unable to assist with operations. Drawing on previous experience where vessels have been mobilised with similar capability for infield work, BHP considers 14 days is conservative. This initial mobilisation would comprise equipment necessary to manipulate manifold, XT and SID valves to allow the well to be killed via the production flowline from the FPSO.

The 21-day duration accounts for similar vessel mobilisation as above with a further 7 days added to account for additional mobilisation of equipment to allow access directly onto the well to perform well kill using the same access points as detailed above in bullet 4.

This worst-case discharge duration of 21 days to halt the continuous flow from the well is considered highly conservative due to the quantity of barriers and control measures that must fail to initiate the ultimate control measure. Further information on '*Source Control – Well Intervention*' is provided in Section 9.4.1 and the Crosby-3H1 OPEP (Appendix G).

Table 8-3: Worst-case schedule to gain well control based on implementation of control measures

Control Measures			Time to Implement
Response Owner	**Scenario**	**Control Measure**	
LWI Vessel Response	LWI vessel operable	Close Surface Controlled Subsurface Safety Valve (SCSSV): Halt flow from well through venting pressure from control line on vessel to enable SCSSV close.	Immediate
	LWI vessel operable	Kill well (by bullheading): Halt flow from well by pumping well kill fluid through the well service lines via two entry points on the SID to displace existing well fluids with well kill fluid.	0.25 days
	LWI vessel operable	Kill well (by installation of pressure retaining cap): Halt flow from well by installation of a specifically designed pressure retaining cap to upper section of SID lubricator.	0.25 days
	LWI vessel operable	Kill well (by bullheading via vessel deployment of 2" flexible line): Halt flow from well by pumping well kill fluid from the vessel via access line mounted onto lower SID and accessed from a 2" flexible line deployed from the vessel with two access points to the well: • Via 2" well service line in the lower SID connecting to the well bore at bottom of SID. • Via gas lift line on production flowbase - The same 2" well service line can be diverted via additional pipework on the SID and a flexible jumper to the gas lift line on the production flowbase.	0.5 days
	LWI vessel operable	Kill Well (by annulus kill): Halt flow from well by pumping well kill fluid from the vessel via well access from the annulus side of XT through the small bore tree cap test (TCT) line.	1.5 days
	LWI vessel operable, but has drifted off location (approx. <50 m)	Close Valves (ROV deployment): Halt flow from well through vessel deployment of ROV to close valves on SID.	0.5 days
FPSO Response (*Pyrenees Venture*)	LWI vessel inoperable	Kill well (via FPSO): Halt flow from well by pumping well kill fluid from the FPSO via production flowline. This requires deployment of an alternative vessel with ROV capability to control the XT.	14 days
Alternate Vessel	LWI vessel inoperable	Kill well (via alternate vessel): Halt flow from the well through deployment of alternative vessel with ROV capability to kill the well (same sequence as steps above initiated by vessel above, with the exception of Steps 2 and 5).	**21 days**
Other Alternative Control Measures			
• Multiple access points for well kill will allow options should access be blocked.			

8.2.3 Oil Spill Modelling Overview

Spill modelling was carried out using SINTEF's Oil Spill Contingency and Response (OSCAR) System (Version 11.0.1). OSCAR is a system of integrated models that quantitatively assess the fate and transport of hydrocarbons in the marine environment, as well as evaluate the efficacy of response measures (Reed *et al.*, 2001; Reed *et al.*, 2004).

OSCAR provides an integrated hydrocarbon transport and weathering model that accounts for hydrocarbon advection, dispersion, surface spreading, entrainment, dissolution, biodegradation, emulsification, volatilisation and shoreline interaction.

Three-dimensional (3D) OSCAR modelling was undertaken in stochastic mode (total of 120 realisations per scenario) with start dates spaced approximately fortnightly over a five year period. Inputs into the model were sourced from HYCOM (regional ocean currents, temperature and salinity profiles), TPXO7.2 (tidal currents) and NCEP/NCAR (regional winds).

OSCAR enables simulation of a hydrocarbon release scenario in deterministic mode (i.e. a scenario is simulated with one start date with spatial results available at fixed time intervals over the duration of the simulation) or stochastic mode (i.e. a scenario is simulated a number of times with varying start dates, and the results are outputted spatially in a probabilistic manner).

Table 8-4 provides the details on the model input specifications for the modelled scenarios.

Table 8-4: Model input specifications

Parameter	Subsea Crude Spill (well)	Surface MDO Spill
Location	Crosby-3H1 well at: 114°05' 42.504" E 21°32' 43.063" S	
Depth of spill (m)	167 [1]	Sea surface
Total depth at location (m)	197	197
Hydrocarbon type	Crosby crude oil	Marine diesel oil
Liquid release volume	1,930 m^3	186 m^3
Liquid release rate	91.9 m^3/day	-
Gas release volume	58,275 sm^3 (2.058 MMscf)	-
Gas release rate	0.098 MMscf/day	-
Release duration	21 days	Instantaneous
Number of realisations (runs)	120	
Timing of release risk period	All months	

Note 1: Water depth based on release point on SID

Weathering Modelling

Modelling for both the MDO spill and the loss of containment scenarios, included a preliminary analysis of the hydrocarbon weathering using the SINTEF Oil Weathering Model. The model predicts the weathering (i.e. mass balance partitioning) of hydrocarbons under steady-state metocean conditions. Weathering simulations were run for constant wind speeds of 1 m/s (low winds), 5 m/s (moderate winds) and 10 m/s (high winds). The simulations were based on a test case of 100 m^3 of hydrocarbon release instantaneously onto the sea surface.

Deterministic Modelling

OSCAR enables simulation of a hydrocarbon release scenario in deterministic mode (i.e. a scenario is simulated with one start date with spatial results available at fixed time intervals over the duration of the simulation). OSCAR also includes functionality for simulating the effectiveness of response measures such as dispersant application.

For the subsea crude oil spill scenario, the 120 stochastic realisations were evaluated for the following criteria in order to select individual realisations for more detailed deterministic modelling:

- Greatest accumulation of oil on shorelines above 100 g/m^2
- Minimum arrival time of oil to shorelines above 100 g/m^2
- Maximum length of oiled shoreline above 100 g/m^2

Three stochastic realisations were selected to run in OSCAR's deterministic mode to characterise shoreline loading and the mass balance of the released oil in the marine environment (e.g. proportion of released oil lost to decay or volatilisation, remaining as droplets).

In addition, the realisation with the highest accumulated shoreline mass of oil above the moderate threshold (100 g/m^2) was selected run in deterministic mode with the inclusion of a subsea dispersant injection (SSDI) plan. For this scenario, SSDI involves injecting dispersant into the flow via a pre-existing line that connects the LWI vessel and the SID. The model was set to commence SSDI 4 hours after the start of the subsea crude release, to allow for decision-making and approvals to implement, with an application rate of 1:100 (1 part dispersant to 100 parts liquid crude) and a dispersant efficacy of 75%. In addition, the deterministic realisation was run for a 2-day release duration, which is considered to be a more likely timeframe for halting the release (refer to previous Section 8.2.2 and Table 8-3). The 2-day release duration assumes the same daily release rate of crude oil as the 21-day release scenario, but reduces the total volume of oil released down to 183.8 m^3). Dispersant application was set to be continuous from hour 4 until the end of week 2 (for the 21-day release scenario) or the end of day 2 (for the 2-day release scenario). To determine the fate of the oil, the model was set to run for 56 days in total i.e. a further 35 days following the 21-day release scenario, and a further 54 days following the 2-day release scenario.

SSDI is configured in OSCAR by reducing the oil-water interfacial tension parameter, which has the effect of causing the liquid oil to break up into smaller droplets during release. The oil-water interfacial tension was reduced by half for oil treated by SSDI (i.e. for 75% of the oil), on the basis of advice provided by SINTEF (GHD, 2020).

8.2.4 Hydrocarbon Properties

Generally, the crude oil produced from the Pyrenees reservoirs (Crosby, Ravensworth, Stickle, Tanglehead Wild Bull [upper Pyrenees] and Moondyne) has very similar properties, which is a heavy crude (API 19) with some dissolved methane (25 to 30%). There are very small quantities of lighter hydrocarbons and no hydrogen sulphide (H_2S) within the well streams. However, there is minor potential for reservoir souring to occur over time as produced formation water injection volumes increase. Up to 2.2% CO_2 is present in the well streams. All of the Pyrenees crude oils can be classified as Group III oils under the International Tanker Owners Pollution Federation (ITOPF) classification system, with the Moondyne crude assessed as the most persistent. Data collected on the well fluids suggest the reservoir hydrocarbons were expelled from mature sediments that were deposited under sub-oxic (probably marine) conditions.

Table 8-5 and Table 8-6 provides summary of characteristics for the hydrocarbons relevant to the worst-case spill scenarios identified. Selection of appropriate hydrocarbon analogues were selected from the SINTEF Oil Library that provides the best match to the specified hydrocarbons.

Properties of Crude Oil

BHP provided GHD with the laboratory report for Pyrenees crude, which is a similar oil to Crosby crude, and was used to further inform the selection of a hydrocarbon analogue to represent the crude oil for spill modelling purposes.

Martin Linge Crude 13C was selected from SINTEF's oil library as the crude analogue. A comparison of the whole oil properties for Crosby crude, Pyrenees crude and SINTEF's *Martin Linge Crude 13C* (Table 8-5) indicates a close match between the three crude oil. While the asphaltene content of *Martin Linge Crude 13C* is lower than Crosby crude, the approximate three-fold higher wax content is compensatory for this aspect.

Direct comparisons of the viscosity are not possible because of the large variation in measurement temperatures across the oils. However, the key thing to note is the difference in temperatures at which the viscosity measurements are recorded. Crude oils can vary in viscosity significantly as the temperature changes (i.e. high temperature = low viscosity, and vice versa). The reference temperature for SINTEF's *Martin Linge Crude 13C* is quite cold (13ºC), whereas the Crosby crude and Pyrenees crude reference temperatures are warm (63ºC and 40ºC respectively), so large viscosity differences would be expected.

A comparison of the distillation curves of *Martin Linge Crude 13C* and Pyrenees crude (note, no distillation data are available for Crosby crude) are presented in Figure 8-1. The distillation curve is derived from laboratory tests to determine the percentage of hydrocarbon evaporated (recovered) when heated to various temperatures (or 'cuts'). Lighter oil components evaporate under lower temperatures, whereas heavier oil components have a greater tendency to remain in liquid state, requiring higher temperatures to evaporate. This is analogous to oil weathering in the marine environment, whereby lighter components have a higher tendency to evaporate, dissolve or decay, and heavier components tend to persist as liquid hydrocarbon for extended durations. The distillation curve therefore provides a reasonable prediction of the relative proportions of hydrocarbon components that will have rapid rates of weathering and the relative proportions that will persist. The comparison of the distillation curves of *Martin Linge Crude 13C* and Pyrenees crude indicates excellent agreement, which suggests similar weathering patterns are likely occur in the marine environment. Further, as Pyrenees is a similar oil to Crosby Crude, *Martin Linge Crude 13C* is considered an appropriate analogue for use in the oil spill modelling.

Table 8-5: Crosby crude, Pyrenees crude oil and SINTEF's *Martin Linge Crude 13C* properties

Parameter	Crosby Crude Oil [1]	Pyrenees Crude Oil [2]	SINTEF: *Martin Linge Crude 13C*
API Gravity	19.42	19.3	20.73
Wax Content (%)	0.2	0.5	0.66
Pour Point (ºC)	<-24	-30	-36
Asphaltene (%)	0.2	0.5	0.11
Specific Gravity	0.9376	0.9384	0.93
Viscosity (cP)	19 @ 63ºC	59.13 @ 40ºC	294@ 13ºC

Note 1: Data from Core Laboratories (2003)

Note 2: Data from Intertek (2011)

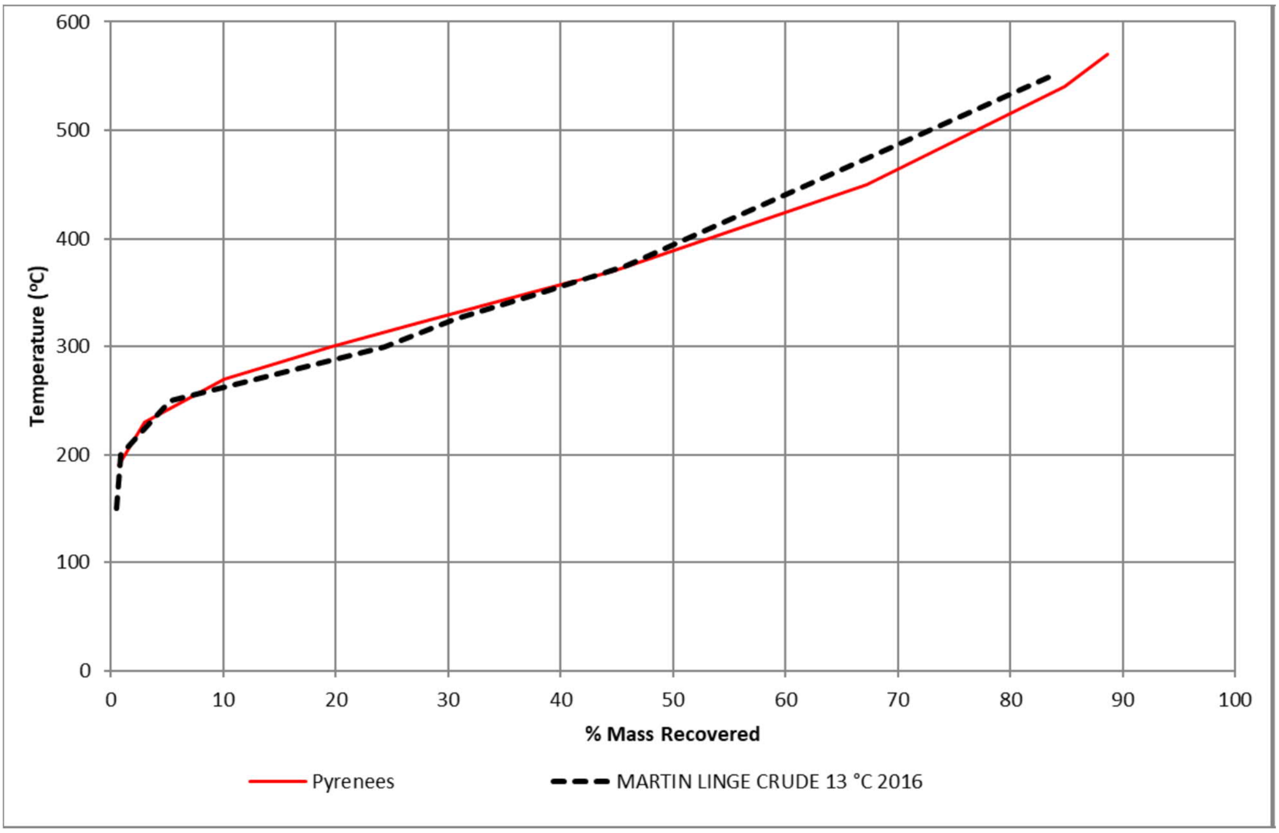


Figure 8-1: Comparison of the boiling point curves for Pyrenees crude and the SINTEF's crude analogue (*Martin Linge Crude 13C*)

Properties of Marine Diesel Oil

Marine diesel is a moderate eight, moderately persistent oil in the marine environment. The International Tanker Owners Pollution Federation (ITOPF) and the Australian Maritime Safety Authority (AMSA) (2015) categorise diesel as a moderate group III hydrocarbon. For the MDO spill modelling, *Marine Diesel (IKU)* was selected from the SINTEF oil library to represent MDO. A summary of the marine diesel oil properties is provided in Table 8-6.

Table 8-6: Marine diesel oil properties

Parameter	Marine Diesel Oil (data from SINTEF's *Marine Diesel IKU*)
API Gravity	0.843
Wax Content (%)	0.05
Pour Point (ºC)	-36
Asphaltene (%)	0.05
Specific Gravity	36.4
Viscosity (cP)	3.9 @ 20ºC

8.2.5 Hydrocarbon Exposure Values

As described in Section 4.1, the spatial extent of the EMBA has been derived using stochastic hydrocarbon fate and transport modelling of the worst-case hydrocarbons spills. To present this large amount of simulated data in a meaningful way and to inform the impact and risk assessment and environmental management actions, appropriate hydrocarbon exposure values were applied to each of the hydrocarbon components. NOPSEMA recommends the selection of hydrocarbon exposure values that broadly reflect the range of consequences that could occur at various concentrations (NOPSEMA, 2019).

The crude spill EMBA shown in Figure 4-1 was defined using low exposure values (Table 8-9). These low exposure values may not be ecologically significant but they are adequate for identifying the full range of environmental receptors that might be contacted by hydrocarbons (NOPSEMA, 2019). In this EP, the EMBA defined by the low exposure values, was used to run the protected matters searches (Section 4.5).

To inform the impact and risk assessment, exposure values that may be representative of biological impact were identified. These are called ‘moderate’ and ‘high’ exposure values (Table 8-9). The moderate and high exposure values were modelled to identify receptors contacted and therefore potentially impacted in the event of the worst-case spill scenarios identified.

Table 8-7: Summary of exposure values applied in the hydrocarbon spill modelling

Exposure Type / Exposure Value		Description
Surface (floating) hydrocarbons	1 g/m^2	***Low:*** It is recognised that 1 g/m^2 represents the practical limit of observing hydrocarbon sheens in the marine environment. This exposure value is below the levels that would cause ecological impacts, but is considered relevant to approximate the area of effect to socio-economic receptors. This exposure value has been used to define the spatial extent of the environment that may be affected (EMBA) from surface hydrocarbons; and used to describe environmental sensitivities within the EMBA.
	10 g/m^2	***Moderate:*** This value is considered appropriate to assess ecological impact risk, as it is the estimate for the minimum thickness of oil that will result in harm to seabirds through ingestion from preening of contaminated feathers, or the loss of thermal protection of their feathers. This has been estimated by different researches at 10-25 g/m^2 (Koops *et al.*, 2004; French, 2009). Furthermore, based on literature reviews on aquatic birds and marine mammals (Engelhardt, 1983; Clark, 1984; Geraci and St. Aubin, 1988; and Jenssen, 1994), the exposure value for harmful impacts is 10 g/m^2. This exposure value is used to determine the risk of exposure that can cause adverse impact to turtles, sea snakes, marine mammals and seabirds (NRDAMCME, 1996). Therefore, the threshold of 10 g/m^2 was selected as a reasonable and conservative value to apply to the risk evaluation with respect to surface oil.
	50 g/m^2	***High:*** This high exposure value for surface oil is above the minimum threshold observed to cause ecological effect. At this concentration surface slicks would be clearly visible on the sea surface.
Shoreline (accumulated) hydrocarbons	10 g/m^2	***Low:*** This low exposure value defines the area for potential socio-economic impacts (e.g. reduction in aesthetic value of the area). This exposure value has been used to define the spatial extent of the environment that may be affected (EMBA) from shoreline hydrocarbons; and used to describe environmental sensitivities within the EMBA.
	100 g/m^2	***Moderate:*** The concentration for exposure to hydrocarbons stranded on shorelines is derived from levels likely to cause adverse impacts to intertidal habitats and associated fauna. Studies have reported oil thicknesses of 0.1 mm (100 g/m^2) as the lethal exposure values for benthic epifaunal invertebrates on intertidal habitats (rock, artificial, or man-made) and in intertidal sediments (mud, silt, sand and gravel) (French-McCay *et al.*, 2003; French-McCay *et al.*, 2004; French-McCay, 2009). It is also the impact threshold assumed for oiling of birds (French-McCay *et al.*, 2004). This exposure value has been used to inform the risk evaluation with respect to accumulated hydrocarbons and the threshold for shoreline response, based on possible clean-up options.
	1,000 g/m^2	***High:*** This low exposure value predicts area likely to require intensive clean-up effort.
Total submerged hydrocarbons (entrained plus dissolved)	10 ppb	***Low:*** Total submerged hydrocarbons, also referred to as 'total water-accommodated fraction' or entrained hydrocarbons, encompass oil droplets in the water column. Much of the published scientific literature does not provide sufficient information to determine if toxicity is caused by the dissolved or the entrained hydrocarbon component, but rather the toxicity of total submerged hydrocarbons. Variation in the methodology of the water-accommodated fraction may account for much of the observed wide variation in reported threshold values, which also depend on the test organism, duration of exposure, oil type and the initial oil concentration. Total oil toxicity acute effects of total oil as LC50 for molluscs range from 500 to 2,000 ppb. A wider range of LC50 values have been reported for species of crustacea and fish from 100 to

Exposure Type / Exposure Value		Description
		258,000,000 ppb (Gulec *et al*., 1997; Gulec and Holdway, 2000; Clark *et al*., 2001) and 45 to 465,000,000 ppb (Gulec and Holdway, 2000; Barron *et al*., 2004) respectively. The 10 ppb exposure value represents the very lowest concentration and corresponds with the lowest trigger levels for total hydrocarbons in water recommended in the ANZECC water quality guidelines for Australia (ANZECC, 2000). This exposure value has been used to define the spatial extent of the environment that may be affected (EMBA) from total submerged hydrocarbons; and used to describe environmental sensitivities within the EMBA.
	100 ppb	***Moderate:*** This exposure value is considered conservative in terms of potential sub-lethal impacts to most species and lethal impacts to sensitive species based on literature for toxicity testing as described above. This exposure value has been used to inform the risk evaluation with respect to total submerged hydrocarbons.
Dissolved hydrocarbons	10 ppb	***Low:*** A large number of studies have been published describing the toxicities of hydrocarbons. The common theme in findings it that the observed toxicity of crude and refined hydrocarbons is primarily attributable to volatile and water-soluble aromatic hydrocarbons (monocyclic aromatic hydrocarbons (MAHs), naphthalenes and phenanthrenes) and polycyclic aromatic hydrocarbons (PAH) of higher molecular weight. Toxicity to aquatic organisms increases with time of exposure, such that organisms may be unaffected by brief exposures (acute) to the same concentration that is lethal at longer exposures (chronic). Data from French-McCay (2002 and 2003) showed that species sensitivity (fish and invertebrates) to dissolved aromatics exposure greater than 4 days (96-hour LC50) under different environmental conditions varied from 6 to 400 ppb with an average of 50 ppb. This exposure value has been used to define the spatial extent of the environment that may be affected (EMBA) from dissolved hydrocarbons; and used to describe environmental sensitivities within the EMBA.
	50 ppb	***Moderate:*** This exposure value approximates toxic effects, particularly sub-lethal effects to sensitive species (NOPSEMA, 2019). French-McCay (2002) indicates that an average 96-hour LC50 of around 50 ppb could serve as an acute lethal threshold. For most marine organisms, a concentration of between 50 and 400 ppb is considered to be more appropriate for risk evaluation. The exposure value for dissolved hydrocarbons has been established with reference to ecotoxicological testing and hydrocarbon chemical analysis undertaken by BHP, on Pyrenees crude oil. Toxicity tests of Pyrenees crude were undertaken on a broad range of taxa of ecological relevance for which accepted standard test protocols are well-established. These ecotoxicology tests are mainly focused on the early life stages of test organisms, when organisms are typically at their most sensitive to hydrocarbons. The toxicity tests were conducted on eight mainly tropical species, representatives from five major taxonomic groups and four trophic levels. The results indicated that Pyrenees crude weathered for 24 hours, was slightly more toxic than the unweathered crude. A derived 95% species protection trigger value of unweathered Pyrenees crude was 94 ppb and 21.44 ppb for weathered Pyrenees crude (Jacobs, 2015). Based on the results, an average exposure value of 50 ppb is considered appropriate for the risk evaluation with respect to dissolved hydrocarbons.
	400 ppb	***High:*** This exposure value approximates toxic effects including lethal effects to sensitive species (NOPSEMA, 2019).

8.2.6 Potential Impacts of Hydrocarbons

To help inform the hydrocarbon spill impact and risk assessment, a summary of potential impacts to the environmental values, sensitivities and receptors within the EMBA from exposure to hydrocarbons is provided in Table 8-8; this information is drawn upon within the hydrocarbon risk assessment for each release scenario.

Table 8-8: A summary of potential impacts to environmental values, sensitivities and receptors within the EMBA from exposure to hydrocarbons

Receptor	Impacts of hydrocarbon on sensitive receptors at the moderate exposure values
At the moderate exposure values, spill modelling predicts (refer to Section 8.3.2 for full description): • ***Surface (floating) hydrocarbons (10 g/m^2) are predicted to travel ~10 km from the release site*** • ***Total submerged hydrocarbons (100 ppb) are predicted to travel <120 km of the release site*** • ***Shoreline accumulated hydrocarbons (100 g/m^2) are predicted to travel <180 km from the release site*** ***No predicted exceedances of dissolved hydrocarbons (50 ppm).***	
Marine fauna	
Plankton (including phyto/ zooplankton, larvae, fish eggs)	The effects of hydrocarbons on plankton have been well studied in controlled laboratory and field situations. The different life stages of a species often show widely different tolerances and reactions to oil pollution (Harrison, 1999). Usually the eggs, larval and juvenile stages will be more susceptible than the adults. Surface and entrained oil could impact fish eggs and larvae due to entrainment in surface slicks. However, fish eggs and larvae are highly dispersive and are carried significant distances by ocean currents. Any impacts to fish eggs and larvae are not anticipated to significantly impact on fish populations. Post-spill studies on plankton populations are few, but those that have been done have shown either no effects or temporary minor effects (Kunhold, 1978). The prime reason put forward to explain the lack of observed effects is that many marine species produce very large numbers of eggs and larval stages to overcome natural losses (such as through predation by other animals; adverse hydrographical and climatic conditions; or failure to find a suitable habitat and adequate food). Therefore, it is unlikely that any localised losses of eggs or larvae caused by a single oil spill event in the open ocean, would have no discernible effect on the size or health of future adult populations in the area. A possible exception to this would be if the oil spill were to coincide with, and be transported to, a mass synchronous spawning event, such as that which is known to occur for corals over a four to five-day period in March/April (Simpson, 1985). Lethal and sub-lethal effects of water-accommodated fractions of oils have been reported for coral gametes at much lesser concentrations than predicted for adult colonies (Simpson *et al*., 1993; Heyward *et al*., 1994; Harrison, 1999; Epstein *et al*., 2000). Recently spawned gametes and larvae may be especially vulnerable to oil spill effects since they are generally positively buoyant and would be exposed to surface slicks. The potential consequences of this vulnerability, in the unlikely event of a worst-possible release event occurring, would be mitigated by the very large numbers of eggs and larvae released (as discussed above).
Fish, sharks and rays (including commercial species)	Near the sea surface, fish are likely to able to detect and avoid contact with surface slicks and as a result, fish mortalities rarely occur in open waters from floating oils (Scholz *et al*., 1992; Kennish, 1997). Pelagic fish species are therefore generally not highly susceptible to impacts from hydrocarbon spills. Demersal fish species living and feeding on or near the seabed in deeper waters are not likely to be affected by surface and entrained oil in open waters. Likewise, most reef fish are expected to occur at water depths significant enough to be unaffected by surface oil; whereas reef fish in shallow waters (<10 m) and sheltered embayments are at greatest risk from surface oil (Law *et al*., 2011), particularly if they are territorial and unlikely to leave their habitat. Within the moderate exposure value area of the EMBA, the shallower intertidal reef areas around the Ningaloo Reef and Muiron Islands are considered to include fish habitats most sensitive to surface oil. Potential direct impacts may include gill contamination, enlarged livers, fin erosion, metabolic stress, reduced production survival of eggs and larvae and reduced survival and growth of recruits (Giari *et al*., 2012; Theodorakis *et al*., 2012). Potential impacts to pelagic fish species include smothering and coating of gills and epidermal areas by suspended oil droplets that could potentially lead to reduction in oxygen exchange efficiency, irritation and infection. Fish may also ingest entrained oil or contaminated food leading to physiological impacts. The toxicity of dispersed hydrocarbons to fish species has been the subject of a large number of laboratory studies. In general, fish mortalities

Receptor	Impacts of hydrocarbon on sensitive receptors at the moderate exposure values
	and/or ecosystem level impacts are rarely observed following oil spills, as for example, evidenced by the lack of any shifts in species composition or abundance of coastal fishes following the Deepwater Horizon spill in the Gulf of Mexico (Fodrie and Heck, 2011). There are various possible explanations for a buffering of effects of surface oil exposure including fish mobility, avoidance behaviour and/or foraging ecology (Peterson *et al*., 1996, Edgar *et al*., 2003). Exposure to dissolved hydrocarbons from crude oil may delay embryo development in some fish potentially prolonging their susceptibility to mechanical damage as well as increased levels of mortality (Carls and Thedinga, 2010). While fish, sharks and rays do not generally break the sea surface, individuals may feed near the surface for short periods. The probability of prolonged exposure to a surface slick by fish, shark and ray species is low. Whale sharks have a broad distribution in tropical and warm temperate seas. In Australian waters, they are known to aggregate at Ningaloo Reef and in the Coral Sea. The whale shark is a migratory fish and only visits Australian waters seasonally. Within the moderate exposure value area of the EMBA, whale sharks are common within the waters adjacent to the Ningaloo Marine Park during their spring and autumn distribution. Whale sharks feed on plankton, krill and fish bait near or on the water surface and they are often observed swimming near the surface during seasonal aggregations, evidence from tracking studies undertaken at the Ningaloo Marine Park and at other international locations indicate that whale sharks can dive to great depths (~700 metres) and that they can remain away from the surface for long periods. As such, it is possible that they may come into direct contact with surface oil or hydrocarbons in the water column during their known aggregation around Ningaloo coast.
Marine mammals	Marine mammals (whales, dolphins and dugongs) come to the sea surface to breathe air. They are therefore theoretically vulnerable to exposure to oil spill impacts caused by contact with hydrocarbons at the sea surface. Whales and dolphins are smooth-skinned, hairless mammals so oil tends not to stick to their skin and since they do not rely on fur for insulation, they will not be as sensitive to the physical effects of oiling. Small doses of oil have been shown to cause acute fatal pneumonia in mammals when aspirated. Studies on effects of petroleum vapours on terrestrial mammals and seals showed (in cases of prolonged exposures and high concentrations) absorption of hydrocarbons in organs and other tissues, and damage to the brain and central nervous system. However, short-term inhalation of petroleum vapours at concentrations similar to those found in oceanic oil spills may not be necessarily detrimental either in terms of structural tissue damage or respiratory gas exchange. Ingested oil, particularly the lighter fractions, can be toxic to marine mammals. Ingested oil can remain within the gastro-intestinal tract and be absorbed into the bloodstream and thus irritate and/or destroy epithelial cells in the stomach and intestine. Dispersed oil is unlikely to cause any effect to marine mammals due to the low toxicity of dispersed oils, low period of exposure that could occur and the low dosage of oil that may be received. The way whales and dolphins consume their food may well affect the likelihood of their ingesting oil. Baleen whales (such as humpback whales), which skim the surface, are more likely to ingest oil than toothed whales, which are ‘gulp feeders’ (Etkin, 1997). Spilled oil may also foul the baleen fibres of baleen whales, thereby impairing food-gathering efficiency or resulting in the ingestion of oil or oil-contaminated prey. Baleen whales may therefore be vulnerable to oil if feeding. Weathered oil residues from an oil spill event may persist for long periods, causing a potential risk to baleen whales’ feeding systems. It should be noted that adult humpback whales, which are seasonally present and relatively abundant in the region, are not thought to be feeding during their migration through the region. The most common whale species in the North West Shelf region is the humpback whale (*Megaptera novaeangliae*) which migrates through the region, during their movement along the Western Australian coast. Humpback whale migration in this region is characterised by three directional phases, these are: • Northbound phase – starts June, peaks July and tapers off by early August; • Transitional phase (peak numbers expected at this time) – occurring late August and early September; and • Southbound phase – occurring early August until the end of November (this phase is segmented by 2-3 week delay in appearance of peak numbers of cow/calf pods after the main migratory body has passed).

Receptor	Impacts of hydrocarbon on sensitive receptors at the moderate exposure values
	The moderate exposure value area of the EMBA extends over known migratory paths for the humpback whale and the pygmy blue whale. In the northwest region, the pygmy blue whale migrates along the 500 m to 1,000 m depth contour on the edge of the continental slope. The northbound component of this migration takes place from May to mid-August, with a peak in July-August, and the southbound component occurs from late October to November December, with a few isolated individuals moving south in January. Studies of bottlenose dolphins, a species common throughout the region, found that this species was able to detect and actively avoid a surface slick after a few brief contacts and that there were no observed adverse effects of the brief contacts with surface slick (Smith *et al.*, 1983). It is not known if other marine mammals likely to be in the area are able to similarly detect and avoid hydrocarbon slicks. It has been proposed that even though whales and dolphins may be able to detect a hydrocarbon slick, the strong attraction to specific areas for breeding, feeding or resting may override any tendency to avoid the noxious presence of hydrocarbons. The nearest such area is Exmouth Gulf, which is used as a resting area by humpback whales during the southern migration. The modelling of oil spill trajectories indicates no oil at the moderate exposure values would enter the Gulf in the event of a large scale spill. Dugongs are common in several locations within moderate exposure value area of the EMBA particularly where there are seagrass beds such as the Ningaloo coastline and the Muiron Islands, although not in the numbers seen in further south in Shark Bay. No information is available regarding the susceptibility or sensitivity of dugongs to hydrocarbon spills. Like whales and dolphins they are likely to be able to detect a surface slick, but it is not known whether they will in fact do so or whether the brief contact may cause eye damage or other significant damage. Entrained and dispersed oil is unlikely to cause any effect to dugongs due to the low toxicity, low period of exposure that could occur and the low dosage of oil that may be received, although indirect effects may occur from impacts of hydrocarbons on their food source (refer to seagrass beds below).
Marine reptiles	*Turtles:* Marine turtles are vulnerable to the effects of hydrocarbon spills at all life stages (eggs, post hatchlings, juveniles and adults) whilst in the water or onshore (NOAA, 2010); however, there is little documented evidence of the effect of hydrocarbons on turtles. Should turtles make contact with a spill, the impact is likely to include oiling of the body as well as irritations caused by contact with eyes, nasal and other body cavities and possibly ingestion or inhalation of toxic vapours (Jones, 1986). Post-mortem investigations on dead loggerhead turtles from the Mediterranean implicated oil as a cause of death in a number of cases (Gramentz, 1988). In these cases, tarballs were found in the mouth and gastro-intestinal tract of the turtles, suggesting ingestion of tarballs as a possible cause of death. Direct contact of marine turtles with hydrocarbons and exposure from hydrocarbons may lead to the following problems: • Digestion/absorption of hydrocarbons through food contamination or direct physical contact, leading to damage to the digestive tract and other organs; • Irritation of mucous membranes (such as those in the nose, throat and eyes) leading to inflammation and infection; • Eggs may be contaminated and inhibit their development or lead to developmental defects in hatchlings, either due to oil on the nesting beach or through transference from the adult turtles whilst laying the eggs; and • Hatchlings, after emerging from the nests, may become oiled as they make their way across the beach to the water. Within the moderate exposure value area of the EMBA, important areas for marine turtles that may be exposure to hydrocarbons in a large scale spill include the North West Cape of the Ningaloo coast and the Muiron Islands. Turtle nesting on beaches at these locations may be vulnerable through the shoreline accumulation of oil. In addition, in the nesting season (September to May for green and loggerheads, and July to May for hawksbill turtles), adult turtles will tend to aggregate in the inter-nesting areas adjacent to the nesting beaches, increasing the vulnerability of turtles in this area in the event of a hydrocarbon spill due to greater turtle densities. Eggs may become directly exposed to hydrocarbons as a result of female turtles becoming oiled from surface oil exposure or when crossing shorelines, resulting in the transfer of hydrocarbons to eggs during nest preparation and laying, which may in turn effect embryo development or lead to embryo mortality (NOAA, 2010).

Receptor	Impacts of hydrocarbon on sensitive receptors at the moderate exposure values
	Newly hatched turtles entering the water from nesting beaches are likely to be highly susceptible to oiling from either shoreline accumulated oil or surface oil, however impacts would be highly seasonal and limited to the periods when hatchlings emerge from the nests 6-8 weeks following nesting by adults. *Seasnakes*: Several species of seasnake are known to occur in the moderate exposure value area of the EMBA. The sensitivity of seasnakes to hydrocarbon spills has been poorly studied. It is expected that susceptibility will be due to their need to surface in order to breathe. Seasnakes also have the ability to breathe through cutaneous respiration (Heatwole, 1999). Surface oil may coat the skin, impairing respiration. Seasnakes may also be susceptible to toxic effects through ingestion of contaminated prey items, however laboratory testing has shown Pyrenees crude to have a very low toxicity and contains a low proportion of the more toxic light end components, it is predicted that any interface with hydrocarbons is unlikely to cause an impact to significant numbers given the widespread distribution of this fauna group within the NWS.
Seabirds and shorebirds	Birds exposed to hydrocarbons may suffer a range of internal and external health effects. Direct contact with hydrocarbons and exposure from hydrocarbons has the potential to cause the following: • Oiled feathers affecting the ability of the birds to fly and those birds on the sea surface may suffer from loss of buoyancy and drown or die from hypothermia; • Skin irritation or ulceration of eyes, mouth or nasal cavities; • Internal effects from poisoning or intoxication through ingestion, preening and ingestion of oil via their prey items; • Reduced reproduction ability; • Reduction in the number of eggs laid; • Decreased shell thickness; and • Disruption of the normal breeding and incubating behaviours. The surface oil component poses the greatest risk of impact to seabirds due to the amount of time they spend on or near the sea surface. Individuals are at risk of lethal or sub-lethal physical and toxic effects due to external exposure (oiling of feathers) and ingestion, especially those close to the source point where concentrations are at their highest. Even small quantities of feathers contaminated by oil can be lethal, causing hypothermia and reduced buoyancy (O'Hara and Morandin, 2010). Seabirds are less likely to be affected by entrained and dissolved hydrocarbons, except through the ingestion of contaminated prey. The waters of the North West region of WA support large populations of seabirds, predominantly tern species (DSEWPaC, 2012d) and the moderate exposure value area in the EMBA includes important breeding, feeding, foraging and refuge sites for a number of EPBC Act-listed migratory and threatened seabirds. The seabirds that most commonly occur within the moderate exposure value area in the EMBA include albatross, petrels, terns and shearwaters. Other seabirds that occur within the wider North West region of WA include noddies, tropicbirds, frigatebirds and boobies. Seabirds spend most of their time at sea, travelling over large distances to forage over the open ocean, returning to land during breeding only and therefore some seabirds may transit the offshore waters within the moderate exposure value area in the EMBA and come into contact with surface oil. While individual seabirds may be affected, it is not predicted that large numbers of seabirds will be impacted from surface oil as they are unlikely to be present in significant numbers due their vast distribution area. In contrast, shoreline accumulated oil poses the greatest risk of impact to shorebirds whereby they come into contact with hydrocarbons washed up onto shore where the shorebirds spend time feeding, roosting and breeding. Seabirds are also at risk when they return to land to breed. Both adults and chicks/fledgings may be impacted through contact, ingestion and/or oiling of feathers. Oiled adults may also transfer oil on to their eggs or chicks. There is the potential of bioaccumulation of toxins ingested by adults affecting embryos and the development of chicks, although this is considered to be low due to the low toxicity of the weathered oil. Indirect impacts may effects shorebirds and wading birds through contamination of foraging areas that may result in a reduction in available prey items (Clarke, 2010).

Receptor	Impacts of hydrocarbon on sensitive receptors at the moderate exposure values
	Shoreline accumulated oil at the moderate exposure value is predicted at the Muiron islands, the North West Cape area, the Onslow Region and Barrow Island. These offshore islands and coastal habitats (particularly intertidal mud flats and sandy beaches) that are important staging sites for migratory shorebirds and important breeding sites. Intertidal mud flats and sandy beaches are also important habitat for shorebirds and migratory wading birds that spend time roosting and feeding on invertebrate infauna such as polychaetes, crustaceans and gastropods.
Shoreline Habitats	
Intertidal sandy beaches/ mud flats	Sandy beaches and intertidal sediments occur extensively along the Ningaloo coast, the western side of Exmouth Gulf, and are also found on many of the offshore islands including but not limited to the Muiron Islands and Barrow Island. They represent an important habitat that supports burrowing fauna of crabs, mainly ghost crabs, and burrowing bivalve molluscs, as well as a diverse community of benthic infauna comprising polychaetes, crustaceans and gastropods. In addition, the beaches provide seasonally important habitat for turtle nesting, breeding seabirds and migratory wading birds, the impacts from hydrocarbons are described previously above. The physical effect of oil is likely to be more significant than the toxicological effect to sandy beach biota given that the crude oil contained in the Pyrenees reservoirs consists mainly of biodegraded hydrocarbons that typically have a very low aromatic content and consequently tend to be low in toxicity. However, temporary declines in infauna and epifauna populations may have an indirect effect on feeding shorebirds, seabirds and migratory wading birds.
Intertidal rocky shores/ reefs	Epibiota that colonise intertidal rocky shores/ reef are vulnerable to oil spills. Filter feeders such as molluscs are particularly vulnerable to lethal and various sub-lethal effects from hydrocarbons in the water column. The latter include alteration in respiration rates, decreases in filter feeding activity, reduced growth rates, biochemical effects, increased predation, reproductive failure and mechanical destruction by waves due to inability to maintain hold on substrate (Connell and Miller, 1981; Ballou *et al*., 1989). The risk of significant impact to rocky shore and limestone platform biota from crude oil from the Pyrenees reservoirs is low due to the low aromatic content and consequently tends to be low in toxicity. In contrast, the recovery time from MDO may be longer.
Macroalgal beds	The morphological features of the algae, such as the presence of a mucilage layer or the presence of fine 'hairs' will influence the amount of hydrocarbon that will adhere to the algae. A review of field studies conducted after spill events by Connell and Miller (1981) indicated a high degree of variability in level of impact, but in all instances the algae appeared to be able to recover rapidly from even very heavy oiling. They attributed the rapid recovery of algae to the fact that for most algae new growth is produced from near the base of the plant while the distal parts (which would be exposed to the oil contamination) are continually lost. A heavy oiling of medium crude oil in Panama resulted in the loss of algae on coastal reefs. Within two months, algal cover had 'recovered' to a level in excess of the seasonal average, although species composition had changed (Cubit *et al*., 1987). The time necessary for recovery of species diversity and community structure is not known. Macroalgal beds occur both intertidally and subtidally within the moderate exposure value area of the EMBA particularly along the western shores of the North West Cape and around the Muiron Islands. Macroalgae on reef fronts and reef edges would not be exposed to direct oiling but may experience exposure to entrained oil or by stranded oil on shorelines that becomes remobilised and entrained in the water column (below entrained thresholds of concern) due to periodic tidal and wave action exposure and during cyclone events. The effect of hydrocarbons on macroalgae, particularly on intertidal shores, is largely dependent on the degree of direct exposure, the shoreline exposure (degree of wave and tidal action) and how much of the hydrocarbon adheres to the algae. Macroalgae on exposed shores is predicted to recover quicker than sheltered shores as a result of wind, wave and tidal driven coastal processes naturally 'flushing' hydrocarbons from the shoreline.
Coral reefs	Corals on reef fronts, reef edges and in deeper lagoonal areas will come into contact with entrained oil through dispersion or by dissolution of toxic hydrocarbons into the water column. Corals reefs will also be vulnerable to stranded oil on shorelines that becomes remobilised due to periodic tidal and

Receptor	Impacts of hydrocarbon on sensitive receptors at the moderate exposure values
	wave action exposure and during cyclone events. Exposure of subtidal corals to water soluble hydrocarbon fractions has the potential to result in lethal or sub-lethal toxic effects. Experimental studies and field observations have found all species of corals to be sensitive to the effects of oil, although there are considerable differences in the degree of tolerance between species (Jackson *et al*., 1989). The effect of oil on corals range from short or long-term sub-lethal effects to irreversible tissue necrosis and death. The timing of an oil spill event in relation to other environmental stresses, such as ambient temperature, or reproductive stage could also have significance in that corals are likely to be more sensitive to oil spill events at times of physiological stress. In an experiment to observe the effect of direct oiling, Johannes *et al*. (1972) exposed the upper half of 22 species of corals to crude oil for one and a half hours. Oil adhered to the exposed surfaces of most species and tissue death ensued in these areas, but not where there was no oil adhesion. Branching corals, such as species of *Acropora* and *Pocillopora*, appear to be more sensitive than other morphological types. Differences in sensitivities may be due to the ease with which oil adheres to the coral structures, the degree of mucous production and self-cleaning or simply different physiological tolerances. The water-accommodated fractions of oil can produce lethal and sub-lethal effects in corals (Loya and Rinkevich, 1980); however documented effects such as increased mucous production, decreased growth rates, changes in feeding behaviours and expulsion of zooxanthellae (Peters *et al*., 1981; Knap *et al*., 1985) generally only occur at concentrations of water-accommodated hydrocarbons that are considerably higher than would occur in field situations. A study by Shafir *et al*. (2007) examined the effect of water-soluble oil fractions (WSFs) of two oils and six different dispersants on two species of corals at concentrations that would occur in event of heavy exposure. The effect of WSFs of oil on the corals tested did not indicate a high sensitivity; rather the effect was described as "none of the crude oil WSF had any impact on survivorship of either *Stylophora pistillata* or *Pocillopora damicornis*." (p.5572 of Shafir *et al*., 2007). That is, at the concentrations tested there was no effect on survivorship of corals. This experiment is consistent with reports of highly variable response by corals after exposure to oils.
Mangroves	Mangroves are considered to be an important component of tropical ecosystems as they provide protection for coastlines and a source of organic matter and nutrients for marine ecosystems. The sensitivity of mangroves to oil spills has been well recorded, with extensive defoliation, and sometimes mortality, being noted following a number of oil spills. These spills have varied in size, oil type, degree of oiling and mangrove species. In general, studies have suggested that damage occurs through the smothering of lenticels (mangrove breathing pores vital for respiration) on pneumatophores or prop roots or by the loss of leaves due to chemical burning (Duke *et al*., 1999). Smothering and contamination can lead to mortality of plants, seedlings and propagules. A comprehensive review of the literature on the impacts of oil spills on mangroves was conducted by Thorhaug (1987), from which it was concluded that while defoliation of mangroves was a common occurrence, massive mortality was not always the ultimate outcome. Mangrove death is predicted whenever when more than 50% of the leaves are lost (Evans, 1985). There may also be some sub-lethal impact to mangroves due to toxicity and it is known that mangroves take up hydrocarbons from oil that contacts leaves, roots or sediments, and it is suspected that this uptake causes defoliation through leaf damage and tree death (Wardrop *et al*., 1987). Within the moderate exposure value area of the EMBA, mangroves occur in the Cape Range National Park (Ningaloo) particularly in Mangrove Bay and Yardie Creek, as well as limited mangrove communities on the Muiron Islands. The isolated stands of mangroves at Mangrove Bay, although relatively small, are of high ecological importance because they are one of the few stands of mangroves on the western coast of the Ningaloo Marine Park.
Seagrass beds	Laboratory tests have illustrated the sensitivity of seagrasses to both surface oil and dissolved or physically dispersed hydrocarbons (Hatcher & Larkum, 1982; Baca and Getter, 1984; Wilson & Ralph, 2017). Stress response has also been demonstrated for seagrass at low hydrocarbon concentrations similar to that expected to occur in oil spill situations (Thorhaug, 1987; Thorhaug *et al*., 1991). Potential direct impacts to seagrasses from hydrocarbons include mortality due to smothering and chemical toxicity. Indirect impacts may occur due to reduced light attenuation, which would restrict the seagrasses ability to photosynthesise, leading to reduced growth rates and reduced flowering capability. Entrained oil may also adhere to seagrass in shallower areas, inhibiting respiration. The susceptibility of seagrass to hydrocarbons will depend largely on their distribution, with communities in deeper water less likely to be affected, whereas seagrass beds in shallower waters are more

Receptor	Impacts of hydrocarbon on sensitive receptors at the moderate exposure values
	likely to be affected by dispersed oil droplets or, in the case of emergent seagrasses, direct oiling. Intertidal seagrass communities would theoretically be the most susceptible because the leaves and rhizomes may both be affected. Seagrass beds occur within the moderate exposure value area of the EMBA occur in the Cape Range/Ningaloo coast area and the Muiron Islands.
Socio-economic	
Fisheries	The EMBA overlaps a number of Commonwealth and State Managed Fisheries (refer to Section 4.11.3). The level of fishing activities in the moderate exposure value area in the EMBA is low. Exclusions zones surrounding a spill can directly impact fisheries by restricting access to fishing vessels. Commonwealth and fisheries are unlikely to be affected from an oil spill due to the water depth at which many of them operate. State pelagic fisheries may be affected loss of fishing effort associated with avoidance of the oil spill, or gear clean-up and associated costs. The market value/demand for fish may also be impacted due to actual or perceived tainting of catches and closure of fishing grounds could also impact operations. The significance of any decrease in market value/demand for fish may be substantial to those few individual fishery operators working in the affected areas but it is unlikely to cause any significant long-term impact to the identified managed fisheries that operate in the region. Aquaculture activities such as pearl and prawning farming may also be affected by oil in the water column tainting stock.
Tourism and recreation	There is a wide variety of nature-based tourism and recreational activities including recreational fishing that occurs in the EMBA for the worst-case spill scenarios. Much of this occurs in the Cape Range/ Ningaloo Marine Park area during the peak tourism season from April to October; although some of the offshore islands also attract visitors such as the Muiron Islands. In the event of an oil spill, there is the potential for temporary closure of all recreational activities, including diving, due to the risk to public health and safety. Similar impacts arising from the shoreline stranding of hydrocarbons will add a visual impact and potentially restricted access to shorelines.
Defence	Military exercise areas are located at Exmouth associated with Royal Australian Air Force Base Learmonth (refer to Section 4.11.5). These training zones overlap the moderate exposure value area within the EMBA. However, they are designated for aerial training and are unlikely to be impacted by a hydrocarbon spill.
Shipping	The impact on shipping in the event of a worst-case discharge is likely to be limited to the potential for minor modification of shipping routes through the implementation of exclusion zones to avoid the spill. Shipping operations may be affected by spill response efforts by way of a 'Notice to Mariners' being issued to avoid the area, leading to the potential diversion from normal shipping routes.
Oil and gas activities	A number of oil and gas operators have operations within the moderate exposure value area within the EMBA. In the event of a large scale spill, petroleum production operations in the region would likely remain unaffected unless a surface slick was within the vicinity and considered to represent a safety hazard at which time the likely response would be to cease production activities. A potential second order effect that may also cause production to cease is a closure of the surrounding areas (such as for safety or navigation control) preventing offtake tankers or support vessels from operating in the area. The impact of ceasing production would be the postponement of income from sales.
Indigenous	Any oil that reaches the coastline from a large scale spill has potential to impact on registered sites and indigenous heritage places along the coastline. In the unlikely event of an oil spill, shoreline accumulated oil may effect sensitive artefacts or areas, which could damage their heritage value. Furthermore, personnel accessing the area to implement response strategies have potential to damage or destroy heritage values of the area. These sensitivities will be prioritised and taken into account as part of the daily Operational NEBA within the OPEP (Appendix G).
Maritime heritage	There are a number of shipwrecks in the EMBA and moderate exposure value area. Surface hydrocarbons will have no impact on shipwrecks. Shipwrecks on shorelines that are exposed at low tide have the potential to be coated in oil with each ebb tide. Hydrocarbons in the water column pose the greatest risk of impacts shipwrecks. Microbial communities (biofilms) on structures and in the surrounding seafloor play important roles in shipwreck preservation and degradation, and in recruitment of macro-organisms to artificial reefs (Hamdan *et al.*, 2018). Hydrocarbons in the water column may potentially impact those microbial and encrusting communities that may in turn affect the structural integrity of the shipwreck.

Receptor	Impacts of hydrocarbon on sensitive receptors at the moderate exposure values
Protected areas	
World Heritage and National Heritage	The Ningaloo Coast with World Heritage and National Heritage listings falls within the moderate exposure value area within the EMBA. The environmental values and sensitivities of the Ningaloo Coast are described in Sections 4.5.2 and 4.5.3. The potential impacts to these are described in the relevant sections of this Table. In the event of an oil spill, receptors in these areas would be prioritised for protection through the Shoreline Protection and Shoreline Clean-up response strategies described in Section 8 and the Crosby-3H1 LWI OPEP (Appendix G).
Commonwealth and State Marine Parks	The EMBA overlaps several Marine Parks (refer to Sections 4.10.1 and 4.10.2). In the event of an unplanned MDO spill, modelling predicted the following Marine Parks could be contacted by surface, total submerged and dissolved hydrocarbons at moderate exposure values: • Australian (Commonwealth) Marine Parks: o Gascoyne; and o Ningaloo • State Marine Parks: o Muiron Islands; and o Ningaloo In the event of an unplanned crude spill, modelling predicted the following Marine Parks could be contacted by total submerged hydrocarbons at moderate exposure values: • Australian (Commonwealth) Marine Parks: o Gascoyne; and o Ningaloo • State Marine Parks: o Muiron Islands; and o Ningaloo The environmental values and sensitivities of these Marine Parks are described in Sections 4.10.1 and 4.10.2. The potential impacts to these are described in the relevant sections of this Table.
Key ecological features	The EMBA overlaps several KEFs (refer to Section 4.10.3). In the event of an unplanned MDO spill, modelling predicted the following KEFs could be contacted by surface, total submerged and dissolved hydrocarbons at moderate exposure values: • Ancient coastline at 125-m depth contour; • Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula; • Commonwealth waters adjacent to Ningaloo Reef; and • Continental slope demersal fish communities. In the event of an unplanned crude spill, modelling predicted the following KEFs could be contacted by total submerged hydrocarbons at moderate exposure values: • Ancient coastline at 125-m depth contour; • Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula (surface hydrocarbons also overlap the KEF boundary);

Receptor	Impacts of hydrocarbon on sensitive receptors at the moderate exposure values
	• Commonwealth waters adjacent to Ningaloo Reef; and • Continental slope demersal fish communities. The environmental values and sensitivities of these KEFs are described in Section 4.10.3, and the potential impacts are described in the relevant sections of this Table. The ancient coastline at 125-m depth contour, the canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula, and the continental slope demersal fish communities KEFs are entirely subtidal. The benthic communities/ habitats associated with these KEFS, such as filter feeding communities and demersal fish assemblages are not predicted to be impacted by hydrocarbons in the event of a spill based on the water depths at which they occur. However, the pelagic marine faunal assemblages that are attracted to the nutrient rich waters, such as whales, whale sharks, large pelagic fish and seabirds are at risk of impacts from surface and entrained hydrocarbons.

8.3 Hydrocarbon Release – Loss of Well Containment

8.3.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Acceptability
Loss of well containment during intervention due to failure of well barrier integrity.	Loss of hydrocarbons (crude oil) to the marine environment.	Reduction in water quality with potential for toxicity effects to marine fauna and flora, oiling of offshore, nearshore and shoreline habitats. Impacts to socio-economic receptors.	100	Highly Unlikely (0.03)	3	Tolerable

8.3.2 Source of Risk

A loss of well containment can lead to an uncontrolled release of reservoir hydrocarbons and other wellbore fluids to the environment. BHP has identified a subsea release of crude oil resulting from a loss of well containment (failure of well barrier integrity) from the Crosby-3H1 well as the scenario with the worst-case credible environmental outcome. Reservoir modelling by BHP has demonstrated that the Crosby-3H1 well cannot sustain flow with both laterals open, and that a continuous hydrocarbon release would only occur after the plug was installed (with L1 isolated), and there were issues with the establishment of available barriers (refer to previous Section 8.2.1).

Reservoir modelling by BHP determined the worst-case maximum credible release of hydrocarbon is 1,930 m^3 crude oil based on L2 open to flow (*BHP Crosby-3H1 Discharge Modelling Memo*, 2020, Document No. PYRWINTF-008). The worst-case duration of uncontrolled flow from a loss of well containment until well control can be established is conservatively estimated to be 21 days (refer to Section 8.2.2 for rationale).

Quantitative hydrocarbon spill modelling was undertaken for the subsea release of 1,930 m^3 of crude oil over a duration of 21 days (refer to Section 8.2.3). Outputs from the modelling, presented below, were used to inform the environmental impact assessment in Section 8.3.3, and to assist with emergency planning.

Industry Statistics

A review of international data provided in the Bureau of Safety and Environmental Enforcement (BSEE) *Loss of Well Control Occurrence and Size Estimators Report* (BSEE, 2017) and the International Oil and Gas Producers *Blowout Frequencies – Risk Assessment Data Directory Report* (IOGP, 2019) was undertaken to provide an understanding of historical event frequency of well release incidents on production wells. The frequencies are mainly based on data from the areas of the US Gulf of Mexico (GoM) outer continental shelf and North Sea. The data is based on events reported in the SINTEF Offshore Blowout Database.

The data reported for releases during wireline activities are the most analogous statistics to highlight since the Crosby-3H1 LWI activities are effectively using the same method of pressure control as used in conventional wireline campaigns. The data demonstrates the very low likelihood of a release during wireline activities:

- Probability, reported as frequency per year, of a well blowout from wireline activities is 4.4×10^{-6}, and for a well release is 1.7×10^{-5}, being an order of magnitude lower than for drilling activities.

Oil Spill Modelling Results

Hydrocarbon Weathering Behaviour

Martin Linge Crude 13C was selected from SINTEF's oil library to represent Crosby crude oil for the subsea crude oil spill scenario. Results of the weathering analysis are shown in Figure 8-2 and are summarised as follows. Under low winds (1 m/s), 95% of the surface slick is predicted to remain after 5 days (120 hours), with only 5% evaporated. Under moderate winds (5 m/s), 12% of the initial surface slick is predicted to evaporate after 5 days, with 8% dispersed to the water column and the remaining 80% persisting as floating oil. In high winds (10 m/s), the oil is predicted to be rapidly dispersed, with 60% entrained in the water column after 5 days, 15% evaporated and 25% remaining on the sea surface.

The crude oil has a high tendency to form stable emulsions, reaching a water content of 50% after 5 days with persistent low winds (1 m/s), and reaching 80% water content after 72 hours and 24 hours under moderate (5 m/s) and high wind speeds (10 m/s), respectively (Figure 8-2).

The modelling results are presented for the fate hydrocarbons at the hydrocarbon exposure values defined in Section 8.2.5. Table 8-9 provides a summary of spill modelling results for sensitive receptors with contact at moderate and high exposure values for the worst-case loss of well containment scenario resulting in a loss of 1,930 m^3 crude oil.

The EMBAs for the worst-case loss of well containment scenario based on the low exposure values for hydrocarbons (Table 8-7) are presented in Figure 8-3, as follows:

- <u>Crude Oil Spill Stochastic EMBA (21-day release)</u>: Based on the stochastic modelling (with the spatial extent of the spill shown as a pink line on Figure 8-3), this EMBA represents 120 stochastic realisations for the 1,930 m^3 subsurface crude oil spill for a duration of 21 days. This represents a highly conservative response time to halt the subsea release (refer to Section 8.2.2 for rationale). This EMBA represents the largest possible extent that could be contacted by overlaying 120 individual spills and was derived using the low hydrocarbon exposure values. This EMBA was used to produce the EPBC Act Protected Matters reports and to describe the environment that may be affected for the worst-case loss of well containment spill scenario (refer to Section 4).
- <u>Crude Oil Spill Deterministic EMBA (21-day release)</u>: Based on the deterministic modelling (with the spatial extent of the spill shown as a grey line on Figure 8-3), this EMBA represents one out of the 120 stochastic realisations for the 1,930 m^3 subsurface crude oil spill for a duration of 21 days. This represents a more realistic spatial extent for the worst-case loss of well containment scenario.
- <u>Crude Oil Spill Deterministic EMBA (2-day release)</u>: Based on the deterministic modelling (with the spatial extent of the spill shown as a green line on Figure 8-3), this EMBA represents one out of the 120 stochastic realisations for a subsurface crude oil spill for a duration of 2 days. The 2-day release assumes the same daily release rate of crude oil as the 21-day release scenario (91.9 m^3/day), but reduces the total volume of oil released to 183.8 m^3). This represents a more likely timeframe to halt the subsea release based on successful early intervention (refer to Section 8.2.2).

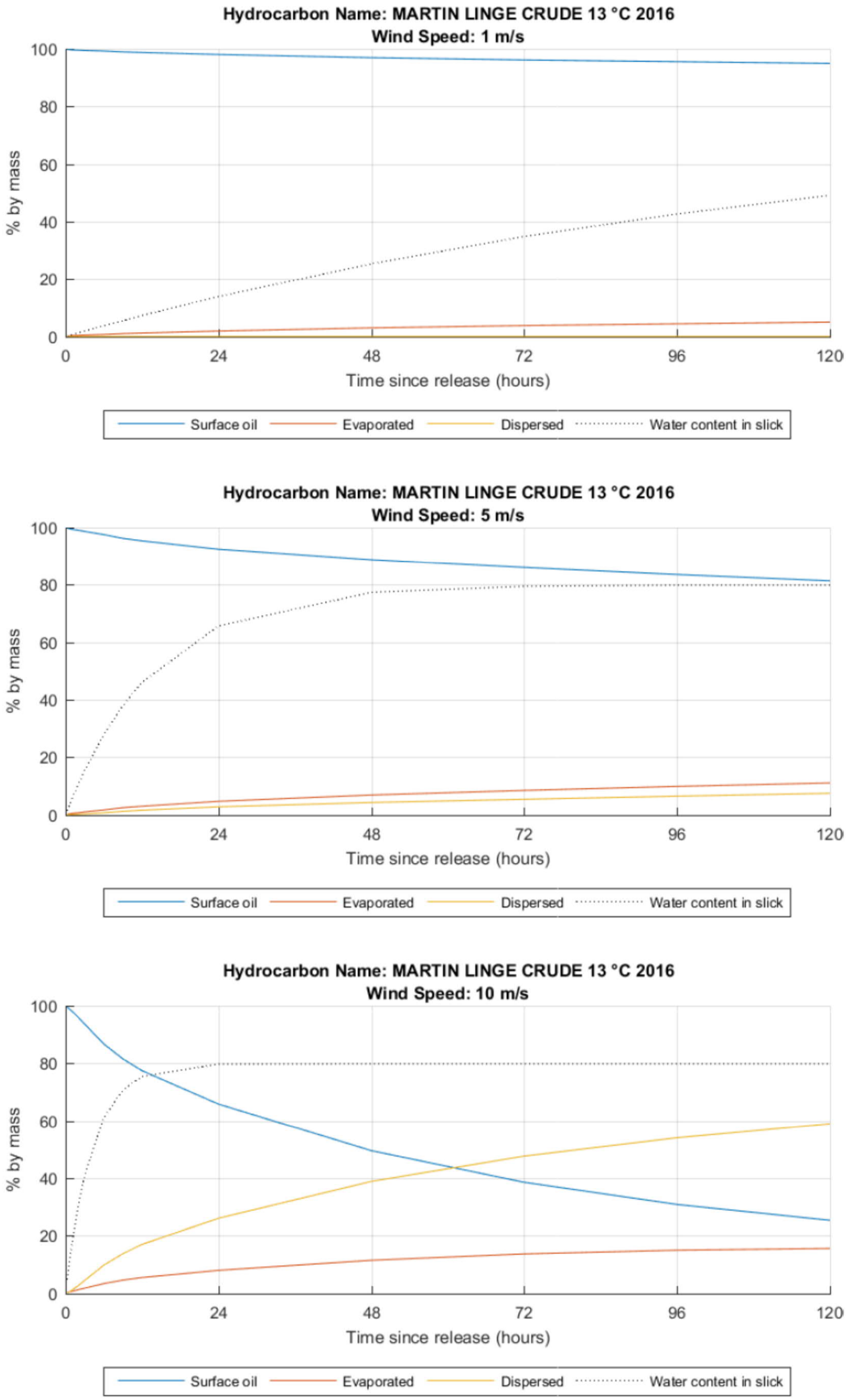


Figure 8-2: Simulated weathering of the SINTEF *Martin Linge Crude 13C* hydrocarbon for constant wind speeds of 1 m/s (top), 5 m/s (middle) and 10 m/s (bottom) (GHD, 2020)

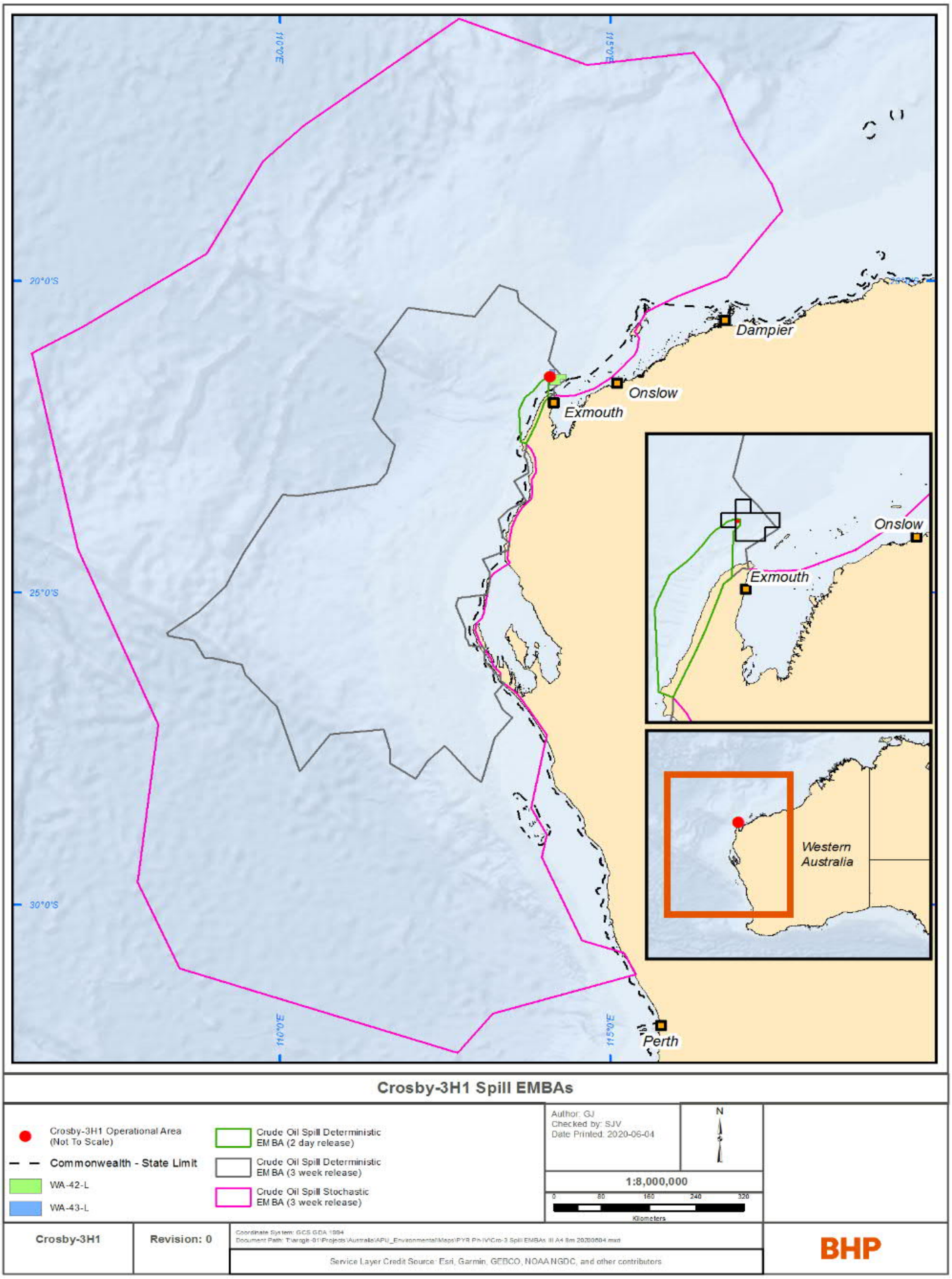


Figure 8-3: Loss of well containment crude oil spill stochastic (3-wk release) and deterministic EMBAs (3-wk and 2-day releases) based on low hydrocarbon exposure values. Deterministic EMBAs based realisations with the worst-case volumes of oil ashore.

Sea Surface Hydrocarbons

Low exposure (>1 g/m^2)

Surface hydrocarbons above the low exposure value were predicted to travel up to ~150 km to the southwest and ~70 km northwest, north and northeast of the release location (see Figure 8-4).

Moderate exposure (>10 g/m^2)

Surface hydrocarbons above the moderate exposure value were predicted to only occur within two model cells within 10 km of the release location.

High exposure (>50 g/m^2)

No contact by surface oil exceeding the high exposure value was predicted.

Sensitive receptors predicted to be contacted at the low exposure value are:

- Geographical Receptors:Ningaloo Region;
- State Marine Parks: Ningaloo
- Australian Marine Parks: Gascoyne and Ningaloo

Dissolved Hydrocarbons

Low exposure (>10 ppb)

Dissolved hydrocarbons above the low exposure value to occur within ~10 km of the release location (see Figure 8-4).

There were no predicted exceedances of the moderate (50 ppb) or high (400 ppb) exposure values. The low flow rate and low proportion of soluble components within the crude oil is insufficient to generate dissolved hydrocarbon concentrations above the moderate exposure value.

Total Submerged Hydrocarbons (entrained plus dissolved)

Low exposure (>10 ppb)

Total submerged hydrocarbons at the low exposure value were predicted to travel up to ~1,100 km to the south, ~1,000 km to the west and ~600 km to the northeast (see Figure 8-4), althought exceedances of the low exposure value were sparse and sporadic. Sensitive receptors predicted to be contacted at the low exposure value are:

- Geographical Receptors: Barrow Island, Carnarvon Region, Dirk Hartog Island, Dorre Island, Geraldton Region, Montebello Islands, Muiron Islands, Ningaloo Region, Onslow Region and Shark Bay Region;
- State Marine Parks: Barrow Island, Montebellow Islands, Muiron Islands and Ningaloo;
- Australian Marine Parks: Abrolhos, Argo-Rowley Terrace, Carnarvon Canyon, Gascoyne, Montebello, Ningaloo and Shark Bay.

Moderate exposure (>100 ppb)

Total submerged hydrocarbons at the moderate exposure value is contained within a much smaller area, extending to a maximum distance of ~120 km from the release location. Sensitive receptors predicted to be contacted at the moderate exposure value are:

- Geographical Receptors: Muiron Islands and Ningaloo Region;
- State marine Parks: Muiron Islands and Ningaloo;
- Australian Marine Parks: Gascoyne and Ningaloo.

Shoreline Accumulated Hydrocarbons

Low exposure (>10 g/m²)

Shoreline accumulated hydrocarbons above the low exposure value were predicted to occur between the Perth Region (~1,100 km to the south) and the Montebello Islands (250 km to the northeast) (see Figure 8-4). Very low (0.1 to 3.3 tonnes) maximum shoreline accumulations were predicted at the very low contact probabilities (<10%) at the Montebello Islands, Thevenard Island, Bernier Island, Dorre Island, the Abrolhos Islands and the Geraldton and Perth Regions; and at low contact probabilities (<23%) at Barrow Island, Dirk Hartog Island and the Shark Bay, Onslow and Carnarvon Regions. Shoreline loadings of 95 tonnes (97% contact probability) were predicted at the Ningaloo Region, and at the Muiron Island (33 tonnes with73% contact probability). The maximum length of oiled shorelines ranged from 201 km (Ningaloo Region), 31 km at Barrow Island, 26 km in the Shark Bay Region, down to between 3 to 14 km at the remaining receptor regions.

Across all shorelines combined, the predicted probability of contact at the low exposure value is 98%. Some seasonality was evident in the shoreline accumulation, with higher shoreline loading (>10 tonnes) typically occurring between October and March.

Moderate exposure (>100 g/m²)

Shoreline accumulated hydrocarbons above the moderate exposure value were predicted to occur up to ~180 km to the south-southwest at the Ningaloo Region and ~160 km to the northwest at Barrow Island. A moderate-high contact probability (68%) was predicted for the Ningaloo Region with a maximum accumulated shoreline load of 92 tonnes, a maximum length of oiled shoreline of 82 km and a mimum arrive time of oil ashore of 1.9 days. The Muiron Islands had a lower predicted contact probability (35%), with a maximum accumulated shoreline load of 33 tonnes, maximum oiled shoreline length of 14 km and a minimum arrival time of 2.1 days. Lastly, a very low contact probability (1%) was predicted for Barrow Island and the Onslow Region, with similar maximum accumulated shoreline loads of 1 tonne at each receptor, similar maximum oiled shoreline length of 3 km, and minimum arrival times of 10.6 days at the Onslow Region and 19.3 days at Barrow Island. No other receptor regions were contacted by shoreline accumulation above the moderate exposure value.

Across all shorelines combined, the predicted probability of contact was 78%.

High exposure (>1,000 g/m²)

Shoreline accumulated hydrocarbons above the high exposure value was limited to the Ningaloo Region and the Muiron Islands only, extending up to ~130 km to the southwest of the release location. Shoreline loadings were only predicted at the Ningaloo Region (50 tonnes), with a minimum arrival time of 3.3 days and maximum length of oiled shoreline of 14 km, and at the Muiron Islands (23 tonnes), with a minimum arrival time of 2.1 days and maximum length of oiled shoreline of 9 km.

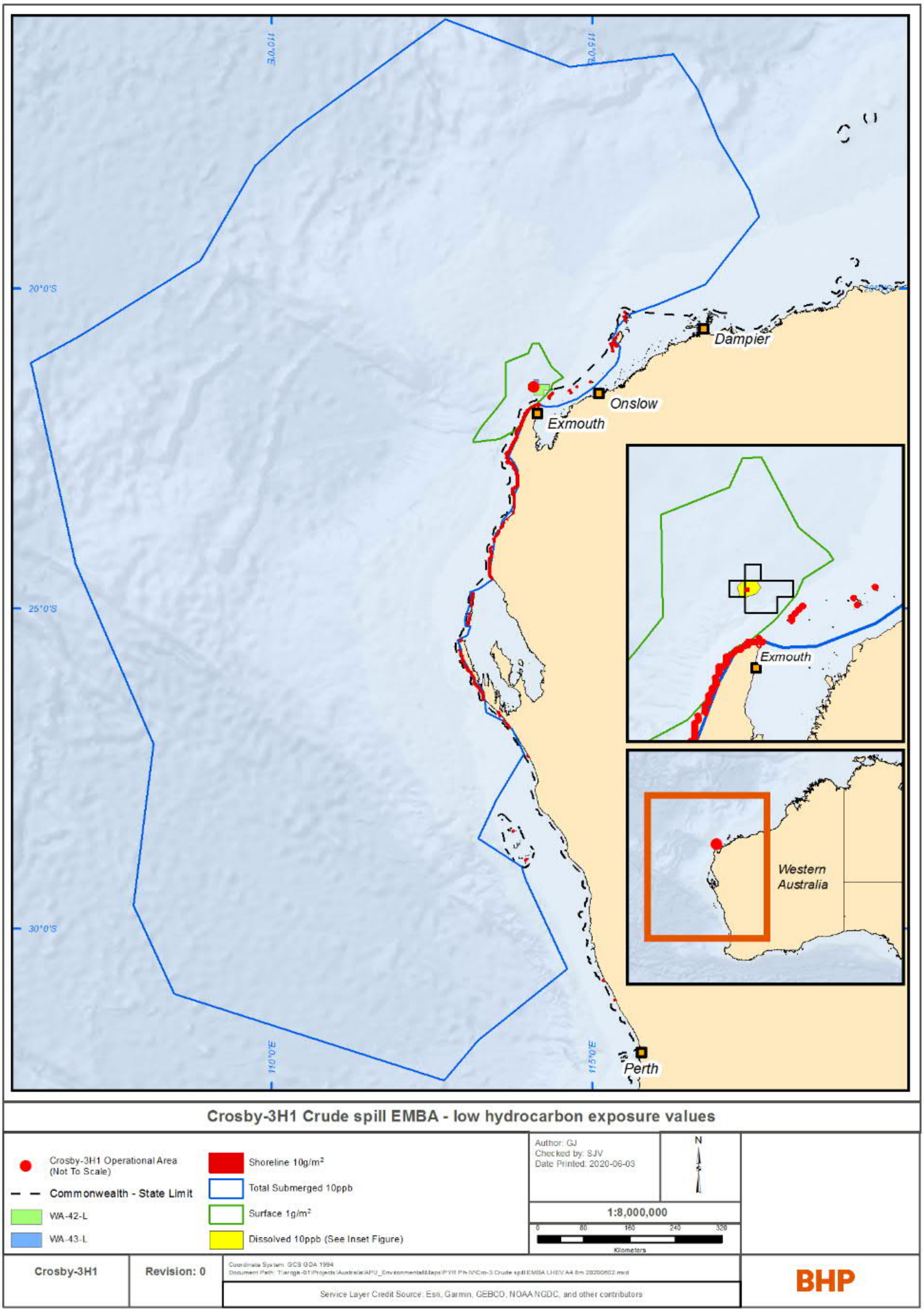


Figure 8-4: Loss of well containment crude oil spill stochastic EMBAs for a 21-day release showing the various hydrocarbon components at the low hydrocarbon exposure values.

Table 8-9: Summary of spill modelling results for sensitive receptors with contact at moderate & high exposure values: 1,930 m^3 crude spill scenario

Receptor	Receptor Type	Minimum Time to Contact (Days)							Maximum Hydrocarbon Concentration							Max. Oil Ashore (tonnes)	Max. Length of Oiled Shoreline (km)
		Moderate Exposure				High Exposure			Moderate Exposure				High Exposure				
		Shoreline accumulation (>100 g/m^2)	Surface Oil (>10 g/m^2)	Total Submerged Oil (>100 ppb)	Dissolved Oil (>50 ppb)	Shoreline accumulation (>1,000 g/m^2)	Surface Oil (>50g/m^2)	Dissolved Oil (> 400 ppb)	Shoreline accumulation (>100 g/m^2)	Surface Oil (>10 g/m^2)	Total Submerged Oil (>100 ppb)	Dissolved Oil (>50 ppb)	Shoreline accumulation (>1,000 g/m^2)	Surface Oil (>50g/m^2)	Dissolved Oil (> 400 ppb	Shoreline accumulation (>100 g/m^2)	Shoreline accumulation (>100 g/m^2)
Receptor Areas																	
Barrow Island	Islands and Reefs	19.3	NC	NC	NC	NC	NC	NC	168	NC	NC	NC	NC	NC	NC	0.9	2.8
Muiron Islands	Islands and Reefs	2.1	NC	13.3	NC	2.1	NC	NC	1542	NC	123	NC	1542	NC	NC	32.5	14.2
Ningaloo Region	Intertidal (mainland)	1.9	NC	3.8	NC	3.3	NC	NC	2,736	NC	182	NC	2,736	NC	NC	91.7	82.1
Onslow Region	Intertidal (mainland)	10.6	NC	NC	NC	NC	NC	NC	108	NC	NC	NC	NC	NC	NC	0.6	2.8
Marine Protected Areas																	
Muiron Islands	State Marine Park	N/A	NC	13.3	NC	N/A	NC	NC	N/A	NC	123	NC	N/A	NC	NC	N/A	N/A
Ningaloo	State Marine Park	N/A	NC	3.7	NC	N/A	NC	NC	N/A	NC	182	NC	N/A	NC	NC	N/A	N/A
Gascoyne	Australian Marine Park	N/A	NC	2.3	NC	N/A	NC	NC	N/A	NC	282	NC	N/A	NC	NC	N/A	N/A
Ningaloo	Australian Marine Park	N/A	NC	1.5	NC	N/A	NC	NC	N/A	NC	251	NC	N/A	NC	NC	N/A	N/A
Key Ecological Features																	
Ancient coastline at 125-m depth contour	KEF	N/A	NC	4.9	NC	N/A	NC	NC	N/A	NC	143	NC	N/A	NC	NC	N/A	N/A

Receptor	Receptor Type	Minimum Time to Contact (Days)							Maximum Hydrocarbon Concentration							Max. Oil Ashore (tonnes)	Max. Length of Oiled Shoreline (km)
		Moderate Exposure				High Exposure			Moderate Exposure				High Exposure				
		Shoreline accumulation (>100 g/m²)	Surface Oil (>10 g/m²)	Total Submerged Oil (>100 ppb)	Dissolved Oil (>50 ppb)	Shoreline accumulation (>1,000 g/m²)	Surface Oil (>50g/m²)	Dissolved Oil (> 400 ppb)	Shoreline accumulation (>100 g/m²)	Surface Oil (>10 g/m²)	Total Submerged Oil (>100 ppb)	Dissolved Oil (>50 ppb)	Shoreline accumulation (>1,000 g/m²)	Surface Oil (>50g/m²)	Dissolved Oil (> 400 ppb	Shoreline accumulation (>100 g/m²)	Shoreline accumulation (>100 g/m²)
Commonwealth waters adjacent to Ningaloo Reef	KEF	N/A	NC	1.5	NC	N/A	NC	NC	N/A	NC	251	NC	N/A	NC	NC	N/A	N/A
Continental slope demersal fish communities	KEF	N/A	NC	4.9	NC	N/A	NC	NC	N/A	NC	370	NC	N/A	NC	NC	N/A	N/A
Canyons linking Cuvier Abyssal Plain and the Cape Range Peninsula	KEF	N/A	10.1	0.3	NC	N/A	NC	NC	N/A	10.8	256	NC	N/A	NC	NC	N/A	N/A

8.3.3 Environmental Impact Assessment

A loss of crude oil to the marine environment would result in a localised (<10 km from release location) reduction of water quality to surface waters, and a wide spread (~120 km from release location) reduction in water quality in the upper surface waters of the water column. Shoreline accumulated hydrocarbons (at the moderate exposure value of 100 g/m^2) have the potential to travel up to 200 km from the release location spanning from Coral Bay to Barrow Island and the Onslow Region. Spill modelling predicts that at the moderate exposure value, there is a low to moderate probability (35%) of relatively low volumes of hydrocarbons contacting shorelines of the Muiron Islands (33 tonnes), moderate to high probability (68%) at the Ningaloo Region (92 tonnes) and low probability (<1%) of reaching Barrow Island (0.9 tonnes) and the Onslow Region (0.6 tonnes).

The following environmental impact assessment is based on potential impacts and risks to the physical environment and biological and socio-economic receptors within the area affected by hydrocarbons at the moderate exposure values. Potential impacts to environmental values, sensitivities and receptors within the spill EMBA from exposure to hydrocarbons are described in previous Table 8-8.

Local Fauna and Threatened and Migratory Fauna

Potential sensitive receptors in the vicinity of the spill area will include fish, marine mammals, marine reptiles and seabirds at the sea surface, which may come into contact with the crude oil leading to potential impacts as described in previous Table 8-8. Each of these receptors is discussed below.

Marine Mammals

At the moderate exposure values for hydrocarbons, a number of threatened and migratory mammals are considered at risk of impact from contact with surface and water column hydrocarbons including sei, pygmy blue, fin, southern right, humpback, Antarctic minke, Bryde’s, orcas, and sperm whales; Indo-Pacific humpback and spotted bottlenose dolphins, and dugongs. Of these, the humpback whale (migration and resting), pygmy blue whale (distribution, foraging and migration) and dugong (nursing, breeding, calving and foraging) BIAs overlap the moderate exposure value area. An unplanned release of crude oil is not expected to interfere with their migration activity. There is the potential for behaviour disruption to the local population and individuals that traverse the spill area. Physical contact with hydrocarbons in the water column and on the sea surface is likely to have biological consequences to individuals, however due to the localised nature of the spill, with surface oil not predicted to travel beyond 10 km at the moderate exposure value and total submerged oil to remain within approximately 120 km of the release site), impacts are not predicted at the population level.

Marine Reptiles

While marine turtle nesting beaches may be contacted by crude oil, turtles will always nest above the high tide mark and any crude oil moving through the beach profile is not predicted to come into contact with nests. Should an unplanned crude spill coincide with marine turtle nesting or young emerging from the nests, adults and hatchlings would be at risk of exposure to crude oil that accumulates on nesting beaches. At the moderate exposure level, low to moderate volumes of crude oil are predicted to accumulate on shorelines at the Murion Islands (33 tonnes), moderate volumes at the Ningaloo Region (92 tonnes) and low volumes at both Barrow Island and the Onslow Region (<1 tonne).

At the moderate exposure values for hydrocarbons, a number of threatened and migratory marine reptile species are considered at risk of impact from contact with surface and water column hydrocarbons including flatback, green, hawksbill, loggerhead and leatherback turtles; and snort-nosed seasnakes. Of these, all of the marine turtles listed have BIAs (inter-nesting and nesting) that overlap the moderate exposure value area. There is the potential for impacts to individuals that traverse the spill area. Physical contact with hydrocarbons in the water column, on the sea surface and accumulated on beaches used by nesting turtles is likely to have biological consequences to individuals, however due to the relatively localised nature of the spill, with surface oil not predicted at the moderate exposure value beyond 10 km of the release location, and low-moderate shoreline loadings, impacts are not predicted at the population level.

Fish (including Sharks and Rays and Commercial Species)

At the moderate exposure values for hydrocarbons, a number of threatened and migratory fish species are considered at risk of impact from contact with surface and water column hydrocarbons including grey nurse, white, shortfin and longfin mako, porbeagle and whale sharks; reef and giant manta rays; and sawfish (dwarf, green and narrow). Of these, whale shark (foraging) BIAs overlap the moderate exposure value area. Key aggregations occur off the Ningaloo coast (March to June) associated with high density prey, with largest numbers generally recorded in April. There is the potential for feeding behaviour disruption to the local population and individuals that traverse the spill area should the timing of the spill coincide with timing of whale shark aggregations.

In the offshore environment, pelagic fish and sharks are expected to move away from areas affected by hydrocarbon spills, such that impacts are expected to be limited to behaviour responses/ displacement. Some mortality and sub-lethal effects may impact individuals located close to the release location, however, overall impacts are not predicted at the population level.

Marine Birds

While marine seabirds may come into contact with crude oil on the sea surface in the offshore environment, migratory shorebirds (and those seabirds that come to shore to breed) are at risk of contact with crude oil that reaches and accumulates on shorelines at the Muiron Islands, the Ningaloo and Onslow Regions, and Barrow Island. Shorebirds are at risk of contact with shoreline accumulated hydrocarbons as they roost, feed and breed on shorelines, although they tend to roost and nest above the high water mark.

At the moderate exposure values for hydrocarbons, a number of threatened and migratory bird species are considered at risk of impact from contact with surface and water column hydrocarbons including petrels (southern giant, soft-plumaged), terns (Caspian, roseate, crested and fairy), shearwaters (wedge-tailed, streaked and flesh-footed), Campbell albatross, lesser frigatebird, common noddy and osprey. Of these, wedge-tailed shearwater (breeding), and roseate and fairy terns (breeding) BIAs overlap the moderate exposure value area.

At the moderate exposure values for hydrocarbons, a number of threatened and migratory species are also considered at risk of impact from contact with shoreline accumulated hydrocarbons that includes red knot, godwits (bar-tailed, Northern Siberian bar-tailed), eastern curlew, sandpipers (common, curlew, pectoral, sharp-tailed), oriental plover, oriental pratincole, Australian painted snipe, and common greenshank.

Impacts are expected to marine seabirds and shorebirds that come into contact with crude oil as well from as indirect effects from localised reduction of prey abundance, however impacts are not predicted at the population level.

Protected Areas

Several protected areas and key ecological features (KEFs) overlap with the moderate hydrocarbon exposure area:

- Australian Marine Parks: Gascoyne and Ningaloo;
- State Marine Parks: Muiron Islands and Ningaloo
- Key ecological features:
  - Ancient coastline at 125 m depth contour;
  - Commonwealth waters adjacent to Ningaloo Reef;
  - Continental slope demersal fish communities; and
  - Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula.

The environmental values and sensitivities of these protected areas are described in Section 4 and the potential impacts to these are described in previous Table 8-8. Due to the localised nature of the spill, with surface oil predicted not to travel more than 10 km from the release location at the moderate exposure values and total submerged oil at relatively low maximum concentrations (182 ppb at Ningaloo Region and 123 ppb at the Muiron Islands), the consequence to these protected areas is considered minor and temporary.

Socio-Economic Receptors

There is the potential for hydrocarbons to temporarily disrupt fishing activities if surface or water column hydrocarbons move through fishing areas. Fishing grounds may be temporarily closed, which would have an impact through loss of income. Market value/ demand for fish may also be impacted due to actual or perceived tainting of catches. Any impacts to fish stock are predicted to be low and temporary due to the rapid dispersal in the offshore environment. Potential direct impacts to fish and planktonic fish larvae are described in previous Table 8-8.

Offshore petroleum activities are likely to be predicted to be affected due to temporary exclusion zones that could be enforced as a safety or navigation control measure, thereby restricting vessels from operating in the area. However, impacts are predicted to be temporary.

Shipping operations are not predicted to be affected by a crude spill. However, response activities may result in temporary diversions from normal shipping routes.

Tourism and recreation could be affected by a crude spill, either from reductions in water quality and shoreline oiling resulting in temporary loss of access or reduction in aesthetic value of the area.

Defence activities are not predicted to be affected by a crude oil spill they are designated for aerial training as opposed to maritime. Any crude oil that reaches shorelines has potential to impact on registered sites and indigenous heritage places along the coastline. In the highly unlikely event of an oil spill, shoreline accumulated oil may effect sensitive artefacts or areas, which could damage their heritage value.

Based on the above assessment, a subsea release of crude oil from a loss of well containment has the potential to impact an array of receptors. The residual risk associated with a loss of well containment scenario has been assessed to be Tolerable.

Species Recovery Plans and Approved Conservation Advice

BHP has considered information contained in recovery plans and approved conservation advice and threat abatement plans (refer to previous Table 4-7). This includes the Recovery Plan for Marine Turtles in Australia (DoEE, 2017).

The overarching objective of the Recovery Plan for Marine Turtles in Australia is to reduce detrimental impacts on Australian populations of marine turtles and hence promote their recovery in the wild. Five species of turtle may occur and have BIAs that intercept the moderate exposure value area within the crude spill EMBA. In addition, the EMBA intercepts inter-nesting habitat identified as habitat critical to the survival for four of these species (green, flatback, hawksbill and loggerhead turtles).

Deteriorating water quality and habitat degradation from pollution, oil spills and chemical discharges is identified as a potential threat to turtles in the Recovery Plan, as well as conservation advice and recovery plans for a number of cetacean, shark and bird species (Table 4-7). The activity will be undertaken with control measures in place to minimise the risk of marine oil pollution events which are consistent with legislative codes, standards and good oil field practice, and recovery plans and approved conservation advice for relevant threatened species. The combination of the preventative control measures (to reduce the likelihood of the event occurring) and spill response strategies (which are aimed at reducing the consequence of the event) together reduce the potential for habitat degradation and/or modification from spill events.

BHP's OPEP (Appendix G) and response strategies include oiled wildlife response and management measures for marine fauna and their habitats. Implementation of these measures is prioritised based on the relative sensitivities and conservation significance of the fauna involved. Therefore the OPEP includes management for conservation species and their habitats, consistent with the requirements of the relevant recovery plans and approved conservation advice.

8.3.4 Demonstration of ALARP

A summary of the ALARP process undertaken for the environmental aspect is presented below. This process was completed as outlined in Section 6.1.2 and included consideration of all controls, analysis of the risk reduction proportional to the benefit gained and final acceptance or justification if the control was not considered suitable (refer Table 8-10). The result of this ALARP Assessment contributes to the overall acceptability of the impact or risk.

Table 8-10: Hydrocarbon release from a loss of well containment – ALARP assessment summary

Hierarchy of Control	Control Measure	Accept/ Reject	Reason	Performance Standard
Eliminate	None identified	N/A	N/A	-
Substitute	None identified	N/A	N/A	-
Administrate	NOPSEMA-accepted Well Operations Management Plan.	Accept	WOMP includes control measures for well integrity, well barrier management and well control to reduce the risk of an unplanned release of hydrocarbons. Control is legislative requirement. The control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.3.1**
	BHP Well Integrity Management System.	Accept	Well integrity management standards and procedures to reduce the risk of an unplanned release of hydrocarbons. Controls based on BHP requirements must be accepted. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.3.2**
	All intervention operations to be undertaken in accordance with BHP's Permit to Work System.	Accept	Controls based on BHP requirements must be accepted. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.3.3**
	Vessel Safety Case includes procedures and control measures for wireline and well intervention operations.	Accept	Testing of the LWI package (SID) includes wireline specification and function testing of control systems. Control is legislative requirement. The control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.3.4**
Pollution Control	Develop and maintain BHP *Crosby-3H1 Light Well Intervention Oil Pollution Emergency Plan (OPEP) (PYHSE-ER-0006).*	Accept	Implements response plan to quickly and efficiently deal with unplanned hydrocarbon spills in order to reduce impacts to the marine environment. Control is legislative requirement. The control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.3.5**
Additional Control Measures Considered				
Pollution Control	Dedicated resources (e.g. spill response equipment) on location to enable rapid response/ deployment.	Reject	Control would enable faster response time by having dedicated equipment resources on standby and in close proximity during the activity. Significant cost associated with this control considered grossly disproportionate compared to low risk of event.	-

ALARP Summary

The risk assessment and evaluation has identified a range of controls that when implemented are considered to manage the risk and impacts of an unplanned hydrocarbon release as a result of a loss of containment during the well intervention activities. The proposed control measures are typical for offshore activities undertaken elsewhere and in the Australian offshore petroleum an exploration industry. In the event of a spill, BHP's activity-specific OPEP (Appendix G) will be implemented. As no additional reasonably practicable control measures were identified to reduce the environmental risk of a loss of well containment and subsequent impact, the risks and impacts are considered ALARP.

8.3.5 Demonstration of Acceptability

BHP considers a range of factors when determining that a level of impact and risk to the environment is broadly acceptable, as summarised in Table 8-11.

Table 8-11: Demonstration of acceptability for a hydrocarbon release from a loss of well containment

Acceptability Criteria	Acceptability Criteria	Demonstration
Codes and Standards	Is the impact or risk being managed in accordance with relevant Australian or International legislation, Ministerial Conditions or standards?	Impacts and risks associated with an unplanned hydrocarbon release from a loss of well containment will be managed in accordance with relevant legislation, codes and standards, e.g. OPGGS Act (2006) and OPGGS (Environment) Regulations (2009) including WOMP and Vessel Safety Case, and BHP HSEC Controls.
Ecologically Sustainable Development (ESD)	Is the proposed impact consistent with the principles of ESD?	BHP undertakes petroleum activities in a manner that is consistent with its Charter values and Code of Business Conduct. In determining the level of acceptability of the effects of an unplanned hydrocarbon release from a loss of well containment, and guided by the Charter value of Sustainability, BHP has identified, assessed and controlled risks associated with this activity to minimise environmental impacts. BHP considers that this approach is consistent with the principles of ESD.
Internal Context		
BHP Charter and HSEC Management System compliance	Is the proposed impact or risk consistent with the requirements of BHP Our Requirements, Petroleum HSE Standard (PET-HSE00-HX-STD-00001) and HSEC Management Systems?	The management of unplanned hydrocarbon release as a result of a loss of well containment will be in compliance with BHP policies and management systems and will be consistent with activities authorised for areas adjacent to a World Heritage Area (WHA).
Professional judgement	Is the impact or risk being managed in accordance with industry best practice?	Controls identified in this plan are consistent with industry best practice and guidelines. Accepted controls that will be implemented are provided in Table 8-10.
ALARP	Are there any further reasonable and practicable controls that can be implemented to further reduce the impact or risk?	All reasonable and practicable controls have been assessed (Table 8-10), additional controls were considered but were found not to be justifiable in further reducing the impacts and risks of an unplanned hydrocarbon release from a loss of well containment without a gross disproportionate sacrifice. BHP considers that the residual risk of an unplanned hydrocarbon

Acceptability Criteria	Acceptability Criteria	Demonstration
		release from a loss of well containment has been demonstrated to be ALARP.
External Context		
Environmental best practice	Are controls in place to manage the impacts and risk to the environment that are commensurate with the nature and scale of any environmental sensitivities of the receiving environment?	The environmental performance outcomes, performance standards and measurement criteria that determine whether the outcomes and standards have been achieved are commensurate with the environmental significance of the receiving environment.
Stakeholder views	Do stakeholders have concerns / issues, and if so, have controls been implemented to manage their concerns / issues?	Stakeholders have been consulted about the petroleum activity (Section 5) and no stakeholder concerns have been raised regarding this aspect.

Acceptability Summary

The proposed management controls for preventing and minimising the risk of an unplanned hydrocarbon release from a loss of well containment are comprehensive and consistent with all relevant codes and standards.

The likelihood of a subsea hydrocarbon release from a loss of well containment is extremely low (rare) when considering industry statistics, and the preventative controls in place. The control measures to reduce the risk of an unplanned release from a loss of well containment event occurring (and minimising the impacts) include, but are not limited to the NOPSEMA-accepted WOMP and Vessel Safety Case, BHP well integrity management standards and procedures, and an activity-specific OPEP (Appendix G).

BHP is satisfied that when the accepted controls are implemented the impact and residual risk of an unplanned crude spill from a loss of well containment is considered ALARP. Furthermore, the adopted controls are considered to be consistent with good oilfield practice/ professional judgement and environmental best practice. All relevant controls were considered as part of the ALARP assessment, and as no other reasonably practicable additional controls were identified that would further reduce the impacts and risks without a grossly disproportionate sacrifice, the impacts and risks are considered ALARP.

With control measures in place, in line with the relevant actions prescribed in the recovery plans and approved conservation advice, the activity will be conducted in a manner that reduces potential impacts from an unplanned spill event to ALARP and an acceptable level.

BHP undertakes petroleum activities in a manner that is consistent with the APPEA Principles of Conduct and hence the principles of ESD. Stakeholders have been consulted about the Activity and no concerns were raised regarding this aspect. BHP undertakes regular consultation with relevant stakeholders about its operations/ activities providing them with sufficient and reasonable opportunities to raise any new concerns or issues for the duration of this activity. On this basis, it is considered that adherence to the performance standards will manage the impacts and risks of an unplanned hydrocarbon release from a loss of well containment to an acceptable level.

8.3.6 Environmental Performance Outcome, Performance Standards and Measurement Criteria

Environmental Performance Outcome	Environmental Performance Standard	Measurement Criteria
No accidental release of hydrocarbons to the marine environment from a loss of well containment.	**PS 8.3.1** **Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations, 2011: Accepted Well Operations Management Plan (WOMP) (PYAIMS-PS-0005); Pyrenees Well Integrity Management System (PYAIMS-PS-0005-0002)**: Pyrenees wells, of which Crosby-3H1 is one, are managed in accordance with approved WOMP, which includes well integrity management to prevent the risk of unplanned hydrocarbon releases.	Acceptance letter from NOPSEMA demonstrated WOMP accepted by regulatory prior to commencement of well intervention activities.
	PS 8.3.2 **BHP Petroleum Well Integrity Standard (DR-STD-PET-DC-0193); BHP Petroleum Well Control Standard (DR-STD-PET-0211); Pyrenees Well Integrity Management System (PYAIMS-PS-0005-0002:** Two well barriers shall be in place that isolate the wellbore prior to commencement of well intervention activities. Well Primary Barrier and Barrier Elements. Well Secondary Barrier and Barrier Elements. Redundant Barrier Elements. Barrier verification pressure testing and well barrier analysis. Shut-in procedures. Well handover/acceptance and handback/acceptance will be documented. Personnel who perform well integrity associated activities shall be trained and competent to perform tasks assigned to them.	Records of well barrier verification including testing records (critical elements list) and pressure testing in daily report. Shut-in procedure testing records. Records of well handover/acceptance and handback/acceptance. Records demonstrate competencies of crew with tasks associated with well integrity.
	PS 8.3.3 **BHP Petroleum HSE Standard (PET-HSE00-HX-STD-00001):** All intervention operations to be undertaken in accordance with BHP's Permit to Work System.	Permit to Work (PTW) for all intervention activities approved and signed by the Ultimate Work Authority.
	PS 8.3.4 **Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations: NOPSEMA-accepted Vessel Safety Case**: The LWI package (SID) will include, but not limited to, the following: • Well intervention and wireline operating procedures. • Well barrier testing including those associated with SID and existing barriers on well (e.g. XT valves).	Records demonstrate well intervention and wireline operations managed in accordance with vessel and BHP work instructions and procedures. Vessel audit and inspection records verify LWI package in compliance with Vessel Safety Case provisions, e.g. procedures, control measures, certification and maintenance requirements for LWI equipment.

	• Certification and maintenance requirements for LWI equipment. • Safety management system including Safety Critical Procedures. • Functional ROVs to allow manual override to allow intervention and control of primary well control barriers. • Well service system (hoses/valves, etc.) to allow access to wellbore via SID. • Autonomous Emergency Shutdown procedures.	Records demonstrate well barrier testing including those associated with SID and existing barriers on well.
	PS 8.3.5 ***BHP Crosby-3H1 Light Well Intervention Oil Pollution Emergency Plan (OPEP) (PYHSE-ER-0006)*:** Crosby-3H1 Light Well Intervention OPEP developed and maintained for the duration of the well intervention activities. Oil spill response executed in accordance with OPEP.	Review of incident response report in line with BHP Crosby-3H1 Light Well Intervention OPEP in the event of a diesel spill.

8.4 Hydrocarbon Release – Loss of Flowline Inventory

8.4.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Acceptability
Loss of inventory (flowline) from dropped object	Loss of hydrocarbons (crude oil) to the marine environment.	Temporary and localised reduction in water quality with potential for toxicity effect to marine fauna and flora in localised area.	10	Highly Unlikely (0.03)	0.3	Tolerable

8.4.2 Source of Risk

During the well intervention activities, the LWI vessel will be operating in the proximity of operationally active subsea infrastructure. Consequently, there is the potential for a dropped object (during lifting) or loss of control of a suspended load to land onto subsea infrastructure and result in damage to (severing/ rupture) of a production flowline or production jumper leading to a subsea release of hydrocarbons (crude oil).

A review of the subsea infrastructure in the operational area identified the following:

- Crosby-3H1 6" production jumper: runs from the Crosby-3H1 XT to Crosby manifold-2; 103 m in length, with an inventory of 1.88 m^3;
- Ravensworth 10" production flowline, located 19.6 m from Crosby-3H1 well, with an inventory of 176.8 m^3. Total loss of inventory calculated as 204 m^3 as includes riser (length 534 m / volume 204 m^3): 204 m^3.

The worst-case subsea loss of containment is defined as a loss of the entire inventory of the 10" Ravensworth production flowline (204 m^3). This scenario is an instantaneous release based on complete severing of the flowline and assumes that only the inventory of the flowline and riser is released due to activation of the isolation at the Ravensworth 2 manifold.

8.4.3 Environmental Impact Assessment

The potential volume of release due to a rupture of subsea infrastructure is less than the scenario of 1,930 m^3 from a loss of well control (Section 8.3); hence environmental impacts of this scenario are covered in the worst-case EMBA and not discussed further here.

8.4.4 Demonstration of ALARP

A summary of the ALARP process undertaken for the environmental aspect is presented below. This process was completed as outlined in Section 6.1.2 and included consideration of all controls, analysis of the risk reduction proportional to the benefit gained and final acceptance or justification if the control was not considered suitable (refer Table 8-12). The result of this ALARP Assessment contributes to the overall acceptability of the impact or risk.

Table 8-12: Loss of flowline inventory – ALARP assessment summary

Hierarchy of Control	Control Measure	Accept/ Reject	Reason	Performance Standard
Substitute	None identified	N/A	N/A	-
Separate	Safe deployment zone for deploying equipment from the vessel.	Accept	Reduces the likelihood of dropped objects landing on subsea infrastructure through deployment of equipment overboard from the vessel only when it is positioned in a safe deployment zone (i.e. vessel not positioned above subsea flowlines, jumpers, etc.). Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.4.1**
Administrate	Minimise dropped object risk during lifting activities through implementation of work (lifting) procedures and competent/certified crew.	Accept	Reduces the likelihood of dropped objects through procedures and standards for lifting equipment inspection and maintenance, lifting procedures, and competent/ certified crew undertaking lifting tasks. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.4.2**
	Lifting gear on vessel's preventative maintenance system.	Accept	Reduces the likelihood of dropped objects as lifting equipment is operating within its parameters. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.4.2**
Pollution Control	Emergency shutdown valve activation.	Accept	Emergency shutdown valves activated to isolate inventory from pipework and riser systems.	**PS 8.4.3**
	Develop and maintain BHP *Crosby-3H1 Light Well Intervention Oil Pollution Emergency Plan (OPEP) (PYHSE-ER-0006).*	Accept	Implements response plan to quickly and efficiently deal with unplanned hydrocarbon spills in order to reduce impacts to the marine environment. Control is legislative requirement. The control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.4.4**
Additional Control Measures Considered				
Eliminate	Eliminate lifting in the field	Reject	This control would eliminate the risk of dropped objects; however, lifting is an essential component of the LWI activities and cannot be eliminated.	-
Engineer	Pre-flushing of production jumper with gas back to FPSO	Reject	Pre-flushing of jumper would minimise oil volumes released in the event of a dropped object compromising production jumper integrity. Based on the low risk and low release volume from production jumper, this control is considered not practicable for low environmental benefit.	-
	Shut-off Ravensworth wells	Reject	Reduces volume of hydrocarbons released in the highly unlikely event of a dropped object landing on production flowline. This would require production to cease and significant production downtime. Based on the low risk and significant cost to production, this control is considered not reasonably practicable.	-

ALARP Summary

The use of the DP system by the LWI vessel avoids the need for anchoring when undertaking works in close proximity to subsea infrastructure, thus eliminating the risk of a dropped anchor on a flowline. A review of the potentially active commercial fisheries (Section 4.11.3) along with consultation undertaken during the development of this EP (Section 5), determined a low likelihood of active commercial fishing in the area, as such, there is a very low risk of a ruptured flowline resulting from commercial fishing activities (i.e. trawling, anchoring).

The risk assessment and evaluation has identified a range of controls that when implemented are considered to manage the risk of hydrocarbon loss from subsea infrastructure as a result of dropped objects. Lifting of equipment cannot be eliminated during the LWI activities. Lifting procedures and inspection/testing requirements for lifting equipment are the key dropped object prevention control reducing the risk of dropped objects onto the subsea production infrastructure.

No additional or alternative controls were identified that could further reduce the risk and impact of a spill to the marine environment. The extensive mitigation and management controls outlined are therefore considered to reduce the risks and impacts to ALARP.

8.4.5 Demonstration of Acceptability

BHP considers a range of factors when determining that a level of impact and risk to the environment is broadly acceptable, as summarised in Table 8-13.

Table 8-13: Demonstration of acceptability for loss of flowline inventory

Acceptability Criteria	Acceptability Criteria	Demonstration
Codes and Standards	Is the impact or risk being managed in accordance with relevant Australian or International legislation, Ministerial Conditions or standards?	Impacts and risks associated with an unplanned hydrocarbon release from a loss of flowline inventory will be managed in accordance with relevant BHP Petroleum Controls.
Ecologically Sustainable Development (ESD)	Is the proposed impact consistent with the principles of ESD?	BHP undertakes petroleum activities in a manner that is consistent with its Charter values and Code of Business Conduct. In determining the level of acceptability of the effects of an unplanned hydrocarbon release from a loss of flowline inventory, and guided by the Charter value of Sustainability, BHP has identified, assessed and controlled risks associated with this activity to minimise environmental impacts. BHP considers that this approach is consistent with the principles of ESD.
Internal Context		
BHP Charter and HSEC Management System compliance	Is the proposed impact or risk consistent with the requirements of BHP Our Requirements, Petroleum Standard and HSEC Management Systems?	Risks and impacts of an unplanned hydrocarbon release from a loss of flowline inventory will be in compliance with BHP policies and management systems and will be consistent with activities authorised for areas adjacent to a World Heritage Area (WHA).
Professional judgement	Is the impact or risk being managed in accordance with industry best practice?	Controls identified in this plan are consistent with industry best practice and guidelines. Accepted controls that will be implemented are provided in Table 8-12.

Acceptability Criteria	Acceptability Criteria	Demonstration
ALARP	Are there any further reasonable and practicable controls that can be implemented to further reduce the impact or risk?	All reasonable and practicable controls have been assessed (Table 8-12), additional controls were considered but were found not to be justifiable in further reducing the impacts and risks of an unplanned hydrocarbon release resulting from a loss of flowline inventory without a gross disproportionate sacrifice. BHP considers that the residual risk of an unplanned hydrocarbon release from a loss of flowline inventory has been demonstrated to be ALARP.
External Context		
Environmental best practice	Are controls in place to manage the impacts and risk to the environment that are commensurate with the nature and scale of any environmental sensitivities of the receiving environment?	The environmental performance outcomes, performance standards and measurement criteria that determine whether the outcomes and standards have been achieved are commensurate with the environmental significance (i.e. a WHA) of the receiving environment.
Stakeholder views	Do stakeholders have concerns / issues, and if so, have controls been implemented to manage their concerns / issues?	Stakeholders have been consulted about the petroleum activity (Section 5) and no stakeholder concerns have been raised regarding this aspect.

Acceptability Summary

The proposed management controls for preventing and minimising the risk of a release of hydrocarbons from subsea infrastructure are comprehensive and consistent with all relevant codes and standards and good oilfield practice. No reasonably practicable additional controls have been identified that would provide a significant net environmental benefit.

The magnitude of the spill is unlikely to be greater than 204 m^3. The offshore oceanic location is such that any spills would be rapidly diluted and dispersed, with any environmental effects being temporary and localised, with significant impacts not expected owing to the short exposure timeframe.

In summary, all relevant controls were considered as part of the ALARP assessment, and as no other reasonable additional controls were identified that would further reduce the impacts and risks of an unplanned spill from subsea infrastructure without a gross disproportionate sacrifice, the impacts and risks are considered ALARP. BHP undertakes regular consultation with relevant stakeholders about its operations/ activities providing them with sufficient and reasonable opportunities to raise any new concerns or issues for the duration of this activity.

BHP is satisfied that when the accepted controls are implemented that the impact and residual risk of an accidental release of hydrocarbons from subsea infrastructure from dropped objects is considered ‘ALARP’ and that adherence to the performance standards will manage the impacts and risks to an acceptable level.

8.4.6 Environmental Performance Outcome, Performance Standards and Measurement Criteria

Environmental Performance Outcome	Environmental Performance Standard	Measurement Criteria
No accidental release of hydrocarbons from flowlines	**PS 8.4.1** Safe deployment zone for deploying equipment from the vessel.	Records demonstrate vessel positioned in safe deployment zone prior to deployment of equipment overboard.
	PS 8.4.2 **Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations: Accepted Vessel Safety Case**: Lifting operations managed in accordance with vessel work instructions and procedures. Vessel Safety Case includes control measures for dropped objects: • Lifting equipment certification and inspection • Heavy-lift procedures • Preventative maintenance on lifting gear (e.g. cranes) Lifting crew competencies/ certification.	Lifting operations managed in accordance with vessel work instructions and procedures. Vessel audit and inspection records verify work (lifting/ operating) procedures in place, lifting crew competencies and lifting gear on PMS.
	PS 8.4.3 **BHP Petroleum Well Integrity Standard (DR-STD-PET-DC-0193); Pyrenees Well Integrity Management System (PYAIMS-PS-0005-0002):** Emergency shutdown functions will be implemented to safeguard the process from escalation due to an upset condition to minimise loss of hydrocarbon containment.	Documented shut-in protocol in place and direct communication between LWI vessel and Pyrenees FPSO Control Room prior commencement of lifting operations. Records demonstrate Emergency Shutdown initiated to minimise loss of hydrocarbon inventory in the event of a dropped object severing flowline.
	PS 8.4.4 ***BHP Crosby-3H1 Light Well Intervention Oil Pollution Emergency Plan (OPEP) (PYHSE-ER-0006)*:** Crosby-3H1 Light Well Intervention OPEP developed and maintained for the duration of the well intervention activities. Oil spill response executed in accordance with OPEP.	Review of incident response report in line with BHP Crosby-3H1 Light Well Intervention OPEP in the event of a hydrocarbon spill.

8.5 Hydrocarbon Release – Vessel Collision

8.5.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Acceptability
Vessel collision resulting in fuel tank rupture	Loss of hydrocarbons (marine diesel oil) to the marine environment	Temporary and localised reduction in water quality with potential for toxicity effects to marine fauna and flora, oiling of offshore, nearshore and shoreline habitats. Impacts to socio-economic receptors.	30	Highly Unlikely (0.03)	0.9	Tolerable

8.5.2 Source of Risk

The presence of the LWI vessel in the operational area for the duration of the well intervention activities (up to 14 days) presents a navigational hazard to third-party vessels. Collisions between the LWI vessel and other vessels was identified as a credible risk. A vessel collision has the potential to result in the rupture of a fuel tank and the release of marine diesel oil. A review of the potentially active commercial fisheries (Section 4.11.3) along with consultation undertaken during the development of this EP (Section 5), determined a low likelihood of active commercial fishing in the area, as such, there is a very low risk of a vessel collision with a commercial fishing vessel.

Marine grade oil (diesel) is stored on-board the vessel as a fuel for vessel engines and generators. There will be no bunkering in the offshore operational area and so the potential for significant release of hydrocarbons to the marine environment is limited to a loss of bulk storage fuel on the vessel as a result of a fuel tank rupture from a vessel collision.

The LWI vessel has a total marine fuel oil capacity 1,480 m^3 that is distributed through a number of isolated tanks and with the largest fuel tank being 186 m^3. In the unlikely event of a vessel collision involving the LWI vessel during the well intervention activities, the vessel have the capability to pump fuel from the ruptured tank to a tank with spare volume capacity in order to reduce the potential volume of fuel released to the marine environment.

Oil Spill Modelling Results

Hydrocarbon Weathering Behaviour

MDO is a moderate weight, moderately persistent oil in the marine environment. Results of the weathering analysis are shown in Figure 8-5 and are summarised as follows. Under low winds (1 m/s), 60% of the surface slick is predicted to remain after 120 hours (5 days). Under moderate winds (5 m/s), 40% of the initial surface slick is predicted to remain after 24 hours, decreasing further to approximately 10% after 48 hours and ~1% after 72 hours. With high winds (10 m/s), the surface slick is predicted to be almost entirely evaporated and dispersed after 12 hours. The MDO has a very low tendency for emulsion formation, with only ~1% water contained entrained into the surface slick after 120 hours for all wind conditions assessed (Figure 8-5).

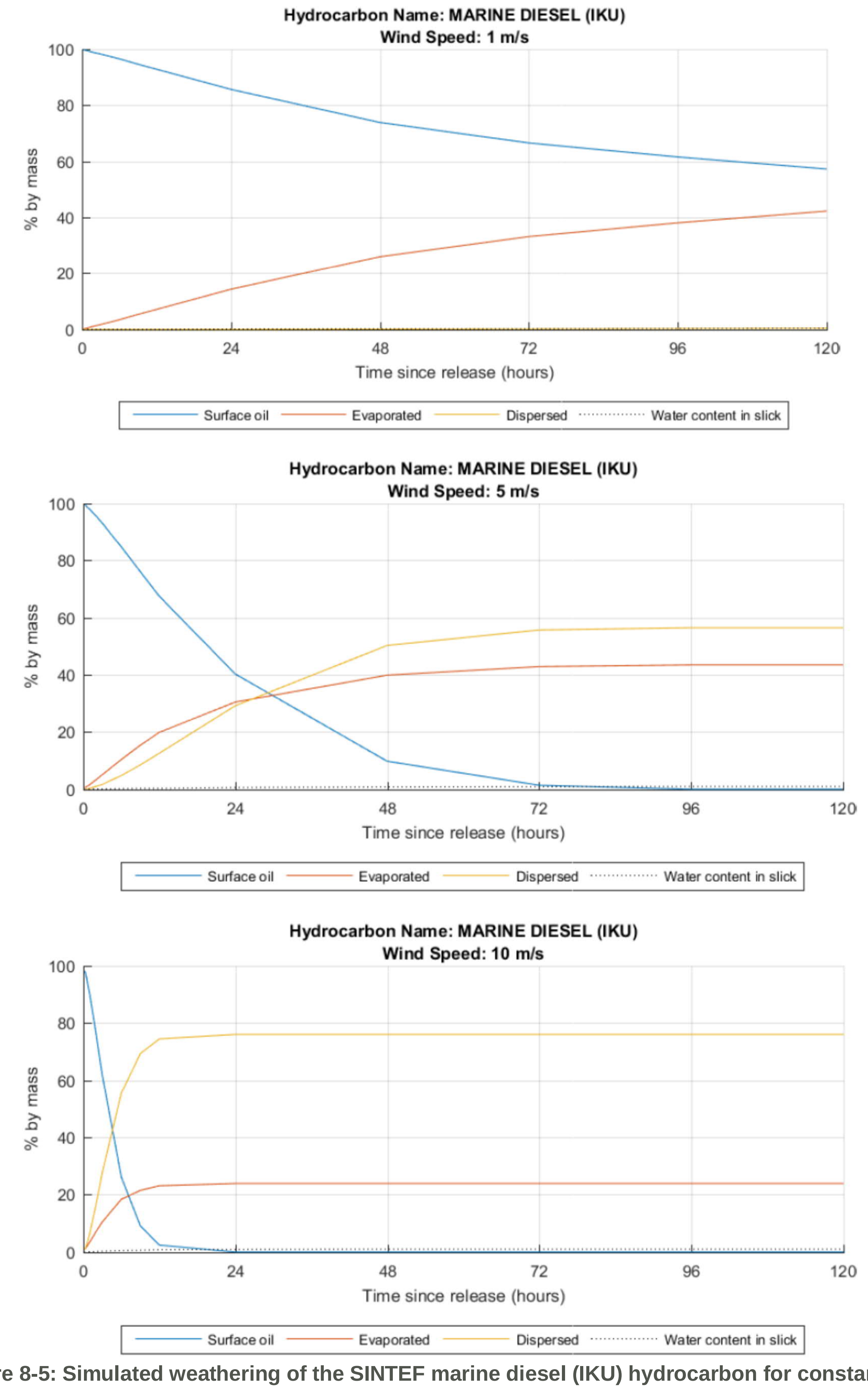


Figure 8-5: Simulated weathering of the SINTEF marine diesel (IKU) hydrocarbon for constant wind speeds of 1 m/s (top), 5 m/s (middle) and 10 m/s (bottom) (GHD, 2020)

The modelling results are presented for the fate hydrocarbons at the hydrocarbon exposure values defined in Section 8.2.5. The spatial extent of the MDO release is presented in Figure 4-1. The outer extent of the MDO EMBA shown is derived from the oil spill modelling defined using the low exposure values (Table 8-9) and is based on the combined area of contact for all hydrocarbon phases (surface oil, dissolved oil, total submerged oil and shoreline accumulated oil).

Sea Surface Hydrocarbons

Low exposure (>1 g/m^2)

Surface hydrocarbons at the low exposure value were predicted to travel up to 250 km to the southwest and 140 km northwest and northeast of the release location.

Moderate exposure (>10 g/m^2)

Surface hydrocarbons at the moderate exposure value were predicted to travel 160 km to the southwest and 90 km to the northwest and northeast of the release location.

High exposure (>50 g/m^2)

Surface hydrocarbons at the high exposure value were predicted to be limited to ~90 km of the release location.

Sensitive receptors predicted to be contacted at the low, moderate and high exposure values are:

- Muiron Islands;
- Ningaloo Region;
- State Marine Parks: Muiron Islands, Ningaloo
- Australian Marine Parks: Gascoyne; Ningaloo

Dissolved Hydrocarbons

Low exposure (>10 ppb)

Dissolved hydrocarbons at the low exposure value were predicted to travel up to 210 km to the southwest and 130 km to the northwest and northeast of the release location. Sensitive receptors predicted to be contacted at the low exposure values are:

- Muiron Islands;
- Ningaloo Region;
- State Marine Parks: Muiron Islands, Ningaloo
- Australian Marine Parks: Gascoyne; Ningaloo

Moderate exposure (>50 ppb)

Dissolved hydrocarbons at the moderate exposure value were predicted to travel 140 km to the southwest and 80 km to the north and northeast of the release location. Sensitive receptors predicted to be contacted at the moderate exposure value are:

- Muiron Islands;
- Ningaloo Region;
- State Marine Parks: Muiron Islands, Ningaloo
- Australian Marine Parks: Gascoyne; Ningaloo

High exposure (>400 ppb)

Dissolved hydrocarbons at the high exposure value were predicted to travel 40 km to the east-southeast of the release location. Sensitive receptors predicted to be contacted at the high exposure values are:

- Muiron Islands;
- State Marine Parks: Muiron Islands

Total Submerged Hydrocarbons (entrained plus dissolved)

Low exposure (>10 ppb)

Total submerged hydrocarbons at the low exposure value were predicted to travel up to 250 km to the southwest, 150 km west and 140 km to the northeast of the release location. Sensitive receptors predicted to be contacted at the low exposure value are:

- Muiron Islands;
- Ningaloo Region;
- Onslow Region
- State Marine Parks: Muiron Islands, Ningaloo
- Australian Marine Parks: Gascoyne; Ningaloo

Moderate exposure (>100 ppb)

Total submerged hydrocarbons at the moderate exposure value were predicted to travel 150 km to the southwest and limited to with 80 km of the release location in all other directions. Sensitive receptors predicted to be contacted at the moderate exposure value are:

- Muiron Islands;
- Ningaloo Region;
- State Marine Parks: Muiron Islands, Ningaloo
- Australian Marine Parks: Gascoyne; Ningaloo

Shoreline Accumulated Hydrocarbons

Low exposure (>10 g/m^2)

Shoreline accumulated hydrocarbons above the low exposure value were predicted to occur between the Ningaloo Region (150 km to the south-southwest) and Barrow Island (160 km to the northeast). Maximum predicted shoreline accumulations were 0.7 tonnes (Barrow Island), 40 tonnes (Muiron Islands) and 45 tonnes (Ningaloo Region), with minimum arrival times of 6 days, 1 day and 0.9 days, respectively. The maximum shoreline lengths were 5.7 km at Barrow Island, 11.3 km at the Muiron Islands and 41.1 km at Ningaloo Region. No other receptor regions were contacted at shoreline accumulation above the low exposure value.

Out of the 120 realisations, 26 of them (22%) received shoreline accumulation above the low exposure threshold. Among these six realisations (5%) exceeded 1 tonne of shoreline accumulated oil, three received approximately 2 tonnes and the other three received between 29 and 45 tonnes. The three highest shoreline loading events occurred for simulation beginning in June, July or August.

Moderate exposure (>100 g/m^2)

Shoreline accumulated hydrocarbons above the moderate exposure value were predicted to occur only up to 70 km to the south-southwest at the Ningaloo Region and 40 km to the east-southeast at the Muiron Islands. Maximum predicted shoreline accumulations at these two receptors were similar with 40 and 45 tonnes at the Muiron Islands and Ningaloo Region, respectively. Similar minimum arrival times were predicted of 1 day

(Muiron Islands) and 0.9 days (Ningaloo Region). The maximum shoreline lengths were 2.8 km at Ningaloo Region and 8.5 km at the Muiron Islands. No other receptor regions were contacted at shoreline accumulation above the moderate exposure value.

High exposure (>1,000 g/m^2)

Surface hydrocarbons above the high exposure value were predicted to be limited to one area of the Ningaloo Region 40 km south of the release site and at the Muiron Islands 40 km to the east-southeast of the release location. Shoreline loadings were similar to those at the moderate exposure value, 36 tonnes at the Muiron Islands and 45 tonnes at the Ningaloo Region, although maximum shoreline lengths were reduce to 2.8 km at the Muiron Islands and 1.4 km at the Ningaloo Region.

Table 8-14: Summary of spill modelling results for sensitive receptors with contact at moderate & high exposure values: 186 m^3 MDO spill scenario

Receptor	Receptor Type	Minimum Time to Contact (Days)							Maximum Hydrocarbon Concentration							Max. Oil Ashore (tonnes)	Max. Length of Oiled Shoreline (km)
		Moderate Exposure				High Exposure			Moderate Exposure				High Exposure				
		Shoreline accumulation (>100 g/m^2)	Surface Oil (>10 g/m^2)	Total Submerged Oil (>100 ppb)	Dissolved Oil (>50 ppb)	Shoreline accumulation (>1,000 g/m^2)	Surface Oil (>50g/m^2)	Dissolved Oil (> 400 ppb)	Shoreline accumulation (>100 g/m^2)	Surface Oil (>10 g/m^2)	Total Submerged Oil (>100 ppb)	Dissolved Oil (>50 ppb)	Shoreline accumulation (>1,000 g/m^2)	Surface Oil (>50g/m^2)	Dissolved Oil (> 400 ppb	Shoreline accumulation (>100 g/m^2)	Shoreline accumulation (>100 g/m^2)
Receptor Areas																	
Muiron Islands	Islands and Reefs	1.0	1.7	3.3	0.8	1.0	0.8	1.5	12,784	52.4	761.5	367.3	12,784	52.4	444.8	39.8	8.5
Ningaloo Region	Intertidal (mainland)	0.9	5.8	4.2	1.1	1.1	3.3	NC	15,857	70.3	276.5	150.8	15,857	70.3	NC	44.9	2.8
Marine Protected Areas																	
Muiron Islands Marine Park	State Marine Park	NC	0.8	0.8	0.8	NC	1.2	1.5	NC	52.4	761.5	367.3	NC	52.4	444.8	NC	NC
Ningaloo Marine Park	State Marine Park	NC	1.0	0.8	0.8	NC	1.0	NC	NC	116.7	624.0	224.3	NC	116.7	NC	NC	NC
Gascoyne AMP	Australian Marine Park	N/A	0.3	0.4	0.4	N/A	0.3	NC	N/A	127.3	924.4	323.9	N/A	127.3	NC	N/A	N/A
Ningaloo AMP	Australian Marine Park	N/A	0.3	0.3	0.3	N/A	0.3	NC	N/A	127.7	506.7	217.0	N/A	127.7	NC	N/A	N/A
Key Ecological Features																	
Continental slope demersal fish communities	KEF	N/A	0.1	0.1	0.1	N/A	0.1	NC	N/A	155.4	896.9	369.4	N/A	155.4	NC	N/A	N/A
Ancient coastline at 125-m depth contour	KEF	N/A	0.4	0.6	0.6	N/A	0.4	NC	N/A	128.2	375.8	132.5	N/A	128.2	NC	N/A	N/A

Receptor	Receptor Type	Minimum Time to Contact (Days)							Maximum Hydrocarbon Concentration							Max. Oil Ashore (tonnes)	Max. Length of Oiled Shoreline (km)
		Moderate Exposure				High Exposure			Moderate Exposure				High Exposure				
		Shoreline accumulation ($>100\ g/m^2$)	Surface Oil ($>10\ g/m^2$)	Total Submerged Oil (>100 ppb)	Dissolved Oil (>50 ppb)	Shoreline accumulation ($>1{,}000\ g/m^2$)	Surface Oil ($>50 g/m^2$)	Dissolved Oil (> 400 ppb)	Shoreline accumulation ($>100\ g/m^2$)	Surface Oil ($>10\ g/m^2$)	Total Submerged Oil (>100 ppb)	Dissolved Oil (>50 ppb)	Shoreline accumulation ($>1{,}000\ g/m^2$)	Surface Oil ($>50 g/m^2$)	Dissolved Oil (> 400 ppb	Shoreline accumulation ($>100\ g/m^2$)	Shoreline accumulation ($>100\ g/m^2$)
Canyons linking Cuvier Abyssal Plain and the Cape Range Peninsula	KEF	N/A	0.1	0.1	0.1	N/A	0.1	NC	N/A	160.0	744.6	244.2	N/A	160.0	NC	N/A	N/A
Commonwealth waters adjacent to Ningaloo Reef	KEF	N/A	0.3	0.3	0.3	N/A	0.3	NC	N/A	127.7	506.7	217.0	N/A	127.7	NC	N/A	N/A

8.5.3 Environmental Impact Assessment

A loss of MDO to the marine environment would result in a localised and temporary reduction in water quality in the upper surface waters of the water column. While MDOs are generally considered to be non-persistent oils, many contain a small present by volume of hydrocarbons that are classified as present.

When spilt at sea, MDOs will spread and thin out quickly and more than half of the volume can be lost to evaporation. Due to their higher solubility and ease of entrainment, MDO spills can have a greater ecological impact in comparison to other floating oils slicks. There is a low probability (2.5%) of relatively low volumes (<45 tonnes) reaching the Muiron Islands and Ningaloo Region at the moderate exposure value.

The following environmental impact assessment is based on potential impacts and risks to the physical environment and biological and socio-economic receptors within the area affected by hydrocarbons at the moderate exposure value.

Local Fauna and Threatened and Migratory Fauna

Marine Mammals

Whales and dolphins spend a significant time at the sea surface in search of food and to breathe, as such if they are in the vicinity of the spill location, they are likely to come into contact with MDO. However, as they are smooth skinned, hairless mammals, MDO tends not to adhere to their skin, limiting the potential impacts of oiling.

Whales and dolphins are not predicted to be impacted by entrained/dissolved hydrocarbons in the water column since they are mobile species and not likely to be constantly exposed for extended durations that would be required to cause any major toxic effects. Given the size of the spill and expected rapid evaporation and dispersion rate, impacts to marine mammals are expected to be low.

At the moderate exposure level, a number of threatened and migratory mammals are considered at risk of impact from contact with surface and water column hydrocarbons including sei, pygmy blue, fin, southern right, humpback, Bryde’s, Antarctic minke, orcas, and sperm whales; Indo-Pacific humpback and spotted bottlenose dolphins, and dugongs. Of these, the humpback whale (migration and resting), pygmy blue whale (distribution, foraging and migration) and dugong (nursing, breeding, calving and foraging) BIAs overlap the moderate exposure value area. An unplanned release of MDO is not expected to interfere with their migration activity. There is the potential for behaviour disruption to the local population and individuals that traverse the spill area. Owing to the rapid dispersion and evaporation of MDO, impacts are not predicted at the population level.

Marine Reptiles

Marine reptiles (turtles and seasnakes) may be exposed to surface and water column hydrocarbons through direct contact resulting in eye and skin damage, ingestion, consumption of contaminated prey items and prolong inhalation of diesel vapour. Ingestion can subsequently lead to physiological effects including internal organ damage. Coasting of their body surface can cause irritation of mucous membranes in the nose through and eyes that can result in inflammation and infection.

Due to the weathering nature of MDO, a spill rapidly and thinly consequently marine reptiles are not expected to ingest significant volumes or result in persistent oiling. Most evaporation of MDO is within the first 48 hours, hence exposure timeframes to vapours is short.

While marine turtle nesting beaches may be contacted by MDO, turtles will always nest above the high tide mark and any MDO moving through the beach profile is not predicted to come into contact with nests. Should an unplanned MDO spill coincide with marine turtle nesting or young emerging from the nests, adults and hatchlings would be at risk of exposure to MDO that accumulates on nesting beaches. At the moderate exposure level, low volumes of MDO (40 to 45 tonnes) is predicted to accumulate on shorelines at the Murion Islands and Ningaloo Region.

At the moderate exposure level, a number of threatened and migratory marine reptile species are considered at risk of impact from contact with surface and water column hydrocarbons including flatback, green, hawksbill, loggerhead and leatherback turtles; and snort-nosed seasnakes. Of these, all of the marine turtles listed have

BIAs (inter-nesting and nesting) that overlap the moderate exposure value area. There is the potential for impacts to individuals that traverse the spill area. Owing to the rapid dispersion and evaporation of MDO, impacts are not predicted at the population level.

Fish (including Sharks and Rays and Commercial Species)

Pelagic fish that spend their time in the upper water column will be at greatest risk of impact from surface and water column hydrocarbons. Pelagic fish are highly mobile and species likely to be include predatory species such as tuna, billfish, mackerel and sharks, as well as rays and sawfish.

Fish near the sea surface are thought to be able to detect and avoid contact with surface slicks and mortalities rarely occur in the event of a hydrocarbon spill in open waters. Those fish that do come into contact with surface and water column hydrocarbons will be affected by smothering through coating of gill structure leading to suffocation or through ingestion leading to potential infection and internal organ or tissue damage.

At the moderate exposure level, a number of threatened and migratory fish species are considered at risk of impact from contact with surface and water column hydrocarbons including grey nurse, white, shortfin, longfin mako, and whale sharks; reef and giant manta rays; and sawfish (dwarf, green and narrow). Of these, whale shark (foraging) BIAs overlap the moderate exposure value area. Key aggregations occur off the Ningaloo coast (March to June) associated with high density prey, with largest numbers generally recorded in April. There is the potential for feeding behaviour disruption to the local population and individuals that traverse the spill area should the timing of the spill coincide with timing of whale shark aggregations. Owing to the rapid dispersion and evaporation of MDO, impacts are not predicted at the population level.

Marine Birds

Marine birds are at risk of exposure to MDO from diving to obtain food or resting on the sea surface. Impact pathways arise from direct oiling, exposure to oil vapours, and direct or indirect ingestion of oil and contaminated food prey. Ingestion can lead to intestinal damage and reproductive effects. Oiling of feathers can affect the bird’s ability to thermo-regulate (IPIECA-IOGP, 2017). Due to the weathering nature of MDO, surface oil spreads rapidly and thinly, and hence marine birds are not expected to ingest significant volumes or result in persistent heavy oiling.

While marine seabirds may be contacted by MDO in the offshore environment, migratory shorebirds are at risk of contact with MDO that reaches and accumulates on shorelines at the Muiron Islands and the Ningaloo Region, albeit a low volumes (40 to 45 tonnes respectively). Shorebirds are at risk of contact with accumulated hydrocarbons as they roost, feed and breed on shorelines, although they tend to roost and nest above the high water mark.

At the moderate exposure level, a number of threatened and migratory bird species are considered at risk of impact from contact with surface and water column hydrocarbons including petrels (southern giant, soft-plumaged), terns (roseate and fairy), shearwaters (wedge-tailed, streaked), Campbell albatross, lesser frigatebird, common noddy and osprey. Of these, wedge-tailed shearwater (breeding), roseate and fairy terns (breeding), and lesser crested tern (breeding) BIAs overlap the moderate exposure value area.

At the moderate exposure level, a number of threatened and migratory species are also considered at risk of impact from contact with shoreline accumulated hydrocarbons that includes red knot, godwits (bar-tailed, Northern Siberian bar-tailed), eastern curlew, sandpipers (common, curlew, pectoral, sharp-tailed), oriental plover, oriental pratincole, Australian painted snipe, fork-tailed swift, and common greenshank.

Protected Areas

Several protected areas and key ecological features (KEFs) overlap with the moderate hydrocarbon exposure area:

- State Marine Parks: Muiron Islands and Ningaloo
- Australian Marine Parks: Gascoyne and Ningaloo
- Key ecological features:
    - Continental slope demersal fish communities

- Ancient coastline at 125-m depth contour
- Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula; and
- Commonwealth waters adjacent to Ningaloo Reef.

Socio-Economic Receptors

There is the potential for hydrocarbons to temporarily disrupt fishing activities if surface or water column hydrocarbons move through fishing areas. Fishing grounds may be temporarily closed, which would have an impact through loss of income. Market value/ demand for fish may also be impacted due to actual or perceived tainting of catches. Any impacts to fish stock are predicted to be low and temporary due to the low volume of MDO released and the rapid dispersal and evaporation of MDO. Potential direct impacts to fish and planktonic fish larvae are described in relevant previous sections.

Offshore petroleum activities are not predicted to be affected by a MDO spill. Given the nature of the spill, it is plausible that temporary exclusion zones could be enforced as a safety or navigation control measure, thereby restricting vessels from operating in the area. However, given the rapid dispersion and evaporation of MDO impacts are predicted to be temporary.

Shipping operations are not predicted to be affected by a MDO spill. However, response activities may result in temporary diversions from normal shipping routes.

Tourism and recreation could be affected by spill MDO, either from reductions in water quality and shoreline oiling resulting in temporary loss of access or reduction in aesthetic value of the area.

Defence activities, as well as maritime and indigenous heritage are not predicted to be affected by an MDO spill.

8.5.4 Demonstration of ALARP

A summary of the ALARP process undertaken for the environmental aspect is presented below. This process was completed as outlined in Section 6.1.2 and included consideration of all controls, analysis of the risk reduction proportional to the benefit gained and final acceptance or justification if the control was not considered suitable (refer Table 8-15). The result of this ALARP Assessment contributes to the overall acceptability of the impact or risk.

Table 8-15: Hydrocarbon release from a vessel collision – ALARP assessment summary

Hierarchy of Control	Control Measure	Accept/ Reject	Reason	Performance Standard
Eliminate	None identified	N/A	N/A	-
Substitute	None identified	N/A	N/A	-
Engineer	Navigation (including lighting, compass/radar), bridge and communication equipment will be compliant with appropriate marine navigation and vessel safety requirements.	Accept	Legislative requirements to be followed reduce the likelihood of interference with other marine users. The control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.5.1**
Separate	Establishment of a 500-m safety exclusion zone around the LWI vessel.	Accept	Control is based on legislative requirements and must be accepted; reduces likelihood of vessel collision with third parties. The control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.5.2**

Administrate	Crew undertaking vessel bridge-watch will be qualified with International Convention of STCW95, AMSA Marine Order – Part 3: Seagoing Qualifications or certified training equivalent.	Accept	Notifications provides other marine users with information regarding activities or hazards and will include details of relevant vessel. Controls based on BHP requirements must be accepted. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.5.1**
	Notification of details (e.g. location, duration, etc.) of well intervention activities to AMSA which triggers issue of Maritime Safety Information (MSI) notifications and to the Australian Hydrographic Service (AHS) which will issue a 'Notice to Mariners".	Accept	Notifications provides other marine users with information regarding activities or hazards and will include details of relevant vessel. Controls based on BHP requirements must be accepted. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.5.3**
	SIMOPs Plan will be controlled through Permit to Work System.	Accept	SIMOPS Plan will prevent interactions with offtake vessels operating from the *Pyrenees Venture* FPSO. Controls based on BHP requirements must be accepted. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice	**PS 8.5.3**
	Establish and maintain a Community Engagement Program by regular meetings with the Community Reference Group (CRG).	Accept	Controls based on BHP requirements must be accepted. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.5.4**
	Consultation with relevant stakeholders.	Accept	Control is legislative requirement. The control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.5.5**
Pollution Control	Vessel has a Shipboard Oil Pollution Emergency Plan (SOPEP) compliant with MARPOL 73/78 Annex I, and Marine Order 91 (Marine Pollution Prevention – Oil), to manage vessel-based spills.	Accept	Implements response plan to quickly and efficiently deal with unplanned hydrocarbon spills in order to reduce impacts to the marine environment. Control is legislative requirement. The control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.5.6**
	Develop and maintain BHP *Crosby-3H1 Light Well Intervention Oil Pollution Emergency Plan (OPEP) (PYHSE-ER-0006).*	Accept	Implements response plan to quickly and efficiently deal with unplanned hydrocarbon spills in order to reduce impacts to the marine environment. Control is legislative requirement. The control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.5.7**
Additional Control Measures Considered				
Separate	Restrict timing of activity to reduce	Reject	The risk to all fauna cannot be eliminated due to variability in timing of environmentally sensitive	-

	potential risks to marine fauna during environmentally sensitive periods.		periods and the unpredictable presence of some species. Due to the short duration of petroleum activity, the risk of a vessel collision is considered very low. Restricting timing or duration of the petroleum activity may have logistical implications or costs. Given the low risk of vessel collision and even lower risk of a vessel collision resulting in a diesel spill, the control is deemed grossly disproportionate to any environmental benefit.	
Pollution Control	Dedicated resources (e.g. spill response equipment) on location to enable rapid response/ deployment.	Reject	Control would enable faster response time by having dedicated equipment resources on standby and in close proximity during the activity. Significant cost associated with this control considered grossly disproportionate compared to low risk of event.	-

ALARP Summary

The risk assessment and evaluation has identified a range of controls that when implemented are considered to manage the risk of an unplanned hydrocarbon release as a result of a vessel collision during the petroleum activity. The presence of the LWI vessel is critical to undertake the LWI activities and cannot be eliminated.

The risk assessment and evaluation identified a range of controls that when implemented are considered to manage the risks and impacts of a hydrocarbon spill to the marine environment from a vessel collision. Bulk storage of diesel is required on-board the vessel as a fuel for vessel engines and generators. Without bulk storage of diesel on-board the vessel, frequent refuelling at sea would be required. The presence of a refuelling vessel and associated supplies of fuel would add additional safety and environmental risks to the activity, which in turn would have a greater consequences in the unlikely event of a vessel collision resulting in a tank rupture. As no additional reasonably practicable control measures were identified to reduce the environmental risk of vessel collision and subsequent impact, the risks and impacts are considered ALARP.

8.5.5 Demonstration of Acceptability

BHP considers a range of factors when determining that a level of impact and risk to the environment is broadly acceptable, as summarised in Table 8-16.

Table 8-16: Demonstration of acceptability for hydrocarbon release from vessel collision

Acceptability Criteria	Acceptability Criteria	Demonstration
Codes and Standards	Is the impact or risk being managed in accordance with relevant Australian or International legislation, Ministerial Conditions or standards?	Impacts and risks associated with an unplanned hydrocarbon release as a result of a vessel collision will be managed in accordance with relevant legislation, codes and standards, including (e.g. *Navigation Act 2012*), codes and Standards (e.g. MARPOL, Marine Orders) and BHP HSEC Controls.
Ecologically Sustainable Development (ESD)	Is the proposed impact consistent with the principles of ESD?	BHP undertakes petroleum activities in a manner that is consistent with its Charter values and Code of Business Conduct. In determining the level of acceptability of the effects of an unplanned hydrocarbon release as a result of a vessel collision, and guided by the Charter value of Sustainability, BHP has identified, assessed and controlled risks associated with this activity to minimise environmental impacts. BHP considers that

Acceptability Criteria	Acceptability Criteria	Demonstration
		this approach is consistent with the principles of ESD.
Internal Context		
BHP Charter and HSEC Management System compliance	Is the proposed impact or risk consistent with the requirements of BHP Our Requirements, Petroleum HSE Standard (PET-HSE00-HX-STD-00001) and HSEC Management Systems?	The management of an unplanned hydrocarbon release as a result of a vessel collision will be in compliance with BHP policies and management systems and will be consistent with activities authorised for areas adjacent to a World Heritage Area (WHA).
Professional judgement	Is the impact or risk being managed in accordance with industry best practice?	Controls identified in this plan are consistent with industry best practice and guidelines. Accepted controls that will be implemented are provided in Table 8-15.
ALARP	Are there any further reasonable and practicable controls that can be implemented to further reduce the impact or risk?	All reasonable and practicable controls have been assessed (Table 8-15), additional controls were considered but were found not to be justifiable in further reducing the impacts and risks of interactions with marine fauna without a gross disproportionate sacrifice. BHP considers that the residual risk of an unplanned hydrocarbon release as a result of a vessel collision has been demonstrated to be ALARP.
External Context		
Environmental best practice	Are controls in place to manage the impacts and risk to the environment that are commensurate with the nature and scale of any environmental sensitivities of the receiving environment?	The environmental performance outcomes, performance standards and measurement criteria that determine whether the outcomes and standards have been achieved are commensurate with the environmental significance of the receiving environment.
Stakeholder views	Do stakeholders have concerns / issues, and if so, have controls been implemented to manage their concerns / issues?	Stakeholders have been consulted about the petroleum activity (Section 5) and no stakeholder concerns have been raised regarding this aspect.

Acceptability Summary

The proposed management controls for preventing and minimising the risk of vessel collision resulting in the loss of bulk storage marine diesel are comprehensive and consistent with all relevant codes and standards including the *Navigation Act 2012*, SOLAS 1974 and Marine Order – Part 30: Prevention of Collisions.

In the event of a vessel collision occurring resulting in a diesel spill, the relevant codes and standards for mitigation measures include MARPOL Annex 1 (Prevention of Pollution by Oil) that includes the requirement for a current Shipboard Oil Pollution Emergency Plan (SOPEP) for all vessels over 400 gross tonnage. In addition, BHP has developed the BHP *Crosby-3H1 Light Well Intervention Oil Pollution Emergency Plan (OPEP) (PYHSE-ER-0006)* (Appendix G) to respond to an emergency situation in this scenario in conjunction with the vessel SOPEP.

BHP is satisfied that when the accepted controls are implemented the impact and residual risk of an unplanned diesel spill from bulk storage to the environment is considered ALARP. Furthermore, the adopted controls are considered to be consistent with good oilfield practice/ professional judgement and environmental best practice. The management and storage of bulk diesel will comply with all relevant laws, codes and standards, as well as the BHP Charter and HSEC Management Systems. All relevant controls were considered as part of the ALARP assessment, and as no other reasonably practicable additional controls were identified that would further reduce the impacts and risks of an unplanned diesel spill from bulk storage without a grossly disproportionate sacrifice, the impacts and risks are considered ALARP. BHP undertakes petroleum activities in a manner that is consistent with the APPEA Principles of Conduct and hence the principles of ESD. Stakeholders have been consulted about the Activity and no concerns were raised regarding this aspect. BHP undertakes regular consultation with relevant stakeholders about its operations/ activities providing them with sufficient and reasonable opportunities to raise any new concerns or issues for the duration of this activity. On this basis, it is considered that adherence to the performance standards will manage the impacts and risks of an unplanned diesel spill from bulk storage to an acceptable level.

8.5.6 Environmental Performance Outcome, Performance Standards and Measurement Criteria

Environmental Performance Outcome	Environmental Performance Standard	Measurement Criteria
No accidental release of hydrocarbons to the marine environment from vessel collision	**PS 8.5.1** ***Navigation Act 2012*; International Convention of the Safety of Life at Sea (SOLAS) 1974; Marine Order - Part 30: Prevention of Collisions, Issue 8; Marine Order 21, Issue 8 (Safety of Navigation and Emergency Procedures); and International Convention of Standards of Training, Certification and Watch-keeping for Seafarers (STCW95):** Navigation (including lighting, compass/radar), bridge and communication equipment will be compliant with appropriate marine navigation and vessel safety requirements. Automatic Identification System (AIS) is fitted and maintained in accordance with Regulation 19-1 of Chapter V of SOLAS. Crew undertaking vessel bridge-watch will be qualified in accordance with International Convention of STCW95, AMSA Marine Order -Part 3: Seagoing Qualifications or certified training equivalent. Bridge-watch on vessel maintained 24-hours per day.	Vessel audit and inspection records demonstrate compliance with standard maritime orders and equipment. Vessel Log Book demonstrates bridge-watch maintained 24-hours per day.
	PS 8.5.2 **BHP Petroleum HSE Standard (PET-HSE00-HX-STD-00001):** Establishment of a 500-m safety exclusion zone around the LWI vessel. SIMOPs Plan prepared to manage vessel interactions during petroleum activity.	Breaches of vessel access within 500 m safety exclusion zone recorded in Marine Log Book and reported via Incident Report Form and documented in Environmental Performance Report. Safety Zone Entry Checklist completed, dated and signed for all entries into the 500-m safety exclusion zone. Permit to Work (PTW) for all activities within the safety zone approved and signed by the Ultimate Work Authority to ensure SIMOPs issues addressed.
	PS 8.5.3 Prior to commencement of activity, notification of details (e.g. location, duration, 500-m safety exclusion zone, etc.) of well intervention activities to AMSA which triggers issue of Maritime Safety Information (MSI) notifications and to the Australian Hydrographic Service (AHS) which will issue a 'Notice to Mariners'.	Records demonstrate notifications to AMSA and AHS advising of details of well intervention activities including 500-m safety exclusion zone.

Environmental Performance Outcome	Environmental Performance Standard	Measurement Criteria
	PS 8.5.4 **BHP Stakeholder Engagement Management Plan (WA) (AOEA-CR-0001) - Community Engagement Program:** The Community Reference Group (CRG) will be advised of, and updated of the proposed LWI activities and timing.	Meeting minute records maintained of CRG meetings, which includes summary of proposed LWI activities.
	PS 8.5.5 BHP consultation with relevant stakeholders to advise of well intervention activities.	Stakeholder communication recorded in database demonstrating assessment of stakeholder feedback received and BHP response.
	PS 8.5.6 **MARPOL 73/78 Annex I and Marine Order 91 (Marine Pollution Prevention – Oil),** as appropriate to vessel class: Current Shipboard Oil Pollution Emergency Plan (SOPEP) in place. Oil spill response executed in accordance with vessel's SOPEP.	Compliant SOPEP as appropriate to vessel class on-board vessel. Vessel incident report records vessel-based hydrocarbon spills managed in accordance with SOPEP. Documentation that SOPEP materials and equipment are maintained and available on the vessel.
	PS 8.5.7 ***BHP Crosby-3H1 Light Well Intervention Oil Pollution Emergency Plan (OPEP) (PYHSE-ER-0006)*:** Crosby-3H1 Light Well Intervention OPEP developed and maintained for the duration of the well intervention activities. Oil spill response executed in accordance with OPEP.	Review of incident response report in line with BHP Crosby-3H1 Light Well Intervention OPEP in the event of a diesel spill.

8.6 Unplanned Discharges – Chemicals and Minor Hydrocarbon Spills

8.6.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Acceptability
Accidental discharge of chemicals and hydrocarbons	Minor spills/ leaks of chemicals and hydrocarbons on the vessel deck reaching the marine environment and from subsea equipment (e.g. ROVs).	Localised and temporary reduction in water quality adjacent to the discharge point associated with hydrocarbon and chemical contaminants causing adverse toxicity effects.	10	Unlikely (0.1)	1	Tolerable

8.6.2 Source of Risk

During the well intervention activities, the handling, use and storage of chemicals and hydrocarbons will be required, which may include, but not limited to:

- Fuel and refined oil
- Hydraulic fluids/ oils
- Subsea control fluids
- Greases and lube oils
- Cleaning and cooling agents
- Biocides and corrosion inhibitors

Spills and leaks of chemicals and hydrocarbons on the vessel deck could occur as a result of spillage during handling, inadequate bunding and/ or storage, inadequate method of securing or tank/ pipework failure, leaks from equipment or rupture or failure of hoses. Chemicals and hydrocarbons are stored in a variety of ways on the LWI vessel dependent to the liquid type and usage requirements, such as IBCs, tote tanks, and large storage tanks, ranging in volumes from 20 L up to 25,000 L. Flammable liquid is stored in double skinned ISO storage tanks. Deck spills and leaks have the potential to reach the marine environment dependent on the volumes involved. Storage areas are typically set up with effective primary and secondary bunding to contain any deck spills. This excludes losses from permanent on-board storage tanks.

Leaks or rupture of ROV hydraulic hoses may occur through equipment malfunction or line pinches which would lead to the loss of small volumes of hydraulic fluids directly to the marine environment. ROVs on the LWI vessel are fitted with leak alarms currently set at 5 L.

During normal well operations involving fluid circulation or in the event that a well kill is required, water/glycol mix and inhibited seawater (including biocide) would be pumped into the production and/or annulus bore of the well. Accidental release of a hose or connection failure while pumping could result in up to 20 m^3 being released.

Subsea control fluid will be Transaqua HT2 which has a dye added to aid in leak detection. This is supplied to the SID via the control umbilical, typically pumped at rates of up to 1 m^3/hour.

A downline contained in the umbilical can be used to supply other chemicals or fluids to the SID; BHP do not plan to use this line.

During wireline operations grease will be pumped into the grease injection head to maintain a pressure seal. These are supplied at low flow rates up to rates up to 0.08 m^3/min. Maximum inventory on the LWI vessel will depend on requirements identified during detailed design.

The only time an unplanned discharge of these chemicals would occur would be in the event of an umbilical/downline rupture, which could be caused by event such as a hose failure or an emergency disconnect. The worst-case discharge during this scenario would be the loss of 4 m^3 of brine, or less than 1 m^3 of other fluids (e.g. subsea control fluid or inhibition chemicals).

Other sources of unplanned discharges that may arise during the well intervention activities include:

- Leaks of chemicals or fluids from the SID, including lubricator, stuffing box, and hose or fitting failure;
- Loss of chemicals or other fluids contained on-board the vessel in holding tanks;
- Stuffing box leak / under pressure;
- Draining of lubricator contents;
- Failure of hydraulic hoses on vessel deck equipment such as deck cranes and Intervention Compensation System;
- Loss of subsea control fluid during intervention operations;
- Lubricant dripping from cables over the deck and into marine environment; and
- Lubricant during wireline operations.

8.6.3 Environmental Impact Assessment

The accidental discharge of chemicals and hydrocarbons has the potential to cause localised toxic effects on marine fauna (pelagic fish, cetaceans and marine reptiles) and flora (phytoplankton) and a localised reduction in water quality. The potential impacts would most likely be highly localised and restricted to the immediate area in the footprint of the spill. Pelagic fish, cetaceans, marine reptiles will be able to move out of the spill area and any accidental spills is therefore not predicted to result in fatalities. Phytoplankton entrained in the spill will be impacted, however, the rapid dilution and dispersal that will result at the oceanic locations, the environmental effects will be temporary and localised, with significant impacts not expected owing to the short exposure timeframe.

Habitat degradation for marine pollution and chemical discharges are highlighted as threats to marine turtles, whales, and a number of migratory shorebirds in relevant Recovery Plans and Approved Conservation Advice (refer to previous Table 4-7). The plans and conservation advice provide recovery objective and action to help combat these threats.

In particular, the Recovery Plan for Marine Turtles in Australia (DoEE, 2017) identifies chemical discharge as a relevant threat to marine turtles. Five species of turtle may occur within the operational area (Section 4.5.6), of which the flatback turtle has an inter-nesting BIA that intercepts the operational area. In addition, the operational area intercepts inter-nesting habitat identified as habitat critical to the survival of the species (all waters within a 60 km radius of nesting areas on Thevenard Island, the Muiron Islands and Pilbara coast). Management measures listed in the Recovery Plan in relation to chemical discharges include implementation of best practices to minimise impacts to marine turtles and marine turtle habitat; and ensure spill risk strategies and response plans adequately include management for marine turtles and their habitats.

It is possible that individual turtles may come into contact with accidental chemical and hydrocarbon spills, however, considering the water depths of the operational area and the distances to nearest nesting beaches, large numbers of inter-nesting turtles are not predicted and significant impacts to populations will not occur. Impacts may occur to a small number of individuals should they be traversing the area when an accidental release occurs.

With the proposed controls in place, BHP considers the potential impacts and risk to marine fauna including turtles from changes in water quality from unplanned discharges of chemicals and hydrocarbons are low. The proposed activity is not inconsistent with recovery plan for marine turtles, as impacts and risks associated with unplanned discharges of chemicals and hydrocarbons were considered in the Environmental Risk Assessment, and a range of control measures were identified and adopted during the ALARP assessments, as detailed below.

8.6.4 Demonstration of ALARP

A summary of the ALARP process undertaken for the environmental aspect is presented below. This process was completed as outlined in Section 6.1.2 and included consideration of all controls, analysis of the risk reduction proportional to the benefit gained and final acceptance or justification if the control was not considered suitable (refer Table 8-17). The result of this ALARP Assessment contributes to the overall acceptability of the impact or risk

Table 8-17: Unplanned discharges of chemicals and minor hydrocarbon spills – ALARP assessment summary

Hierarchy of Control	Control Measure	Accept/ Reject	Reason	Performance Standard
Eliminate	None identified	N/A	N/A	-
Substitute	None identified	N/A	N/A	-
Engineer	None identified	N/A	N/A	-
Separate	None identified	N/A	N/A	-
Administrate	Vessel will comply with the MARPOL 73/78 Annex I, II and III, and Marine Orders 91, 93 and 94.	Accept	Controls based on legislative requirements must be accepted. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.6.1**
	Vessels to have a current International Oil Pollution Prevention (IOPP) certificate for oily water filtering equipment.	Accept	Controls based on legislative requirements must be accepted. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.6.1**
	Vessel audit prior to mobilisation confirms chemical/hydrocarbon storage and handling requirements.	Accept	Audits must be undertaken according to BHP standards. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.6.1**
	Vessels will have current MARPOL-compliant Shipboard Oil Pollution Emergency Plan (SOPEP) and Shipboard Marine Pollution Emergency Plan (SMPEP - for noxious liquid) – the latter may be combined with a SOPEP.	Accept	Controls based on legislative requirements must be accepted. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.6.1**
	All shipboard hazardous liquid, chemical and hydrocarbon spills and leaks will be managed in accordance with the SOPEP/ SMPEP.	Accept	Controls based on legislative requirements must be accepted. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.6.1**
	Spill clean-up equipment is located where hydrocarbons and hazardous chemicals are frequently handled.	Accept	Controls based on legislative requirements must be accepted. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.6.1**
	Chemical selection and assessment process	Accept	All chemicals are reviewed and approved through BHP Hazardous Materials Procedure to ensure suitable for discharge overboard. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.6.2**

Hierarchy of Control	Control Measure	Accept/ Reject	Reason	Performance Standard
	Critical hoses outside bunded areas (e.g. ROVs) are inspected/maintained as part of Vessel Preventative Maintenance System (PMS).	Accept	Maintenance and inspection completed as scheduled on PMS reduce the risk of leaks to the marine environment. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.6.3**
Additional Control Measures Considered				
None identified.				

ALARP Summary

The risk assessment and evaluation has identified a range of control measures that when implemented are considered to manage the impacts and risks of unplanned discharges of chemicals/hydrocarbons. With the proposed control measures in place, the impacts and risks of unplanned discharges of chemicals/hydrocarbons are low and cannot be reduced further. No additional or alternative management measures have been identified that would reduce the environmental impacts and risks associated with unplanned discharges of chemicals/hydrocarbons, as such it is considered reduced to ALARP.

8.6.5 Demonstration of Acceptability

BHP considers a range of factors when determining that a level of impact and risk to the environment is broadly acceptable, as summarised in Table 8-18.

Table 8-18: Demonstration of acceptability for unplanned discharges of chemicals and minor hydrocarbon spills

Acceptability Criteria	Acceptability Criteria	Demonstration
Codes and Standards	Is the impact or risk being managed in accordance with relevant Australian or International legislation, Ministerial Conditions or standards?	Impacts and risks associated with unplanned discharges of chemicals and hydrocarbons will be managed in accordance with relevant legislation (e.g. *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*), and codes and standards (e.g. MARPOL, Marine Orders).
Ecologically Sustainable Development (ESD)	Is the proposed impact consistent with the principles of ESD?	BHP undertakes petroleum activities in a manner that is consistent with its Charter values and Code of Business Conduct. In determining the level of acceptability of unplanned discharges of chemicals and hydrocarbons, and guided by the Charter value of Sustainability, BHP has identified, assessed and controlled risks associated with this activity to minimise environmental impacts. BHP considers that this approach is consistent with the principles of ESD.
Internal Context		
BHP Charter and HSEC Management System compliance	Is the proposed impact or risk consistent with the requirements of BHP Our Requirements, Petroleum Standard and HSEC Management Systems?	The management of risks and impacts in relation to unplanned discharges of chemicals and hydrocarbons will be in compliance with BHP policies and management systems and will be consistent with activities authorised for

Acceptability Criteria	Acceptability Criteria	Demonstration
		areas adjacent to a World Heritage Area (WHA).
Professional judgement	Is the impact or risk being managed in accordance with industry best practice?	Controls identified in this plan are consistent with industry best practice and guidelines. Accepted controls that will be implemented are provided in Table 8-17.
ALARP	Are there any further reasonable and practicable controls that can be implemented to further reduce the impact or risk?	All reasonable and practicable controls have been assessed (Table 8-17); no additional controls were identified to further reduce the impacts and risks of unplanned discharges of chemicals and hydrocarbons. BHP considers that the residual risk unplanned discharges of chemicals and hydrocarbons has been demonstrated to be ALARP.
External Context		
Environmental best practice	Are controls in place to manage the impacts and risk to the environment that are commensurate with the nature and scale of any environmental sensitivities of the receiving environment?	The environmental performance outcomes, performance standards and measurement criteria that determine whether the outcomes and standards have been achieved are commensurate with the environmental significance (i.e. a WHA) of the receiving environment. The potential risks and impacts and proposed control measures are consistent with relevant species recover plans and conservation management plans that identify chemical discharges and marine pollution as a threat (refer to Table 4-7).
Stakeholder views	Do stakeholders have concerns / issues, and if so, have controls been implemented to manage their concerns / issues?	Stakeholders have been consulted about the petroleum activity (Section 5) and no stakeholder concerns have been raised regarding this aspect.

Acceptability Summary

The storage and use of chemicals and hydrocarbons is standard industry practice and the potential impacts are well understood. All chemicals/hydrocarbons for intended release or discharge to the marine environment are selected and approved in line with BHP procedures. Further, prior to mobilisation, a vessel audit and inspection will verify vessel compliance and chemical/hydrocarbon storage and handling management measures on-board to minimise risks of decks spill reaching the marine environment.

The offshore oceanic location is such that any unplanned releases would be rapidly diluted and dispersed, with any environmental effects being temporary and localised, with significant impacts not expected owing to the short exposure timeframe. The proposed control measures for preventing and minimising the risk of accidental release of chemicals and hydrocarbons occurring are comprehensive and consistent with all relevant codes and standards and good oilfield practice. No additional controls have been identified to further reduce the impacts and risks of unplanned discharges.

BHP is satisfied that when the accepted controls are implemented that the impact and residual risk of unplanned discharges of chemicals and hydrocarbons to the environment are considered ALARP. Furthermore, the adopted controls are considered consistent with good oilfield practice/ professional judgement and environmental best practice.

BHP has considered information contained in recovery plans and conservation management plans where chemical discharges and marine pollution has been identified as a risk to protected marine species (refer to previous Table 4-7). The control measures proposed are consistent with management actions described in the plans.

BHP undertakes petroleum activities in a manner that is consistent with the APPEA Principles of Conduct and hence the principles of ESD. Stakeholders have been consulted about the LWI activities and no concerns regarding this aspect have been raised. BHP undertakes regular consultation with relevant stakeholders about its operations/ activities providing them with sufficient and reasonable opportunities to raise any new concerns or issues for the duration of this activity. On this basis, it is considered that impacts and risks associated with unplanned discharges of chemicals/hydrocarbons will be managed to an acceptable level.

8.6.6 Environmental Performance Outcome, Performance Standards and Measurement Criteria

Environmental Performance Outcome	Environmental Performance Standard	Measurement Criteria
No accidental release of environmentally hazardous chemicals or minor hydrocarbon spills to the marine environment.	**PS 8.6.1** **Protection of the Sea (Prevention of Pollution from Ships) Act 1983 – Part II (Section 9); MARPOL 73/78 Annex I, II and III; Marine Order 91 (Pollution Prevention – Oil), Marine Order 93 (Pollution Prevention – Noxious Liquid Substances), Marine Order 94 (Pollution Prevention – Packaged Harmful Substances)** as appropriate to vessel class: Vessel compliant with Marine Order 91. Current International Oil Pollution Prevention (IOPP) certificate for oily water filtering equipment. Vessel will have current MARPOL-compliant SOPEP and Shipboard Marine Pollution Emergency Plan (SMPEP - for noxious liquid) – the latter may be combined with a SOPEP. Continuous bunding or drip trays around machinery or equipment with the potential to leak. Spill clean-up equipment and scupper plugs or equivalent deck drainage control measures located where hydrocarbons and chemicals are stored and frequently handled,	Audit and inspection records show: • Vessel compliant with MARPOL 73/78 Annex I, II and III, and Marine Orders 91, 93 and 94; • Oil and oily water is managed in accordance with Marine Order 91. Current IOPP certificate in place for vessel in accordance with Marine Order 91. MARPOL-compliant SOPEP/ SMPEP onboard vessel. Documentation that SOPEP/ SMPEP materials and equipment are available on vessels prior to and during activity Vessel incident report records all shipboard chemical spills and hydrocarbon spills managed in accordance to SOPEP/ SMPEP
	PS 8.6.2 **BHP Hazardous Materials Acquisition Environmental Supplement (AO-HSE S-0002):** Where Offshore Chemical Notification Scheme (OCNS) rating of D or E or a CHARM rating of Silver or Gold rated chemicals intended for liquid discharge are used, no further control required. If other non-rated chemicals intended for liquid discharge are used, chemical selection procedures described in Hazardous Materials Acquisition Environmental Supplement (AO-HSE S-0002) will be followed.	Documentation showing that chemicals discharged to the marine environment are ranked D or better on OCNS ranked list or Silver or better on CHARM rating. Where chemicals are to be discharged to the marine environment are not D/ E rated through OCNS or Gold/ Silver rated through CHARM, then documented evidence to show that Hazardous Material Procedure has been followed.
	PS 8.6.3 **Vessel Preventative Maintenance System:** Critical hoses outside bunded areas (e.g. ROVs) are identified and regularly inspected/maintained/replaced as part of the Preventative Maintenance System.	Records in the Preventative Maintenance System demonstrate inspections of critical hoses comply with equipment specifications.

8.7 Unplanned Discharges – Solids

8.7.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Acceptability
Accidental release of solid objects overboard	Loss of solid waste or equipment overboard due to improper waste management or handling error.	Impacts to marine fauna (e.g. ingestion, entanglement) and seabed disturbance if object heavy enough to sink to the seabed.	10	Unlikely (0.1)	1	Tolerable

8.7.2 Source of Risk

The handling and storage of solid materials and waste on-board the vessel has the potential for accidental overboard release. Small quantities of hazardous and non-hazardous materials will be used and waste created and then handled and stored on the vessel. In the normal course of operations, solid waste will be stored on the vessel until it is transported via port facilities for appropriate disposal at licensed on shore facilities (refer to previous Section 7.8). However, accidental releases to the marine environment are a possibility, especially in rough ocean conditions and high winds, when items have the potential to roll off or be blown off the deck, if not appropriately stored or secured.

General non-hazardous waste include general domestic and galley waste and recyclables such as scrap materials, cardboard packaging, wood, paper and empty containers. Volumes of non-hazardous waste generated on the vessels are generally low. Hazardous wastes are defined those wastes that are or contain ingredients harmful to health or the environment. Hazardous wastes likely to be generated on-board the vessel includes oil contaminated materials (e.g. sorbents, filters and rags), chemical containers and batteries, medical wastes, paints and aerosol cans. The volumes of hazardous wastes generated are relatively small.

Solid objects/ equipment has the potential to be accidentally released overboard from manual handling errors or unsecure/ unbalance loads during lifts. All non-buoyant solid waste material or dropped objects/ equipment are expected to remain within the operational area as they sink through the water column and settle on the seabed. Buoyant waste material lost overboard could potentially be carried by ocean currents beyond the operational area.

8.7.3 Environmental Impact Assessment

The known and potential impacts to the marine environment from the accidental release of hazardous solid waste/ materials and dropped objects include:

- Marine pollution and contamination (and a temporary and localised reduction in water quality);
- Ecotoxicological effects, injury or fatality of marine fauna through ingestion of, and entanglement in marine debris;
- Smothering of benthic habitats, if dropped object is heavy enough to sink to the seabed.

Heavier solid hazardous materials and objects/ equipment accidentally released overboard would sink to the seabed in the operational area. The area of impact would be limited to the footprint (size) of the object with physical disturbance to the benthic sediments and communities beneath the object. Unless retrieved, the disturbance would remain until the object eventually breaks down and disintegrates, which could potentially be many years, dependent on the waste material. There are no sensitive or unique marine habitats in the operational area and the consequence to benthic habitats and invertebrate communities is considered to be highly localised and negligible.

Marine debris is one of the world's five major marine pollutants (ANZECC, 1995) and is increasing worldwide. Harmful marine debris refers to all land-source garbage, plastics and floating non-biodegradable material that may cause harm to vertebrate marine species, including marine turtles, birds, marine mammals, fish, sharks and rays. During the well intervention activities, there is the potential for impacts on marine fauna that come into contact with buoyant solid objects, such as packaging, plastic objects, etc. accidentally released overboard. Such objects could potentially be carried by ocean currents beyond the operational area.

Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in harmful debris was listed as a key threatening process under the EPBC Act in August 2003. Floating non-biodegradable marine debris has been highlighted as a threat to marine turtles, whales, whale sharks, albatrosses and giant petrels in the relevant Recovery Plans and Approved Conservation Advice (refer to previous Table 4-7). The plans, conservation advice and the *Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia's Coasts and Oceans* (DoEE, 2018) have specified a number of recovery objectives and actions to help combat this threat.

The disposal of plastic materials at sea is totally prohibited by the International Convention for the Prevention of Pollution from Ships (MARPOL) to which Australia is a signatory.Given the typically small volumes of solid wastes that may be accidentally released during any given event, potential impacts to sensitive species are expect to be restricted to individual animals. Many of the vertebrate species considered vulnerable to marine debris occur seasonally or expected to occur in low densities (transiting the operational area).

8.7.4 Demonstration of ALARP

A summary of the ALARP process undertaken for the environmental aspect is presented below. This process was completed as outlined in Section 6.1.2 and included consideration of all controls, analysis of the risk reduction proportional to the benefit gained and final acceptance or justification if the control was not considered suitable (refer Table 8-19). The result of this ALARP Assessment contributes to the overall acceptability of the impact or risk.

Table 8-19: Unplanned discharges of solid objects – ALARP assessment summary

Hierarchy of Control	Control Measure	Accept/ Reject	Reason	Performance Standard
Eliminate	Recovery of dropped objects overboard where safe and practicable to do so.	N/A	Minimise impacts resulting from dropped objects overboard through retrieval. Control is feasible, standard practice with minimal cost.	**PS 8.7.1**
Substitute	None identified	N/A	N/A	-
Engineer	None identified	N/A	N/A	-
Separate	Consider the waste management hierarchy to eliminate, reduce, recycle or reuse in lieu of disposal in the management plan.	Accept	Controls based on legislative requirements must be accepted. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.7.2**
Administrate	Develop and implement a waste management plan for managing waste generation, transport and disposal.	Accept	Controls based on legislative requirements must be accepted. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.7.2**
	Vessel will comply with the MARPOL 73/78 Annex III and V, and the following Marine Orders:	Accept	Controls based on legislative requirements must be accepted. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.7.2**

Hierarchy of Control	Control Measure	Accept/ Reject	Reason	Performance Standard
	Marine Order 94 (Packaged Harmful Substances). Marine Order 95 (Garbage)			
	Minimise dropped object risk during lifting activities through implementation of work (lifting) procedures and competent/certified crew.	Accept	Reduces the likelihood of dropped objects through procedures and standards for lifting equipment inspection and maintenance, lifting procedures, and competent/ certified crew undertaking lifting tasks. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.7.3**
	Lifting gear on vessel's preventative maintenance system.	Accept	Reduces the likelihood of dropped objects as lifting equipment is operating within its parameters. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.7.3**
	Environmental awareness induction provided to all marine crew includes overview of waste management.	Accept	Providing training to personnel assists in understanding obligations. Controls based on legislative requirements must be accepted. Control is feasible, standard practice with minimal cost.	**PS 8.7.4**
Additional Control Measures Considered				
None identified.				

ALARP Summary

The risk assessment and evaluation has identified a range of control measures that when implemented are considered to manage the impacts and risks of unplanned discharges (solids) from the LWI vessel during the activity. The generation of solid hazardous and non-hazardous waste is unavoidable, and lifting operations are required as part of the activity. Dropped objects and equipment loss could potentially occur during the activity, but will be managed through work (lifting) procedures and equipment management. With the proposed control measures in place, the impacts and risk of unplanned discharges (solids) are low and cannot be reduced further. No additional or alternative management measures have been identified that would reduce the environmental impacts and risks associated with unplanned discharges (solids), as such it is considered reduced to ALARP.

8.7.5 Demonstration of Acceptability

BHP considers a range of factors when determining that a level of impact and risk to the environment is broadly acceptable, as summarised in Table 8-22.

Table 8-20: Demonstration of acceptability for unplanned discharges of solid objects

Acceptability Criteria	Acceptability Criteria	Demonstration
Codes and Standards	Is the impact or risk being managed in accordance with relevant Australian or International legislation, Ministerial Conditions or standards?	Impacts and risks associated with unplanned discharges (solids) management will be managed in accordance with relevant legislation (e.g. *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*), and codes and standards (e.g. MARPOL, Marine Orders).
Ecologically Sustainable Development (ESD)	Is the proposed impact consistent with the principles of ESD?	BHP undertakes petroleum activities in a manner that is consistent with its Charter values and Code of Business Conduct. In determining the level of acceptability of unplanned discharges (solids), and guided by the Charter value of Sustainability, BHP has identified, assessed and controlled risks associated with this activity to minimise environmental impacts. BHP considers that this approach is consistent with the principles of ESD.
Internal Context		
BHP Charter and HSEC Management System compliance	Is the proposed impact or risk consistent with the requirements of BHP Our Requirements, Petroleum Standard and HSEC Management Systems?	The management of risks and impacts in relation to unplanned discharges (solids) will be in compliance with BHP policies and management systems and will be consistent with activities authorised for areas adjacent to a World Heritage Area (WHA).
Professional judgement	Is the impact or risk being managed in accordance with industry best practice?	Controls identified in this plan are consistent with industry best practice and guidelines. Accepted controls that will be implemented are provided in Table 8-19.
ALARP	Are there any further reasonable and practicable controls that can be implemented to further reduce the impact or risk?	All reasonable and practicable controls have been assessed (Table 8-19); no additional controls were identified to further reduce the impacts and risks of unplanned discharges (solids). BHP considers that the residual risk of unplanned discharges (solids) has been demonstrated to be ALARP.
External Context		
Environmental best practice	Are controls in place to manage the impacts and risk to the environment that are commensurate with the nature and scale of any environmental sensitivities of the receiving environment?	The environmental performance outcomes, performance standards and measurement criteria that determine whether the outcomes and standards have been achieved are commensurate with the environmental significance (i.e. a WHA) of the receiving environment. The potential risks and impacts and proposed control measures are consistent with relevant species recover plans, conservation management plans and threat abatement plans that identify ship-sourced marine debris as a threat, including but not limited to: • Threat Abatement Plan for the Impacts of Marine Debris on Vertebrate Wildlife of Australia's Coasts and Oceans • Recovery Plan for Marine Turtles in Australia 2017-2027

Acceptability Criteria	Acceptability Criteria	Demonstration
		• Conservation Advice for the Humpback Whale • Conservation Management Plan for the Southern Right Whale 2011-2021 • Conservation Advice for the Whale Shark • Background Paper, Population Status and Threats to Albatrosses and Giant Petrels Listed as Threatened under the EPBC Act 1999
Stakeholder views	Do stakeholders have concerns / issues, and if so, have controls been implemented to manage their concerns / issues?	Stakeholders have been consulted about the petroleum activity (Section 5) and no stakeholder concerns have been raised regarding this aspect.

Acceptability Summary

The handling and use of hazardous and non-hazardous solid materials is standard practice and the potential impacts are well understood. BHP has procedures in place for verifying contractors' management of waste and the storage of wastes on-board vessels and for onshore disposal by waste removal contractors. Lifting (equipment, containers, etc.) on the vessel cannot be eliminated during the LWI activities. Lifting procedures and inspection/ testing requirements for lifting activities reduce the risk of dropped objects.

BHP is satisfied that when the accepted controls are implemented that the impact and residual risk of unplanned discharges (solids) to the environment are considered ALARP. Furthermore, the adopted controls are considered consistent with good oilfield practice/ professional judgement and environmental best practice.

BHP has considered information contained in recovery plans, conservation management plans and threat abatement plans where ship-sourced marine debris has been identified as a risk to protected marine species (refer to previous Table 4-7). The control measures proposed are consistent with management actions described in the plans.

BHP undertakes petroleum activities in a manner that is consistent with the APPEA Principles of Conduct and hence the principles of ESD. Stakeholders have been consulted about the LWI activities and no concerns regarding this aspect have been raised. BHP undertakes regular consultation with relevant stakeholders about its operations/ activities providing them with sufficient and reasonable opportunities to raise any new concerns or issues for the duration of this activity. On this basis, it is considered that impacts and risks associated with unplanned discharges (solids) will be managed to an acceptable level.

8.7.6 Environmental Performance Outcome, Performance Standards and Measurement Criteria

Environmental Performance Outcome	Environmental Performance Standard	Measurement Criteria
No unplanned discharges of solid objects to the marine environment. **Waste is managed in accordance with legislate requirements and Vessel Waste Management Plan.**	**PS 8.7.1** Recovery of dropped objects and/ or hazardous solid wastes lost overboard where safe and practicable to do so.	Fate of dropped objects detailed in incident documents.
	PS 8.7.2 **Vessel will comply with MARPOL 73/78 Annex III and V, and the following Marine Orders, as appropriate to vessel class:** Marine Order 94 (Pollution Prevention – Packaged Harmful Substances) Marine Order 95 (Pollution Prevention – Garbage)	Garbage Record Book or manifests, including transport, treatment, recycling and disposal. Audit and inspection records show waste is managed in accordance with Marine Order 94 and 95.
		Audit and inspection records show waste is managed in accordance with MARPOL 73/78 Annex III and V, and Marine Order 94 and 95.
		Audit and inspection records show lids/ covers on skips/ bins where waste is stored.
	PS 8.7.3 **Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations: Accepted Vessel Safety Case**: Lifting operations managed in accordance with vessel work instructions and procedures. Vessel Safety Case includes control measures for dropped objects: • Lifting equipment certification and inspection • Heavy-lift procedures • Preventative maintenance on lifting gear (e.g. cranes) Lifting crew competencies/ certification.	Lifting operations managed in accordance with vessel work instructions and procedures.
		Vessel audit and inspection records verify work (lifting/ operating) procedures in place, lifting crew competencies, lifting gear on PMS.
	PS 8.7.4 Environmental awareness induction provided to marine crew prior to activities include overview of waste management.	Signed environmental awareness induction attendance records demonstrate environmental briefing has been conducted for marine crew, including overview of waste management.

8.8 Marine Fauna Interaction

8.8.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Acceptability
Interaction with marine fauna	Accidental collision between LWI vessel and marine fauna	Potential lethal impact or injury to protected marine species.	10	Highly Unlikely (0.03)	0.3	Tolerable

8.8.2 Source of Risk

The physical presence and/ or movements of the LWI vessel in and around the operational area may present a potential hazard to slow moving marine megafauna (cetaceans, marine turtles or whale sharks). Vessel movements can result in collisions between the vessel (hull, propellors) and marine fauna, with potential impacts ranging from minor behavioural interferences (e.g. avoidance) to severe impacts such as injury and mortality through vessel strikes. Potential behavioural responses to underwater noise emissions during the petroleum activity are discussed in Section 7.5.

The LWI vessel will be stationary or moving at low speeds when undertaking the well intervention activities. The risk period is restricted to the duration that the vessel is on location in the operational area (up to 14 days).

8.8.3 Environmental Impact Assessment

Considering the low vessel movements associated with the LWI activities and the low vessel speeds in the operational area, it is unlikely that the activity will have a significant impact on migratory fauna species or other transiting marine fauna that may be present. In the highly unlikely event of a whale or turtle mortality, the effect is not likely to be significant (as defined by EPBC Act significance impact guidelines) at the population level.

Vessel collisions have been known to contribute to the mortality of marine fauna including resident and migrating turtles (Hazel and Gyuris, 2006; Hazel *et al*., 2007) and migratory whales (Laist *et al*., 2001; Jensen and Silber, 2003). For both whales and turtles, the risk of lethal collision is a function of abundance of animals in the area of operations, probability of a collision and the probability of that collision being fatal.

Cetaceans

The likelihood of vessel-whale collision being lethal is influenced by vessel speed. The risk of a collision causing mortality of the whale increases as the vessel speed increases (Laist *et al*., 2001; Jensen and Silber, 2003). Vanderlaan and Taggart (2007) found that the chance of lethal injury to a large whale as a result of a vessel strike declines from 80% at 15 knots to about 20 % at 8.6 knots.

The LWI vessel will be either stationary or moving slowly (~4 knots) in the operational area, hence the chance of a vessel-whale collision resulting in lethal outcome within these waters is much reduced. According to the data of Vanderlaan and Taggart (2007), it is estimated that the risk is less than 10% at a speed of 4 knots. Vessel-whale collisions at this speed are uncommon and, based on reported data contained in the US National Ocean and Atmospheric Administration database (Jensen and Silber, 2003) there only two known instances of collisions when the vessel was travelling at less than 6 knots, both of these were from whale watching vessels that were deliberately placed amongst whales.

The reaction of whales to the approach of a vessel is quite variable. Some species remain motionless when in the vicinity of a vessel while others are known to be curious and often approach vessels that have stopped or are slow moving, although they generally do not approach, and sometimes avoid, faster moving vessels (Richardson *et al*., 1995).

Five listed threatened and migratory species of cetacean were identified as potentially occurring in, or have habitat in the operational area: the sei whale, pygmy blue whale, fin whale, Southern right whale and humpback whale. The operational area intercepts BIAs for the pygmy blue whale (part of the migratory corridor) and the humpback whale (migratory corridor). The worst-case consequence from a vessel strike would be the fatality of a single EPBC Act-listed individual species, however as they would represent an individual within the local population it is not expected that it would result in a decreased population size. However, considering the low vessel movements and low vessel speeds in the operational area, it is unlikely there would be a significant impact on cetaceans at the population level.

Whale Sharks

Whale sharks are at risk from vessel strikes as they spend time feeding at the sea surface. Whale sharks may traverse offshore NWS waters including the operational area during their migrations to and from aggregation areas along the Ningaloo coast and the operational area intercepts the foraging BIA for the species. Seasonal aggregations along the Ningaloo coast can be variable although usually between March and July, with peak numbers recorded in April and May (Sleeman *et al*., 2010). Outside of this period, individual may still be present.

Turtles

There is no available data on factors affecting the likelihood of a vessel-turtle collision being lethal. It is reasonable to assume that the higher the speed of collision, the greater the risk of mortality, but contact with the propeller would be lethal at almost all speeds. Studies have shown that turtles are less likely to flee from a fast moving vessel, presumably because of poor hearing and visual senses than from a slow-moving vessel (Hazel *et al*., 2007).

Five listed threatened and migratory species of marine turtle were identified as potentially occurring in, or have habitat in the operational area: green, flatback, hawksbill, leatherback and loggerhead turtles. Marine turtles are predominantly oceanic species except in the nesting season when they come ashore. There are no shorelines near the operational area, but marine turtles may transit the operational area to forage on nearby reefs with the closest nesting areas >27 km away (Muiron Islands and North West Cape: green, hawksbill and loggerhead turtles). In addition, the operational area intercepts BIAs for green, hawksbill, loggerhead and flatback turtles, and critical habitat (inter-nesting) for flatback turtles.

Considering the low vessel movements and the low speeds in the operational area, it is unlikely that presence of the vessel will have a significant impact on turtles at the population level.

Species Recovery Plans and Approved Conservation Advice

BHP has considered information contained in relevant recovery plans and approved conservation advice for cetaceans and marine turtles that identify vessel strike as a threat (Table 4-7).

BHP has evaluated the impacts and risks associated with vessel strike and vessel disturbance. BHP considers the proposed activity is not inconsistent with recovery plans for cetaceans and marine turtles, as impacts and risks associated with marine fauna interaction were considered in the Environmental Risk Assessment, and a range of preventative controls were identified and adopted during the ALARP assessments, as detailed below.

8.8.4 Demonstration of ALARP

A summary of the ALARP process undertaken for the environmental aspect is presented below. This process was completed as outlined in Section 6.1.2 and included consideration of all controls, analysis of the risk reduction proportional to the benefit gained and final acceptance or justification if the control was not considered suitable (refer Table 8-21). The result of this ALARP Assessment contributes to the overall acceptability of the impact or risk.

Table 8-21: Interference with marine fauna – ALARP assessment summary

Hierarchy of Control	Control Measure	Accept/ Reject	Reason	Performance Standard
Eliminate	None identified	N/A	N/A	-
Substitute	None identified	N/A	N/A	-
Engineer	None identified	N/A	N/A	-
Separate	None identified	N/A	N/A	-
Administrate	Vessel Master to operate vessels in accordance with the Part 8 of the OPGGS Act 2006 – (s. 280 (2)(c)); EPBC Regulations 2000 – Part 8 Division 8.1 (r. 8.05) Interacting with Cetaceans (modified to include turtles and whale sharks) to avoid interactions with whales, whale sharks, and marine turtles.	Accept	Reduces interaction risk to cetaceans (modified to include turtles and whale sharks). Controls based on legislative requirements must be accepted. Control is feasible, standard practice with minimal cost.	**PS 8.8.1**
	Implement EPBC Act 1999 – Ministerial Approval Decision April 2006 (EPBC 2005/2034) Conditions in relation to cetacean and whale shark interactions and sightings reporting.	Accept	Controls based on legislative requirements must be accepted. Control is feasible, standard practice with minimal cost.	**PS 8.8.2**
	Environmental awareness induction provided to all marine crew to advise marine fauna interaction requirements.	Accept	Providing training to personnel assists in understanding obligations. Controls based on legislative requirements must be accepted. Control is feasible, standard practice with minimal cost.	**PS 8.8.3**
Additional Control Measures Considered				
Separate	Restrict timing of activity to reduce potential risks to marine fauna during environmentally sensitive periods.	Reject	The risk to all fauna cannot be eliminated due to variability in timing of environmentally sensitive periods and the unpredictable presence of some species. Due to the short duration of petroleum activity, the risk of interaction with marine fauna is considered very low. Restricting timing or duration of the petroleum activity may have logistical implications or costs. Given the low risk of interactions with marine fauna, the control is	-

Hierarchy of Control	Control Measure	Accept/ Reject	Reason	Performance Standard
			deemed grossly disproportionate to any environmental benefit.	
Engineer	Passive acoustic monitoring to detect cetaceans in the vicinity of the vessels	Reject	The cost of a PAM system has been estimated to be unacceptably high and would require several permanent mooring locations in the operational area with real time monitoring and analysis. Given that LWI vessel would be stationary for the most part or moving slowly (hence little chance of strike) it is considered that the cost is grossly disproportionate to the benefit that may gained.	-

ALARP Summary

The risk assessment and evaluation has identified a range of controls that when implemented are considered to manage the risk of interference to marine fauna during the petroleum activity. The presence and movement of the LWI vessel is critical to undertake the LWI activities and cannot be eliminated.

The following additional controls were considered:

Whales:

Alternative controls considered for avoiding impacts to whales were:

<u>Passive acoustic monitoring</u>: Passive acoustic monitoring systems are available for detecting whales. The chief disadvantage is that they can only detect whales if they are vocalising therefore they must be used in combination with visual monitoring (i.e. it is an additional measure not a replacement for visual monitoring). To be effective PAM need to have a means of feeding back information to the vessels in real-time. The cost (in terms of time to develop, test and implement as well as monetary expense) of a PAM system has been estimated to be very high and would require several permanent mooring locations around the vessels with real time monitoring and analysis. Given that LWI vessel would be stationary or moving slowly (hence little chance of collision with whales) and the short duration of the LWI activity (up to 14 days), it is considered that the cost is disproportionate to the very minor net environmental benefit that may accrue; and

<u>Timing of activities</u>: Timing the activities to avoid periods of peak whale abundance was been considered. The benefit that may accrue from avoiding periods of peak whale density is considered to be negligible based on the simple observation that even with all the oil and gas development (and associated vessel movements) occurring in the Exmouth Basin over the last ten years the humpback whale population (Stock IV) has grown at an estimated 10% per year to the point where IUCN have removed the humpback whales from the threatened category and there have been no recorded cases of whale-vessel collisions. As discussed previously, Bejder *et al*. (2015) found the population abundance of eastern and western Australian humpback whales has recovered to more than approximately 50% of their pre-whaling abundance and argued that, based on meeting the eligibility criteria for removing a species from any category in the list of threatened species under the EPBC Act, the available scientific evidence does not support the listing of humpback whale populations on the EPBC Act list of Threatened species. The cost that would be associated with avoiding periods of peak whale density is highly variable ranging from no cost, should it happen coincide with vessel availability, to several millions of dollars if it requires placing contracted vessels on stand-by. Given that the procedures proposed for preventing vessel-whale collisions have been demonstrated to be effective it is considered that the potential cost of additional control of varying the timing of the activities to avoid peak whale abundance is grossly disproportionate to the negligible benefit that may accrue.

Turtles:

There are no guidelines or standards for avoidance of collisions with turtles. Given their protected species status, the following alternative control is proposed:

Avoidance procedure: Extend to turtles a modified version of the avoidance procedure in place for whales. The procedure would prohibit intentionally travelling greater than 6 knots within 50 m of a turtle and not knowingly approach closer than 25 m to a turtle (note difference in distance compared to whales is due to practical limitation on sighting turtles in the open ocean). These additional control measures would not incur any additional cost, except on occasions when turtles approach within the caution zone.

With no further alternative and practicable control measures identified and with the proposed management controls in place that are consistent with legislative requirements, regulations and standards, it is considered that the risk of injury or mortality to marine fauna from interaction with the LWI vessel has been reduced to ALARP.

8.8.5 Demonstration of Acceptability

BHP considers a range of factors when determining that a level of impact and risk to the environment is broadly acceptable, as summarised in Table 8-22.

Table 8-22: Demonstration of acceptability for interaction with marine fauna

Acceptability Criteria	Acceptability Criteria	Demonstration
Codes and Standards	Is the impact or risk being managed in accordance with relevant Australian or International legislation, Ministerial Conditions or standards?	Impacts and risks associated with the unplanned interference to marine fauna will be managed in accordance with relevant legislation, codes and standards, including: • EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans; • Ministerial Conditions (EPBC 2005/2034); and • Relevant Recovery Plans and Conservation Advice that list vessel strike/disturbance as a threat to the species.
Ecologically Sustainable Development (ESD)	Is the proposed impact consistent with the principles of ESD?	BHP undertakes petroleum activities in a manner that is consistent with its Charter values and Code of Business Conduct. In determining the level of acceptability of the effects of unplanned interference to marina fauna, and guided by the Charter value of Sustainability, BHP has identified, assessed and controlled risks associated with this activity to minimise environmental impacts. BHP considers that this approach is consistent with the principles of ESD.
Internal Context		
BHP Charter and HSEC Management System compliance	Is the proposed impact or risk consistent with the requirements of BHP Our Requirements, Petroleum Standard and HSEC Management Systems?	The use of the LWI vessel will be in compliance with BHP Charter values and management systems.
Professional judgement	Is the impact or risk being managed in accordance with industry best practice?	Controls identified in this plan are consistent with industry best practice and guidelines. Accepted controls that will be implemented are provided in Table 8-21.
ALARP	Are there any further reasonable and practicable controls that can be implemented to further reduce the impact or risk?	All reasonable and practicable controls have been assessed (Table 8-21), additional controls were considered but were found not to be justifiable in further reducing the impacts and risks of interactions with marine fauna without a gross disproportionate sacrifice. BHP

Acceptability Criteria	Acceptability Criteria	Demonstration
		considers that the residual risk of interactions with marina fauna has been demonstrated to be ALARP.
External Context		
Environmental best practice	Are controls in place to manage the impacts and risk to the environment that are commensurate with the nature and scale of any environmental sensitivities of the receiving environment?	The environmental performance outcomes, performance standards and measurement criteria that determine whether the outcomes and standards have been achieved are commensurate with the environmental significance of the receiving environment.
Stakeholder views	Do stakeholders have concerns / issues, and if so, have controls been implemented to manage their concerns / issues?	Stakeholders have been consulted about the petroleum activity (Section 5) and no stakeholder concerns have been raised regarding this aspect.

Acceptability Summary

The presence of the LWI vessel cannot be avoided. While the potential exists for a collision between a vessel and a marine turtle/cetacean/whale shark, it is considered a rare scenario. The vessel essentially be stationary or travelling at very low speeds in the operational area, also reducing the likelihood of fauna strike. In the highly unlikely event of a whale or turtle mortality, the effect is not likely to be significant (as defined by EPBC Act significance impact guidelines) at the population level.

The proposed control measures for protection of whales is consistent with regulatory requirements imposed on the whale watching industry and best practice for managing interactions with whales. An additional control has been identified (similar to whale avoidance measures but with reduced distances) to further reduce the risk of vessel-turtle collisions to acceptable levels.

All relevant controls were considered as part of the ALARP assessment, and as no other reasonable additional controls were identified that would further reduce the impacts and risks of interference to marine fauna without a gross disproportionate sacrifice, the impacts and risks are considered ALARP. Stakeholders have been consulted about the activities, and no comments were received regarding this aspect. BHP undertakes regular consultation with relevant stakeholders about its operations/ activities providing them with sufficient and reasonable opportunities to raise any new concerns or issues for the duration of this activity.

BHP is satisfied that when the accepted controls are implemented that the impact and residual risk of interference with marine fauna is considered 'ALARP' and that adherence to the performance standards will manage the impacts and risks of interference with marine fauna to an acceptable level.

8.8.6 Environmental Performance Outcome, Performance Standards and Measurement Criteria

Environmental Performance Outcome	Environmental Performance Standard	Measurement Criteria
No injury or mortality to marine fauna as a result of vessel strike	**PS 8.8.1** **OPGGS Act 2006 – (s. 280 (2) (c)) - EPBC Regulations 2000 – Part 8 Division 8.1 (r. 8.05) Interacting with cetaceans (modified to include turtles and whale sharks):** Vessels will not knowingly travel at speeds greater than 6 knots within 300 m of a whale/ whale shark and 150 m for a dolphin (50 m of a turtle) (caution zone). Vessels will not knowingly approach closer than 100 m for a whale/ whale shark, 50 m for a dolphin (and 25 m of a turtle). If the cetacean/ whale shark shows signs of being disturbed, the vessels will immediately withdraw from the caution zone at a constant speed of less than 6 knots. Vessels must move at a constant slow speed and with minimal noise away from a cetacean that is approaching so that the vessel remains at least 300 m from the cetacean[3]. Sightings of cetaceans and whale sharks are recorded and reported to the Vessel Master.	Records of breaches of vessel and cetaceans/ whale sharks/ turtles interaction requirements outlined in EPBC Regulations reported via Monthly Recordable Incident Report and Environmental Performance Report.
	PS 8.8.2 **EPBC Act 1999 – Ministerial Approval Decision April 2006 (EPBC 2005/2034) Conditions:** 1 (a) iv: 'Cetacean interaction procedures for supply vessels and aircraft that are consistent with Part 8 of the EPBC Regulations 2000; and 1 (a) v: 'Cetacean and whale shark sightings reporting'.	Environment Induction attendance record demonstrates vessel crew are aware of marine fauna (cetaceans, turtles and whale sharks) interaction requirements that are consistent with Part 8 of the EPBC Regulations 2000 Documented evidence that cetacean and whale shark sightings annually reported to DoEE.
	PS 8.8.3 Environmental awareness induction provided to marine crew prior to activities to advise marine fauna interaction requirements. Cetacean and whale shark sightings are recorded and reported secondary to the primary responsibilities of crew, and cetacean and whale shark sightings annually reported to DoEE.	Signed environmental awareness induction attendance records demonstrate environmental briefing has been conducted for marine crew, including sightings and recording requirements. Documented evidence that cetacean and whale shark sightings have been reported.
	PS 8.8.4 Injury or death of any marine fauna species listed as threatened or migratory under the EPBC Act reported to NOPSEMA. Any vessel strike incidents with a whale in the operational area is reported in the National Ship Strike Database at: https://data.marinemammals.gov.au/report/shipstrike	Vessel collision incident report. National Ship Strike Database entry number.

[3] For safety reasons, the above distances are not applied for a vessel holding station or with limited manoeuvrability.

8.9 Introduction of Invasive Marine Species

8.9.1 Summary of Risk Assessment and Evaluation

Aspect	Source of Risk	Potential Impact	Severity Factor	Likelihood Factor	Residual Risk	Acceptability
Introduced marine species	Movement of vessel from known high invasive marine species risk areas	Introduction of invasive marine species to area leading to major impact to native species.	100	Highly Unlikely (0.03)	3	Tolerable

8.9.2 Source of Risk

Biofouling on immersed surfaces (e.g. ship hulls), floating/ immersible equipment and within internal seawater circulation systems, as well as ballast water, are potential pathways for invasive marine species (IMS) to translocate on offshore vessels.

There is the potential for the LWI vessel to transfer IMS from international waters into the operational area and for them to establish in the local environment. There is a smaller risk of transfer of IMS from Australian waters.

The LWI vessel will likely mobilise to the operational area from Singapore. Mobilisation of the vessel will be in accordance with biosecurity and marine assurance requirements.

Ballast Water

The Commonwealth Department of Agriculture, Water and the Environment (DAWR) is the lead agency for management of ballast water, with responsibility (formerly the Department of Agriculture). Vessels manage ballast water in accordance with International Maritime Organisation (IMO) Ballast Water Management (BWM) Convention, IMO Guidelines, the mandatory Australian Ballast Water Management Requirements (DAWR, 2017) that is enforced under the *Biosecurity Act 2015* and associated local measures intended to minimise the risk of transplanting harmful aquatic organisms and pathogens from ships' ballast water and associated sediments, while maintaining ships safety. Contracted vessels have individual Ballast Water Management Plans.

Vessels arriving from overseas, intending to discharge trim or ballast water in coastal Australian waters are required to have undertaken a ballast water exchange in accordance with Department of Agriculture, Water Resources requirements. The Australian ballast water management requirements are now aligned with the (BWM) Convention:

- All vessels must carry a valid Ballast Water Management Plan;
- Vessels with a ballast water management system (BWMS) should also carry a Type Approval Certificate specific to the type of BWMS;
- All vessels must submit a Ballast Water Report. Vessels intending to discharge ballast are obligated to report;
- International vessels can submit a Ballast Water Report through the Maritime Arrivals Reporting;
- System (MARS) at least 12 hours prior to arrival;
- All vessels must maintain a complete and accurate record of all ballast water movements; and
- Domestic trading vessels can request a low risk exemption through a Domestic Risk Assessment. All applications must be submitted through MARS.

From September 2019, all vessels that use ballast water are required to meet the Regulation D2 discharge standard of the International Convention for the Control and Management of Ships' Ballast Water and Sediments (the Convention) at their next renewal survey. Vessels using ballast water exchange as their primary ballast water management method are required to phase out this management method and meet the Regulation D2 discharge standard. Vessels may meet this standard by installing an International Maritime Organisation (IMO) Type Approved ballast water management system, or as specified within the Convention.

Vessels will exchange ballast water outside ports where possible.

The proposed control measures for IMS introduced by ballast water are consistent with the Australian Ballast Water Management Requirements. They are also consistent with good oilfield practice.

Biofouling

The Commonwealth Department of Agriculture, Water and the Environment is the lead agency for management of Biofouling on vessel hulls, external niche areas and immersible equipment pose a potential risk of IMS in Australian waters. Under the National Biofouling Management Guidelines Guidance for the Petroleum Production and Exploration Industry and IMO Guidelines for the control and management of ships' biofouling to minimise the transfer of invasive aquatic species (resolution MEPC.207(62), DAWR and DoEE guidelines 5 6 and APU IMS Management Procedure a risk assessment approach is applied to manage biofouling.

The BHP APU IMS Management Procedure outlines:

- Regulatory Framework for management of IMS;
- Identify BHP's marine activities at risk of facilitating introduction/translocation of IMS into WA and Commonwealth waters;
- BHP and Contractors roles and responsibilities
- Procedure for assessing vessel and immersible equipment for IMS risk; and
- Management and mitigation measures to prevent IMS incursions and manage identified bio-fouling pre hire and post-mobilisation.
  - All contracted vessels are required to complete the IMS risk assessment process described in this procedure. The IMS risk assessment assigns a final risk category of low, moderate, uncertain or high) to vessels based on a range of information including last port of call, age of antifouling coating etc. If a risk category of moderate, uncertain or high is scored, a range of management options are available including inspections, cleaning or treatment of internal seawater systems.
  - Provide all documentation to BHP during the Marine Management Process prior to hire; and
  - Any vessel contracted for greater than 12 months will be audited annually

8.9.3 Environmental Impact Assessment

The present knowledge base is inadequate to produce a detailed character profile of all marine organisms that may be translocated by shipping beyond their natural range. Ruiz *et al*. (2000) have analysed the common factors influencing success of translocated marine pests. The majority of marine pest species appear to have planktotrophic larvae, however oviparous species are included. Many of them are epibenthic fouling species but some are soft substratum burrowers or planktonic. It seems likely that many of them are transported as ship bottom fouling organisms rather than as propagules in ballast water.

Assessment of environmental risk has considered the probability of introduction of marine pest species between the source and destination and the similarity of source and discharge habitats:

- The probability of introduced species from the Central Indo-West Pacific Province surviving in the area is low, but if they were to be dispersed to the coastal habitats the probability of survival would be high.
- The potential ecological effect of this relatively high survival potential may be mitigated by the similarity of the marine species of the region; and

- The probability of introduced species from the more distant South Japan, East African, North Indian and Pacific Islands Provinces surviving in the area also is low. If they were dispersed to coastal habitats the impact would be moderate to major, given the greater number of sister and analogue species that could damage the receiving ecosystems.

IMS may also be economically damaging, including direct damage to assets (fouling of vessel hulls and infrastructure), depletion of commercial marine species, and damage to recreational vales of the area (tourism and recreational fishing). Furthermore, once introduced to an area, eradication or control of introduced species may be difficult, expensive and disruptive or damaging to other marine life.

8.9.4 Demonstration of ALARP

A summary of the ALARP process undertaken for the environmental aspect is presented below. This process was completed as outlined in Section 6.1.2 and included consideration of all controls, analysis of the risk reduction proportional to the benefit gained and final acceptance or justification if the control was not considered suitable (refer Table 8-23). The result of this ALARP Assessment contributes to the overall acceptability of the impact or risk.

Table 8-23: Introduced marine species – ALARP assessment summary

Hierarchy of Control	Control Measure	Accept/ Reject	Reason	Performance Standard
Eliminate	None identified	N/A	N/A	-
Substitute	None identified	N/A	N/A	-
Engineer	None identified	N/A	N/A	-
Separate	None identified	N/A	N/A	-
Administrate	LWI vessel will comply with the BHP APU IMS Management Procedure.	Accept	Controls based on legislative requirements must be accepted. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.9.1**
	Ballast water exchange or treat ballast water exchange using an approved ballast water treatment system.	Accept	Controls based on legislative requirements under the *Biosecurity Act 2015* must be accepted. Control is feasible, standard practice with minimal cost. Benefits outweigh any cost sacrifice.	**PS 8.9.2**
Additional Control Measures Considered				
Eliminate	Mandatory dry-cock cleaning of vessel prior to entry to the operational area to reduce risk of IMS introduction	Reject	Substantial costs and would affect schedule resulting in potential delays. Significant cost deemed grossly disproportionate to very low risk given controls already in place.	-
Engineer	No ballast water exchange	Reject	Ballast water exchange is critical for maintaining vessel stability.	-

ALARP Summary

The risk assessment and evaluation has identified a range of control measures that when implemented are considered to manage the risk of introducing invasive marine species during the LWI activities. No additional or alternative management procedures have been identified that would reduce the environmental impacts and risks associated with IMS, as such it is considered reduced to ALARP.

8.9.5 Demonstration of Acceptability

BHP considers a range of factors when determining that a level of impact and risk to the environment is broadly acceptable, as summarised in Table 8-24.

Table 8-24: Demonstration of acceptability for introduction of invasive marine species

Acceptability Criteria	Acceptability Criteria	Demonstration
Codes and Standards	Is the impact or risk being managed in accordance with relevant Australian or International legislation, Ministerial Conditions or standards?	Impacts and risks associated with introduced marine species will be managed in accordance with relevant legislation, and codes and standards (e.g. International Convention on the Control of Harmful Anti-fouling Systems on Ships). Management consistent with: • *Biosecurity Act 2015* • National Biofouling Management Guidance for Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee, 2018) • *WA Fish Resources Management Act 1994* • Performance standards are consistent with the Ballast Water Management Requirements (as defined under the *Biosecurity Act 2015*) (aligned with the International Convention for the Control and Management of Ships' Ballast water and Sediments)
Ecologically Sustainable Development (ESD)	Is the proposed impact consistent with the principles of ESD?	BHP undertakes petroleum activities in a manner that is consistent with its Charter values and Code of Business Conduct. In determining the level of acceptability of introduction of IMS in the field, and guided by the Charter value of Sustainability, BHP has identified, assessed and controlled risks associated with this activity to minimise environmental impacts. BHP considers that this approach is consistent with the principles of ESD.
Internal Context		
BHP Charter and HSEC Management System compliance	Is the proposed impact or risk consistent with the requirements of BHP Our Requirements, Petroleum Standard and HSEC Management Systems?	The contracting and use of vessels will be in compliance with BHP Charter values and management systems.
Professional judgement	Is the impact or risk being managed in accordance with industry best practice?	Controls identified in this plan are consistent with industry best practice and guidelines. Accepted controls that will be implemented are provided in Table 8-23.
ALARP	Are there any further reasonable and practicable controls that can be implemented to further reduce the impact or risk?	All reasonable and practicable controls have been assessed (Table 7-17), additional controls were considered but were found not to be practicable in further reducing the impacts and risks of introduced marine species without a gross disproportionate sacrifice. BHP considers that the residual risk of introduced marine species has been demonstrated to be ALARP.

Acceptability Criteria	Acceptability Criteria	Demonstration
External Context		
Environmental best practice	Are controls in place to manage the impacts and risk to the environment that are commensurate with the nature and scale of any environmental sensitivities of the receiving environment?	The environmental performance outcomes, performance standards and measurement criteria that determine whether the outcomes and standards have been achieved are commensurate with the environmental significance of the receiving environment.
Stakeholder views	Do stakeholders have concerns / issues, and if so, have controls been implemented to manage their concerns / issues?	Stakeholders have been consulted about the petroleum activity (Section 5) and no stakeholder concerns have been raised regarding this aspect. BHP will continue to liaise with WA Department of Primary Industries and Regional Development (DPIRD) on current requirements for the management of the risk of marine pest introduction in WA waters.

Acceptability Summary

The proposed control measures for preventing and minimising the risk of introduced marine species are comprehensive and consistent with all relevant codes and standards and good oilfield practice. No reasonably practicable additional controls have been identified that would provide a significant net environmental benefit.

The proposed control measures are consistent with the Australian Ballast Water Management Requirements and the National Biofouling Management Guideline.

All relevant controls were considered as part of the ALARP assessment, and as no other reasonably practicable additional controls were identified that would further reduce the impacts and risks of introduced marine species without a grossly disproportionate sacrifice, the impacts and risks are considered ALARP. BHP undertakes regular consultation with relevant stakeholders about its operations/ activities providing them with sufficient and reasonable opportunities to raise any new concerns or issues for the duration of this activity.

BHP is satisfied that when the accepted controls are implemented the impact and residual risk of introduced marine species to the environment is considered ALARP and that adherence to the performance standards will manage the impacts and risks of introduced marine species to an acceptable level.

8.9.6 Environmental Performance Outcome, Performance Standards and Measurement Criteria

Environmental Performance Outcome	Environmental Performance Standard	Measurement Criteria
No introduction of invasive marine species	**PS 8.9.1** **Marine Orders 8 - Part 98: Marine Pollution - Anti-fouling Systems:** International Convention on the Control of Harmful Anti-fouling Systems on Ships (IMO, 2001). Prohibits the use of harmful organotins in antifouling paints used on ships and establishes a mechanism to prevent the potential future use of other harmful substances in anti-fouling systems.	Records indicate ship anti-fouling systems have not used harmful organotins.

Environmental Performance Outcome	Environmental Performance Standard	Measurement Criteria
	PS 8.9.2 **Australian Ballast Water Management Requirements(as defined under the *Biosecurity Act 2015*) (aligned with the International Control and Management of Ships' Ballast water and Sediments:** Ballast water exchange or treat ballast water using approved ballast water treatment system.	Ballast water exchange records maintained which verifies compliance against Ballast Water Management requirements.
	PS 8.9.3 **BHP Introduced Marine Species Management Procedure:** LWI vessel will complete an IMS risk assessment, before mobilisation to operational area, as described in BHP Introduced Marine Species Management Procedure. The IMS risk assessment assigns a final risk category of low, moderate, uncertain or high to vessels based on a range of information including last port of call, age of anti-fouling coating etc. If a risk category of moderate, uncertain or high is scored, a range of management options are available including inspections, cleaning or treatment of internal seawater systems.	Record and review of IMS risk assessment by the BHP Environmental Specialist LWI vessel prior to entry into the operational area. Records of management measures implemented if required, through the IMS vessel risk assessment process.

9 Hydrocarbon Spill Response

As required by the OPGGS (Environment) Regulations, BHP has prepared the *Crosby-3H1 Light Well Intervention Oil Pollution Emergency Plan (OPEP) (PYHSE-ER-0006)* (refer to Appendix G). The OPEP is the primary reference document and key control measure to be implemented in the event of an oil spill during the well intervention activities and has been developed as a formal means of establishing the processes and procedures to ensure that BHP maintains a constant vigilance and readiness to prevent and, where required, respond to and effectively manage oil spill incidents that may occur. The OPEP has been developed to be compliant with the OPGGS (Environment) Regulations.

This section of the EP provides a description of the proposed oil spill response strategies based on the worst-case spill scenarios. The response strategies presented are based on the outcome of a Strategic Net Environmental Benefit Analysis (NEBA). For each of the proposed response strategies, their benefits and constraints are presented along with an assessment of the associated risks and impacts that may occur from their implementation.

9.1 Spill Response Levels

To establish oil spill response arrangements that can be scaled up or down depending on the nature of the incident by integrating with other local, regional, national and industry plans and resources, BHP uses a tiered response approach. The criteria for determining the hydrocarbon spill ‘levels’ for the purpose of the spill response have adopted from the NatPlan and are described in Table 9-1. The ‘level-rating’ for oil spill response provides a magnitude description of the potential impact and the effort to support oil spill response.

The ‘Level’ is determined by the relevant Commander, such as the Field Response Team (FRT) Commander (for a small spill) or by the Incident Management Team (IMT) Incident Commander.

Typically, Level 1 spill responses can be resourced using shipboard or port located spill kits. Vessels are required to maintain a current SOPEP and appropriate spill kits, response capabilities and trained personnel. Likewise, designated ports and harbours are required to have as a minimum Level 1 response capability on site.

For Level 2-3 spills, BHP maintains a broad set of spill response capabilities. BHP also has contracts and Memorandum of Understanding (MoU’s) with National and International third-party spill response providers to ensure response capabilities can be drawn upon.

Table 9-1: Worst-case spill scenarios for the LWI activities and incident classification used to inform spill response

Level	Level Definition	Crosby-3H1 LWI Spill Scenarios
1	**An incident will have minor or limited impacts on the environment which can be controlled by the resources normally available onsite without the need to mobilise BHP IMT or other external resources.**	
	An incident: • Occurs within a single jurisdiction; • Simple IAP required; • Resourced from within one area; • Environmental would be isolated and/or natural recovery expected within weeks; • Wildlife impacts limited to individual fauna; • That has no immediate concern of shoreline impact; and • With a BHP Risk Matrix Consequence Level 1-2.	Refined oil/ hazardous chemicals (<80 L)

Level	Level Definition	Crosby-3H1 LWI Spill Scenarios
2	**An incident will have substantial impacts to the environment and cannot be be controlled by the use of onsite resources alone and required external resources and support to combat the situation.**	
	An incident: • Occurs across multiple jurisdictions; • Outline of the IAP required; • Requires intra-state resources; • Significant environmental impacts, recovery may take months, remediation required; • Wildlife impacts to groups of fauna or threatened fauna; • Shoreline impact is expected; and • With a BHP Risk Matrix Consequence Level 3+.	MDO spill from vessel collision (186 m^3 MDO) and Loss of flowline inventory (204 m^3 crude oil)
3	**An incident will have serious impacts to the environment and occurs across multiple/ international jurisdictions and requires mobilisation of state, national or international resources and support to combat the situation.**	
	An incident: • Occurs across multiple / international jurisdictions; • Detailed IAP required; • Requires national / international resources; • Significant environmental area impacted, recovery may take months, remediation required; • Wildlife impacts to large numbers of fauna; • With a BHP Risk Matrix Consequence Level 4+.	Loss of well containment (1,930 m^3 crude oil)

9.2 Source of Risk

This EP has identified all worst-case and credible hydrocarbon spill scenarios as:

- Level 3: Loss of well containment with subsurface release of 1,930 m^3 of crude oil over three weeks (refer to Section 8.3);
- Level 2: Loss of flowline inventory with subsurface release of 204 m^3 of crude oil (refer to Section 8.4); and
- Level 2: Fuel tank rupture from a vessel collision resulting in a surface release of 186 m^3 MDO (refer to Section 8.5).

9.3 Strategic Net Environmental Benefit Analysis of Response Options

In the oil spill response planning process, BHP has adopted a comprehensive Net Environmental Benefit Analysis (NEBA) methodology to select and justify the appropriate response strategy combinations for individual credible and worst-case hydrocarbon spill scenarios. A strategic NEBA was conducted to select the potential oil spill response strategies in the event of a Level 2 or 3 hydrocarbon spills (Table 9-2). The focus of the NEBA was to understand the consequences of ‘no action’ and to select an oil spill response strategy that delivered a net environmental benefit using the OPEP Priorities.

The NEBA methodology utilised is described as follows:

- LIST the response strategies available;
- IDENTIFY the benefit, environmental impact and operational challenge of each response strategy;
- EVALUATE the viability of each response strategy in a particular credible scenario;

- FILTER the result to identify all the viable strategies for a particular credible scenario;
- FORMULATE options of different strategy combinations; and
- COMPARE these options and select the preferred option of strategy combination.

From these results, the priority application ZONE of each strategy is identified in the preferred strategy combination by selecting the:

- Primary response strategy, which is confirmed to be used and should be applied as soon as possible;
- Secondary response strategy, which will be only applied if needed and practical; and
- Nil response strategy, which is a non-preferred option, will not be used and does not identify a net environmental benefit.

In the event of an oil spill, an Operational NEBA will be undertaken to select spill response options that have a net environmental benefit. It is likely that spill response will involve a combination of response options and will evolve over time as conditions change.

Table 9-2: Strategic NEBA of response option for hydrocarbon spills

RS #	Spill Response Strategy	Overview of Environmental Benefits	Associated Environmental Risks/ Impacts	Operational Constraints	Apply Response		Primary or Secondary Response	Justification Note
RS1.1	Source Control – Vessel Control	Limits and/or prevents further discharge of hydrocarbons to the marine environment by halting the spill (e.g. transfer fuel to another tank).	No significant impacts.	Health and safety considerations may delay implementation under certain circumstances (e.g. vapours).	Level 2 – MDO	Yes	Primary	Control at the vessel will always be attempted as the immediate primary response to halt further spill to marine environment.
					Level 2 – Crude (Flowline release)	N/A	-	
					Level 3 – Crude (Loss of well containment)	N/A	Primary	
RS1.2	Source Control – Subsea Intervention	Prevents further discharge of hydrocarbons to the marine environment by halting the spill.	No significant impacts.	Health and safety considerations may delay implementation under certain circumstances.	Level 2 – MDO	N/A	-	Subsea source control will always be attempted as the immediate primary response to halt further spill to marine environment for subsea releases
					Level 2 – Crude (Flowline release)	Yes	Primary	
					Level 3 – Crude (Loss of well containment)	Yes	Primary	
RS2	Monitor and Evaluate	Constant monitoring and evaluation by surveillance is a mandatory strategy required for real-time decision-making during a spill event.	Risks/ impacts from operations of monitoring vessels and aircraft (e.g. emissions such as air, noise and liquid waste, marine fauna interaction, interference with other users, etc.).	Weather conditions may put constraints on visual observations (vessel and/or aerial). Stringent safety management requirements for aerial and marine operations. Potential coordination of multiple vessels/ aircraft within limited area (SIMOPS).	Level 2 – MDO	Yes	Primary	Surveillance activities ensure constant monitoring and evaluation of the spill.
					Level 2 – Crude (Flowline release)	Yes	Primary	
					Level 3 – Crude (Loss of well containment)	Yes	Primary	
RS3.1	Dispersant – Surface Application	Benchmarking shows dispersants have an efficacy of 75-85% on surface oil within a 24 hour application window. Moves oil from the sea surface into the water column and dilutes concentration (lowers but does not eliminate impacts). The dispersed oil trajectory is only influenced by ocean currents, removing "wind assistance" and minimises shoreline impacts. This can reduce the oil contact by volume and lower probability of stranding. Dispersed oil breaks down faster.	Discharge of dispersant into environment. Adds chemical to environment when it is not likely to impact high or extreme environment receptors. Operation of aircraft and support vessel (efficacy testing). No removal of crude oil from environment.	No applicable to diesel spills due to rapid dispersion and spreading. Crude oil may only be amenable to dispersion for 24 to 48 hours after release. Requires clear area / no simultaneous operations. Supply chain could limit supply dispersant.	Level 2 – MDO	No	-	Applied to breakdown the hydrocarbon and allow/enhance dispersion into the water column, potentially reducing shoreline contact and increasing natural rates of biodegradation.
					Level 2 – Crude (Flowline release)	Yes	Secondary	
					Level 3 – Crude (Loss of well containment)	Yes	Secondary	
RS3.2	Dispersant – Subsea Application	Dispersant that is added subsea to the oil release will cause a large reduction in the interfacial tension and the turbulence of the release conditions will convert a greater proportion of the oil into droplets that are small enough to be retained in the water column by the prevailing oceanographic conditions. Moves oil into the water column and dilutes concentration (lowers concentration but does not eliminate impacts). The dispersed oil trajectory is only influenced by ocean currents, removing "wind assistance" and minimises shoreline impacts. This can reduce the oil contact by volume and lower probability of stranding. Dispersed oil breaks down faster.	Discharge of dispersant into environment. Adds chemical to environment when it is not likely to impact high or extreme environment receptors. Initial response limited to amount of dispersant on vessel. No removal of crude oil from environment.	Crude oil may only be amenable to dispersion for 24 to 48 hours after release.	Level 2 – MDO	No	-	Strategy aims to increase dispersion (entrainment of fine oil droplets) and reduce the amount of oil expressing at sea surface, and may reduce volume of oil loading on shorelines.
					Level 2 – Crude (Flowline release)	No	-	
					Level 3 – Crude (Loss of well containment)	Yes	Secondary	
RS4	Marine Recovery	Limits the movement of surface crude in the marine environment and recovers oil from environment.	Operation of vessels (e.g. burn fuel, physical presence, discharges) for the placement and movement of booms.	Boom deployment may be delayed in serious incident where safety of personnel is priority.	Level 2 – MDO	No	-	Deployment of equipment (booms, skimming equipment) for recovery of oil slicks from
					Level 2 – Crude (Flowline release)	Yes	Secondary	

RS #	Spill Response Strategy	Overview of Environmental Benefits	Associated Environmental Risks/ Impacts	Operational Constraints	Apply Response		Primary or Secondary Response	Justification Note
		No applicable for diesel spills due to rapid dispersion and spreading and therefore unlikely to encounter films great than 20-25 µm.	Equipment and labour intensive. Waste disposal of recovered crude oil. Cleaning and disposal of contamination from boom.	Wind and surface currents are key constraint for the boom operation in the open ocean. Current speed for boom (approx. 1 knot depending on boom and angle). Inefficient and impractical on thin slicks, in inclement weather or high seas Oil recovery typically <10% of the oil spilled in open ocean environments. Requires surface oil thick enough for the response option to be effective Bonn Agreement Oil Appearances Code 4 (discontinuous true oil colour) and 5 (continuous true oil colour)	Level 3 – Crude (Loss of well containment)	Yes	Secondary	sea surface and potentially reduce volumes contacting shorelines. Not suitable for MDO spills due to rapidly spreading and high evaporation rates.
RS5	Shoreline Protection	If modelling suggests impact to sensitive resources protective and deflective booming can be undertaken.	Operation of vessels. Defective booms. Operation of vessel (e.g. burn fuel, physical presence, discharges). Cleaning of contaminated booms and waste disposal of recovered crude and water. Waste disposal of recovered crude oil. Cleaning and disposal of contamination from boom.	Wind and surface currents are key constraint for the boom operation in the open ocean. Resources and logistics support. Current speed for boom (approx. 1 knot depending on boom and angle). Inefficient and impractical on thin slicks, in inclement weather or high seas Oil recovery typically <10% of the oil spilled in open ocean environments. Requires surface oil thick enough for the response option to be effective Bonn Agreement Oil Appearances Code 4 (discontinuous true oil colour) and 5 (continuous true oil colour)	Level 2 – MDO	Yes	Secondary	Applicable to Level 2 and Level 3 spills to minimise the amount of hydrocarbons contacting shorelines.
					Level 2 – Crude (Flowline release)	Yes	Primary	
					Level 3 – Crude (Loss of well containment)	Yes	Primary	
RS6	Mechanical Dispersion	No significant benefit unless this technique is coupled with the use of dispersants.	Operation of vessel (e.g. burn fuel, physical presence, discharges).	Offshore vessels are designed not to cavitate, so not efficient at breaking up hydrocarbon films. Small particle size required otherwise material resurfaces. Wind speeds above 20 knots provide natural dispersion, making this method redundant. Cannot be performed where there are high concentrations of vapour.	Level 2 – MDO	No	-	Mechanical dispersion uses vessels with propellors that can cavitate. The turbulence created helps to break-up surface slicks, dispersing hydrocarbons into the column where biodegradation process are enhanced due to smaller droplet sizes. This strategy requires vessels on site with engines that cavitate. Wave action provides some effect.
					Level 2 – Crude (Flowline release)	No	-	
					Level 3 – Crude (Loss of well containment)	No	-	
RS7	In-Situ Burning	Removes oil from environment.	Operation of a 4 vessel spread (2 x boom sweep, 1 x igniter, 1 x observer). Particulates (smoke) in air with associated health risks. In complete combustion may produce toxic chemicals.	Need to build a thick film for ignition (5 to 10 mm). Wind is a key constraint, calm seas and ideal conditions are considered necessary for booming operations to get a thick film thickness and safe ignition. Availability of fire boom.	Level 2 – MDO	No	-	Not applicable as insufficient surface slick thickness predicted. The experience and expertise is not readily available in Australia.
					Level 2 – Crude (Flowline release)	No	-	
					Level 3 – Crude (Loss of well containment)	No	-	
RS8	Shoreline Clean-Up	Effective shoreline strategies are: - Natural recovery; - Deflection and protection; - Manual recovery; and - Debris removal.	Labour intensive. Logistics. Waste management.	Shoreline characteristics (substrate type, beach type, exposure to wave action, biological, social, heritage or economic resources, amount of crude present) and access requirements.	Level 2 – MDO	No	-	Highly volatile components likely to evaporate prior to shoreline contact, hence shoreline clean-up may cause more impact than the hydrocarbons.
					Level 2 – Crude (Flowline release)	Yes	Primary	
					Level 3 – Crude (Loss of well containment)	Yes	Primary	

RS #	Spill Response Strategy	Overview of Environmental Benefits	Associated Environmental Risks/ Impacts	Operational Constraints	Apply Response		Primary or Secondary Response	Justification Note
RS9	Natural Recovery	No additional impacts associated with response activities.	No additional impacts.	No constraints.	Level 2 – MDO	Yes	Primary	Makes use of the natural degradation and weathering process to breakdown and remove surface oil and stranded hydrocarbons. Effectively this response strategy means no direct action other than monitor and evaluate spill trajectory and rate of habitat/ community recovery.
					Level 2 – Crude (Flowline release)	Yes	Primary	
					Level 3 – Crude (Loss of well containment)	Yes	Primary	
RS10	Environmental Monitoring	Benefits outweigh impacts. Primary tool for determining the extent, severity and persistence of environmental impacts from oil spills, and determine how effective the oil spill response is being in protecting the environment.	Labour intensive. Logistics. Operation of vessel (e.g. burn fuel, physical presence, discharges). Noise from support vessels and helicopters. Vessel collision. Obstacles to other sea users.	Weather conditions may put constraints on visual observations (vessel and/or aerial). Stringent safety management requirements for aerial and marine operations. Potential coordination of multiple vessels/ aircraft within limited area (SIMOPS).	Level 2 – MDO	Yes	Primary	Applicable to Level 2 and Level 3 spills to monitor impact and recovery from oil spill events.
					Level 2 – Crude (Flowline release)	Yes	Primary	
					Level 3 – Crude (Loss of well containment)	Yes	Primary	
RS11	Oiled Wildlife Response	Pre-oiling activities including onshore exclusion barriers, hazing and pre-emptive capture used to reduce incidence of animals becoming oiled. Post-oiling activities including collection and rehabilitation to treat oiled fauna and return to similar suitable habitat. Utilisation of local skilled veterinarians for treatment of oiled wildlife.	Labour intensive. Logistics. Operation of vessel (e.g. burn fuel, physical presence, discharges). Hazing: Accidentally drive oiled wildlife into oil, or separate groups/individuals (e.g. parent/ offspring pairs). Pre-emptive capture and post-oiled collection: Risk of injury and inappropriate field collection/ handling during pre-emptive capture and post-oiled collection. Rehabilitation: inadequate/ inappropriate animal husbandry leading to stress/ injury/ death. Inappropriate relocation points leading to disorientation / stress.	Wind is a key constraint, calm seas and ideal conditions are considered necessary for capture operations. Weather constraints for use of aerial observation/ tracking fauna. Navigation of multiple vessels within a small area. Availability of suitable space/ location in township to handle rehabilitation and fauna treatment.	Level 2 – MDO	Yes	Primary	Applicable where surface hydrocarbons causes oiling risk to marine fauna. Applicable to Level 2 and Level 3 spills.
					Level 2 – Crude (Flowline release)	Yes	Primary	
					Level 3 – Crude (Loss of well containment)	Yes	Primary	
RS12	Forward Command Post	Benefits outweigh impacts. Establishes local command. Better communication with local resources and stakeholders	Labour intensive. Logistics. Mobilisation of personnel to Exmouth or Onslow – aviation fuel, etc.	Availability of suitable command post (location/ building) in Exmouth.	Level 2 – MDO	Yes	Secondary	Constant monitoring and evaluation of spill and response activities by people on-location during a spill event.
					Level 2 – Crude (Flowline release)	Yes	Secondary	
					Level 3 – Crude (Loss of well containment)	Yes	Primary	
RS13	Waste Management	Benefits outweigh impacts. Oiled waste removed from site by trained contractors and dealt with at an approved waste management facility.	Labour intensive. Logistics.	Logistics constraints in moving waste from site to approved waste facility.	Level 2 – MDO	No	N/A	Applicable where surface hydrocarbons causes oiling risk to marine fauna.
					Level 2 – Crude (Flowline release)	Yes	Primary	
					Level 3 – Crude (Loss of well containment)	Yes	Primary	

9.4 Environmental Impact and Risk Assessment for Spill Response Activities

While spill response activities are intended to reduce the potential environmental consequences of a hydrocarbon spill, they can introduce new impacts and risks. In the event of a hydrocarbon spill, response strategies will be implemented where possible to reduce environmental impacts to ALARP. The response strategies deemed appropriate based on the predicted nature and scale of the worst-case spill scenarios identified for the Crosby-3H1 well intervention activities have been identified (via the preliminary NEBA, and ALARP demonstration) (refer to previous Section 9.3).

The OPEP (Appendix G) provides for the following selected response strategies in the event of a spill:

- Source control:
  - Vessel control;
  - Subsea intervention;
- Monitor and evaluation
- Chemical dispersant:
  - Surface application; and
  - Subsea application
- Marine recovery;
- Shoreline protection
- Shoreline clean-up;
- Natural recovery;
- Environmental monitoring;
- Oiled wildlife response;
- Forward command post; and
- Waste management.

The following sub-sections present the identified suitable response spill strategies identified in Table 9-2, the impacts and risks associated with their implementation, and control measures for reducing impacts and risks to ALARP and acceptable levels. Section 9.5 and assesses their effectiveness and adequacy of resourcing available to support spill response strategies to further justify reducing impacts and risks to ALARP and acceptable levels.

Typical environmental aspects, impacts and risks that may arise from conducting spill response activities are similar to those already described in Sections 7 and 8 for planned activities and unplanned events, particularly for vessel-based operations. The greatest potential for impacts additional to those described for routine activities is from chemical dispersant application, shoreline clean-up and oiled wildlife response operations.

A number of response strategies, namely RS1 Source Control, RS2 Monitor and Evaluate, RS3 Dispersants, RS4 Marine Recovery, RS5 Shoreline Protection, RS6 Shoreline Clean-Up and RS10 Environmental Monitoring include components of their response activities that are vessel-based, and the impacts and risks associated with their implementation from vessels are assessed previously in this EP and relate to the following:

- Physical presence (Section 7.3);
- Vessel discharges and emission (light, noise, atmospheric, routine and non-routine discharges, waste management in Sections 7.4 to 7.8);
- Unplanned discharges (solids, liquids, and hydrocarbon spills in Sections 8.4 to 8.7);
- Marine fauna interaction (Section 8.8); and

- Introduction of invasive marine species (Section 8.9).

As such, impacts and risks relating to the above aspects associated with the spill response strategies are not considered further in assessment below.

9.4.1 Spill Response: Source Control – RS1.1 Vessel Control and RS1.2 Subsea Intervention

The purpose of this section is to describe BHP's strategy in relation to Source Control to:

- Limit the release of oil discharged to the marine environment and prevent further release of oil by isolating the source of the release; and
- Manage to ALARP and acceptable levels the risks and impacts of Source Control response strategy to environmental sensitivities.

The strategy includes identification of the risks and impacts associated with Source Control, which is includes consideration of the benefits associated with vessel control and subsea intervention. It then demonstrates that these impacts and risks can be reduced to ALARP and acceptable levels, enabling source control to be a primary response strategy.

Specifically this section includes:

- Identification of the potential impacts of vessel control, which includes discussion on vessel control effectiveness, demonstrating that the application of vessel control can reduce the total volume of oil ashore;
- Demonstration of oil spill preparedness;
- Controls in place to mitigate the impacts and risks of vessel control on sensitive environmental receptors;
- Demonstration that the vessel control strategy proposed by BHP is ALARP and acceptable; and
- Environmental performance outcomes, performance standards and measurement criteria for Source Control.

Summary of Activity – Vessel Control

The LWI vessel used for the well intervention activities will have a current SOPEP in accordance with the requirements of MARPOL Annex I (Prevention of Pollution by Oil). This plan outlines responsibilities, specific procedures and resources available in the event of an oil or chemical spill. Spills that occur beyond the capability of the vessel will be managed in accordance with BHP's *Crosby-3H1 Light Well Intervention OPEP (PYHSE-ER-0006)*.

Vessel Source Control methods are implemented as the primary response strategy for responding to single point releases from hull leakage and spills in the event of a vessel collision. Vessel Source Control will be activated immediately by persons onboard, under the direction of the Vessel Master, to reduce or control the discharge and conducted according to the vessel-specific MARPOL-compliant SOPEP for vessels, as required under *International Convention for Protection of the Sea (Prevention of Pollution from Ships) Act 1983*; AMSA Marine Orders – Part 91 and Part 94; and MARPOL Annexes I and III. Vessel Source Control activities will always include consideration of human health and safety.

Vessel Source Control activities will be dependent on the type of incident but may include:

- Closing valves, isolating pipework and shutting down pumps.
- The use of temporary patches or bungs/ plugs to seal holes to prevent further releases, until more permanent measures can be made.
- The transfer of product between tanks on the vessel or between vessels - in the event of a leaking tank or tank rupture from a vessel collision.
- The use of spill response equipment located around the vessel, including small booms, absorbent pads, spill absorbent litter, spill recovery containers, permissible cleaning agents and other materials available onboard to clean-up spilled material on deck. Remaining oily spill residues on decks or other surfaces

may be washed into drains leading to the oil-water separator system to treat the effluent prior to discharge.

Summary of Activity – Subsea Intervention

Subsea Intervention methods are implemented for a Level 2/3 subsea release. Source Control via subsea intervention is the primary response strategy for responding to subsea loss of well control at the SID due to failure of well barrier integrity (Level 3 spill); and responding to a loss of inventory from a dropped object on a flowline (level 2 spill). Subsea Intervention Source Control will be activated immediately by persons onboard, under the direction of the Vessel Master, to reduce or control the discharge and conducted according to the vessel-specific emergency procedures. Source Control actions will always include consideration of human health and safety.

Subsea Intervention activities will be dependent on the nature of the release but may include:

- Initiate emergency shutdown – dropped object severing flowline incident;
- The activation of SID and well head controls via manual ROV override;
- Closure of the Surface Controlled Subsurface Safety Valve (SCSSV):

  This is achieved through venting pressure from the control line on the vessel.
- Well kill (by bullheading production bore):

  This is achieved by pumping well kill fluid through the well service lines via two potential entry points on the SID to displace existing well fluids into the formation with well kill fluid.
- Shutdown of release by installation of pressure retaining cap:

  This is achieved by ROV installation of a specifically designed pressure retaining cap to the upper section of the SID lubricator. The well could then be killed using the most appropriate method from those same access points outlined previously.
- Well kill (by bullheading production bore or annulus via vessel deployment of 2" flexible line):

  This is achieved by pumping well kill fluid from the vessel via access line mounted onto lower SID and access from a 2" flexible line deployed from the vessel with two access point on the well:

  1. Via 2” well service line in the lower SID connecting to the production well bore at the bottom of the SID.
  2. Via the gas lift line on the production flow base into annulus – the same 2" well service line can be diverted via additional pipework on the SID and a flexible jumper to the gas lift line on the production flowbase.
- Well kill (by annulus kill):

  This is achieved by pumping well kill fluid from the vessel via well access from the annulus side of the XT through the small bore tree cap test (TCT) line.
- Well kill (by bullheading production bore or annulus via FPSO):

  This will involve vessel manipulating manifold and tree SID valves to allow the well to be killed via the production or gas lift flowline from the FPSO prior to the dynamic well kill procedures.

In conjunction with concurrent Source Control activities, if initial Source Control – Subsea Intervention actions have not been successful in halting subsea release and if Operational NEBA demonstrates a net environmental benefit, activate RS3 Dispersants Response Strategy for application of subsea dispersants (refer to Section 9.4.3).

Potential Environmental Impact and Risks

None in addition to those already associated with vessel-based activities.

Source Control Environmental Performance

Table 9-3 provides the environmental performance outcomes, performance standards and measurement criterial for the Source Control response strategy.

In the event of a spill, Operational NEBAs (refer to Section 3.2 of the OPEP) will be completed daily, to take into account spill trajectories, prevailing weather and planned actions for the day. The initiation criteria, course of action, resources, supporting documentation and termination criteria associated with each response strategy are detailed in the BHP *Crosby-3H1 Light Well Intervention Oil Pollution Emergency Plan (OPEP) (PYHSE-ER-0006)* (Appendix G).

Table 9-3: Environmental performance – Source Control

RS1 Source Control			
Environmental Performance Outcome	**To prevent the impact on the marine environment resulting from hydrocarbon spills by reducing, controlling or halting the discharge of hydrocarbons by the implementation of source control methods.**		
Response Strategy	**Control Measure ID**	**Performance Standard**	**Measurement Criterial**
Source Control	**PS RS1.1**	Operational NEBA to include evaluation of requirement for implementation of Source Control.	Documentation of completed Operational NEBA.
	PS RS1.2	Modelling predictions of spill trajectory to be undertaken to support the Operational NEBA.	Documentation of Contract with AMOSC who maintains call-off contract with RPS-APASA.
	PS RS1.3	Response strategy activities continued until termination criteria met.	Incident log.
	PS RS1.4	Arrangements for access to source control personnel are maintained during the activity.	Contract/MoUs for source control personnel.
Source Control – Vessel Control	**PS RS1.5**	Source Control – Vessel Control to be managed in accordance with vessel-specific (SOPEP/SMPEP for vessels, in line with MARPOL Annex I).	Vessel audit/ inspection records.
			Spill reports logged as per vessel procedures. Spill exercise close out reports.
	PS RS1.6	Onboard response capabilities in the event of an oil spill are tested maintained and available prior to mobilisation to demonstrate preparedness.	Record of SOPEP drills and spill exercises in vessel log.
			Vessel audit/ inspection records.
	PS RS1.7	Scupper plugs or equivalent deck drainage control measures available where hazardous chemicals and hydrocarbons stored and frequently handled.	Vessel audit/ inspection records.
Source Control – Subsea Intervention	**PS RS1.8**	Source Control – Subsea intervention to be managed in accordance with Vessel Safety Case.	BHP review confirms LWI Vessel Contractor Annual Audit 'Critical' Actions have been closed out.

RS1 Source Control			
Environmental Performance Outcome	**To prevent the impact on the marine environment resulting from hydrocarbon spills by reducing, controlling or halting the discharge of hydrocarbons by the implementation of source control methods.**		
Response Strategy	**Control Measure ID**	**Performance Standard**	**Measurement Criterial**
			Intervention reports logged as per vessel procedures.
	PS RS1.9	Onboard response capabilities in the event of an oil spill are tested maintained and available prior to mobilisation to demonstrate preparedness.	Record of subsea intervention drills and spill exercises in vessel log.
			Documentation that subsea intervention equipment and procedures are maintained and available on the LWI vessel.
	PS RS1.10	*Crosby-3H1 LWI OPEP (PYHSE-ER-0006):* Activity-specific OPEP details response to control loss of containment from production well/ flowline.	Incident log.

9.4.2 Spill Response: RS2 Monitor and Evaluate

Summary of Activity

The Monitor and Evaluate Response Strategy will be implemented for Level 1 – 3 spills. Constant monitoring and evaluation by surveillance is a mandatory strategy required for real-time decision-making during a spill event. This strategy includes assessment of the location, weather and sea state conditions, volume of oil being released, oil weathering state, and trajectory of the spill. The spill will be monitored constantly and evaluated by surveillance techniques. The results of surveillance operations are crucial for implementing further strategies for responding to and managing a spill event. Additionally, this response strategy will provide information in support of the decision-making process of whether natural dispersion is an appropriate strategy. If aerial surveillance or modelling indicates that extreme or high sensitivity receptors are at risk of being impacted by surface hydrocarbons (refer to Table 5 of OPEP Table 5), then RS10 Environmental Monitoring will be activated.

The purpose of this section is to describe BHP's approach in relation to the monitor and evaluate response strategy in order to:

- Track and monitor the trajectory of the spill to enable real-time decisions to be made to prevent impacts to extreme and highly sensitive environmental receptors; and
- Manage to ALARP and acceptable levels the risks and impacts of the monitor and evaluate strategy on sensitive environmental receptors.

The strategy includes a description of the impacts and risks associated with monitor and evaluate operations during spills, which includes consideration of the benefits associated with the monitor and evaluate response strategy. It then demonstrates that these impacts and risks can be reduced to ALARP and acceptable levels, enabling monitor and evaluate to be a key response strategy in the event of hydrocarbon spills.

Specifically this section includes:

- Assessment of the potential impacts and risks of the monitor and evaluate strategy and the benefits of the response strategy;
- Controls in place to mitigate the impacts and risks of the monitor and evaluate strategy on sensitive environmental receptors;
- Demonstration that monitor and evaluate response strategy proposed by BHP is ALARP and acceptable; and
- Environmental performance outcome, performance standards and measurement criteria for the monitor and evaluate strategy.

Monitoring and evaluation will require access to aircraft, vessels and personnel. In the event of a spill, the following monitoring and evaluation methods will typically be implemented, dependent on the volume of the spill:

- Aerial surveillance;
- Vessel surveillance;
- Spill Trajectory Modelling; and
- Subsea plume tracking via the deployment of autonomous underwater vehicles (AUVs).

Aerial Surveillance

Aerial surveillance will be commissioned by the Incident Commander or by a designated officer of the nominated Control Agency. Aerial surveillance will be by helicopter. BHP has access to trained aerial observers in industry through mutual aid. BHP has access to helicopters under a crew transfer contracts with helicopter providers CHC and Babcock. In addition to the aircrew, trained aerial surveillance observers will be included on the flights to confirm the size of the spill and its location. This information will be sent back to IMT for further processing. A schedule of flights will be developed, to ensure sufficient timely information is available for fate modelling. Aerial observations will only be undertaken during daylight hours. The aerial surveillance will include digital imagery of the spill, the GPS coordinates of the spill extremities, an estimate of the spill thickness and the time of the observations.

Vessel Surveillance

Marine surveillance will either be carried out by the LWI Vessel, tender vessel or other vessels of opportunity located in Exmouth, Onslow and/ or Dampier.

Oil Spill Tracking Buoys

Self-Locating Datum Marker Buoys (SLDMB) or Oil Spill Tracking Buoys (OSTBs) will monitor the movement of hydrocarbons via satellite. A minimum of one OSTB will be onboard the LWI vessel for the duration of the activity for immediate deployment in the event of a major spill incident.

Oil Spill Trajectory Modelling

Oil spill trajectory modelling (OSTM) will be conducted to predict the extent of impacts to offshore habitat for any physical disturbance that may impact shoreline, nearshore areas, or areas protected for the purpose of conservation. The IMT will engage RPS-APASA via a call-off contract maintained by AMOSC to start modelling the spill, and correlate it with real data received from aerial surveillance, OSTBs and/ or seagliders. From these sources, RPS-APASA will develop an oil spill trajectory model for the next 5 days, which will allow the IMT to direct resources for the next phase of the response. Alternative oil spill modelling agencies may be selected dependent on operational requirements.

Satellite Imagery

Satellite imagery of the spill will be obtained via contractual arrangements with OSRL.

Subsea Plume Tracking

The seaglider is an autonomous underwater vehicle (AUV) that moves horizontally and vertically in a sawtooth vertical profile by variable buoyancy for deployments of 15-30 days (600-1,500 km), which surfaces periodically to transmit data and download new instructions.

Oil Spill Preparedness

Oil spill preparedness for the elements of the monitor and evaluate response activities comprise contractual arrangements with Oil Spill Response Agencies (OSRA's), e.g. AMOSC / OSRL, and/ or service agreements with third party vendors for the provision of services such as oil spill tracker buoys, subsea plume tracking and satellite imagery.

Potential Environmental Impacts and Risks

The risks and impacts associated with the vessels involved in the monitor and evaluate response activities from their physical presence, noise and atmospheric emissions, interference with marine fauna, planned and unplanned discharges, and accidental spills have been discussed in the following previous sections:

The impacts and risks associated with aircraft involved in the RS2 Monitor and Evaluate relate acoustic disturbance. During the response activities aircraft and vessels will generate noise both offshore and in coastal areas in proximity to sensitive receptors such as shorebirds, marine mammals, fish and shark species.

Monitor and Evaluate Environmental Performance

Table 9-4 provides the environmental performance outcomes, performance standards and measurement criterial for the Monitor and Evaluate response strategy.

The initiation criteria, course of action, resources, supporting documentation and termination criteria associated with each response strategy are detailed in the BHP *Crosby-3H1 Light Well Intervention Oil Pollution Emergency Plan (OPEP) (PYHSE-ER-0006)* (Appendix G).

Table 9-4: Environmental performance – Monitor and Evaluate

RS2 Monitor and Evaluate			
Environmental Performance Outcome	**Implementation of monitor and evaluate activities in order to provide situational awareness to inform IMT decision-making.**		
Response Strategy	**Control Measure ID**	**Performance Standard**	**Measurement Criterial**
Monitor and Evaluate	**PS RS2.1**	Monitor and Evaluate activities to be reviewed and managed in accordance with the IAP.	Daily Incident Action Plans (IAPs).
	PS RS2.2	Spill fate modelling initiated within 2 hours of incident notification.	Trajectory modelling request form issued within 2 hours of spill notification.
	PS RS2.3	Operational NEBA to include evaluation of requirement for various monitoring and evaluation activities to be employed i.e. aerial/vessel surveillance; autonomous underwater vehicles; oil spill tracker buoys (OSTBs); and satellite imagery.	Documentation of completed Operational NEBA.
	PS RS2.4	AMOSC / OSRL contracts and Mutual Aid MOU's, and other third party agreements (e.g. CHC, marine vendors) for provision of	Documentation of AMOSC / OSRL contracts and Mutual Aid MoU's and other third

RS2 Monitor and Evaluate			
Environmental Performance Outcome	**Implementation of monitor and evaluate activities in order to provide situational awareness to inform IMT decision-making.**		
Response Strategy	**Control Measure ID**	**Performance Standard**	**Measurement Criterial**
		equipment/ supplies, resources and assistance in the event of spill incidents.	party agreements (e.g. CHC, marine vendors) stored.
	PS RS2.5	Contract with AMOSC who maintain a call-off contract with RPS-APASA* to provide spill modelling as required in place during operations. Ensure spill modelling capability meets and exceeds the industry standards for oil spill modelling, such that: • Within 2 hours following initial spill notification, oil spill modelling agency to be on standby for trajectory modelling; • Within 4 hours of notification, oil spill modelling agency to provide oil spill trajectory modelling report; and • Oil spill modelling agency to undertake any additional modelling requirements as per daily Incident Action Plan (IAP). *Alternative oil spill modelling agencies may be selected dependent on operational requirements.	Documentation of Contract with AMOSC who maintains call-off contract with RPS-APASA. *Alternative oil spill modelling agencies may be selected dependent on operational requirements.
	PS RS2.6	Contract in place with OSRL to provide satellite imagery within 24 hours of request by BHP IMT.	Documentation of Contract with OSRL to provide satellite imagery.
	PS RS2.7	Contract in place with oil spill tracker buoy vendor during operations.	Documentation of Contract with tracker buoy vendor. Record of delivery of tracker buoys.
	PS RS2.8	Agreement in place with preferred vendor during operations to monitor subsea hydrocarbons (water/ sediment quality and benthic infauna) to serve as potential triggers for BHP's Environmental Monitoring procedures (refer to RS10: Environmental Monitoring): • Seabirds and migratory shorebirds; • Marine mammals and megafauna (inc. whale sharks); • Benthic habitats and primary producers; • Marine reptiles;	Documentation of agreement in place prior to commencement of LWI activities.

RS2 Monitor and Evaluate			
Environmental Performance Outcome	**Implementation of monitor and evaluate activities in order to provide situational awareness to inform IMT decision-making.**		
Response Strategy	**Control Measure ID**	**Performance Standard**	**Measurement Criterial**
		• Commercial and recreational fisheries; and • Fish monitoring.	
	PS RS2.9	Oil spill tracker buoy deployed from the LWI vessel within 2 hours of spill incident.	Evidence of OSTB on LWI vessel prior to commencement of LWI activities.
	PS RS2.10	Maintain capability to monitor spill location and movement via aerial surveillance and observations to enable identification of potential contact with sensitive receptors: • First overflight observations to Pyrenees FPSO within 2 hours of request by BHP IMT; • Ensure first aerial observation flights can be completed (in daylight hours) within 8 hours post-spill; and • Enable surveillance information to be used to inform IAPs and response strategy selection.	Records of aerial surveillance logs maintained.
	PS RS2.11	Response strategy activities continued until termination criteria met.	Spill reports and incident response reports detail no hydrocarbons detected by any of the surveillance techniques.
	PS RS2.12	Surveillance data, spill trajectory modelling, satellite imagery and subsea plume tracking incorporated into IAP preparation process for the response strategies.	Spill reports and incident response reports.

9.4.3 Spill Response: RS3 Dispersants

Summary of Activity

Dispersants are a valuable response tool and, if used correctly, can greatly facilitate the protection of sensitive shorelines and other resources.

Dispersants are used to break surface oil slicks into fine droplets that then disperse into the water column below entrained thresholds that may impact marine fauna and other sensitive receptors. This reduces the effect of oil from being driven by wind towards shore and promotes oil biodegradation of the oil in the water column, hence enabling prevention of contact with sensitive environmental receptors. Subsea dispersant application is a relatively new technology however and has been proven to provide advantages during a response in order to reduce the impact. Both applications are a recognised response strategy throughout the world and has been used successfully in recent oil spill events such as the Macondo and Montara well blow out events. For these reasons, dispersant application (surface and subsea) is a key component of BHP's response strategy associated with a loss of containment event, particularly to prevent or reduce impact of surface oil on extreme and highly sensitive shoreline receptors associated with the Ningaloo Reef.

While dispersants reduce surface oil, thereby providing protection for sensitive receptors that may be impacted by surface oil, they also increase the amount of dispersed oil in the immediate vicinity where it is applied. This will result in a larger magnitude of impact to sensitive receptors (if present) to dispersed oil than would have occurred if dispersant had not been applied. Further, dispersants are known to have their own toxic properties, have varying efficacy on different types of crude oil, and the physical process of applying dispersant has its own set of impacts and risks. For these reasons, dispersants must only be applied in accordance with a carefully considered strategy, which takes into account both the benefits and impacts and risks associated with applying it in a particular situation.

The purpose of this section is to describe BHP's strategy in relation to dispersant application to:

- Prevent impact of surface oil on extreme and highly sensitive shoreline receptors;
- Maximise the effectiveness of dispersant through subsea application; and
- Manage to ALARP and acceptable levels the impact of dispersant use to other ecosystems.

The strategy includes a description of the impacts and risks associated with dispersant use during a loss of hydrocarbons incident, which includes consideration of the benefits associated with dispersant application. It then demonstrates that these impacts and risks can be reduced to ALARP and acceptable levels, enabling dispersant use to be a key response strategy in responding to a loss of containment.

Specifically, this section includes:

- Assessment of the potential impacts of the dispersant application process, which includes discussion of the benefits of dispersant use, demonstrating that application of dispersant can reduce the total volume of oil ashore;
- Considerations that will be applied during the Operational NEBA;
- Demonstration of oil spill preparedness;
- Controls in place to mitigate the impacts and risks of dispersant use on sensitive environmental receptors;
- Demonstration that dispersant strategy proposed by BHP is ALARP and acceptable; and
- Environmental performance outcome, performance standards and measurement criteria for dispersant use.

Potential Environmental Impacts and Risks

Information presented in this section relates to Pyrenees crude. As previously mentioned in Section 8.2.4, the crude oil produced from the Pyrenees reservoirs has very similar properties; as such the effects of chemical dispersant applicant to Crosby crude can be assumed to be similar to the information presented below for Pyrenees Crude. Pyrenees crude is the generic term for crude oil produced from the Pyrenees reservoirs (Crosby, Ravensworth, Stickle, Tanglehead Wild Bull [upper Pyrenees] and Moondyne).

Dispersant Efficacy

Efficacy testing of fresh Pyrenees crude oil indicated it may be treated by all the chemical dispersants tested, with the best performing dispersants being Corexit 9500, Corexit 9527A, and Slickgone NS, all of which dispersed over 75% of the oil in the active phase. Fresh and weathered Pyrenees crude oil was also tested with dispersants Ardrox 6120 and Finasol OSR52 to determine the dispersant efficacy (Intertek Geotech, 2014). Dispersants were added at the ratio of dispersant to oil of 1:20. Unweathered and weathered oil showed a similar effect of dispersant exposure with Ardrox 6120 after 24 hours, with weathered oil showing 72.6% efficacy and unweathered oil showing 74.9% efficacy. In contrast, Finasol OSR52 performed better on Pyrenees crude oil weathered for 24 hours (73.6% efficacy) compared to unweathered crude (39% efficacy).

Toxicity Effects of Chemical Dispersants

Oil dispersants do not reduce the total amount of oil entering the marine environment, however, they can disperse surface oil before it reaches the shoreline. The chemical agents used as a dispersant work by reducing the tension between oil and water, thereby enhancing the natural process of dispersion and biodegradation that takes place when waves mix large numbers of small droplets into the water beneath a slick. The decision to use dispersants is a trade-off between decreasing the risk to organisms that utilise the water’s surface and coastline, and possibly increasing the risk to fish populations, seagrasses and coral reefs, and organisms that live on the seafloor and within the water column if these groups are exposed to dispersed oil before the natural processes of biodegradation have removed the oil from the system.

The acute toxicity of chemically dispersed oil is primarily associated with the dissolved oil following dispersal, not with the actual dispersants (NRC, 2005). Data from numerous studies collated as part of the NRC review of dispersant efficacy and effects included the results of studies examining the toxicity of Corexit 9500 and Corexit 9527A (the two most common and readily available dispersants) to seven species (4 fish, 2 mysid shrimp and 1 oyster). The results indicate that for all species tested, the Corexit dispersants were less toxic than the chemically enhanced water-accommodated fraction (i.e. dispersant and dispersed hydrocarbon), which were less toxic than the untreated water-accommodated fraction of oil.

It is generally thought that the dispersants available at present are expected to be much less toxic than early generation dispersants. The toxicity of dispersants used in the early 1970s ranged from 5 to 50 mg/L measured as an LC50 to rainbow trout over 96 hours while dispersants available today, vary from 200 to 500 mg/L in toxicity and contain a mixture of surfactants and a less toxic solvent (Fingas, 2002). However, Rial *et.al*. (2013) tested the toxicity of four dispersants on sea urchin embryo larval development and determined that the EC50 varied from 1.2 to 34 mg/L, they concluded that sensitivity to dispersants appears to be species and life stage dependent.

Other studies have reported that dispersants were potentially toxic to corals. Ardrox 6120 was found to be toxic to planula larvae of scleractinian corals *Acropora tenuis*, *Goniastrea aspera* and *Platgyra sinensis* with 100% larval mortality at dispersant concentrations of ≥75 ppm within 12 to 48 hours (Lane and Harrison, 2000). It was noted that the dispersant concentration that caused significant mortality of larvae in this study was well within those that may occur in the field where dispersant has been applied to an oil slick. Where dispersant is applied at the rate of 15% of slick volume (as recommended for many oil types), dispersal of a 1 cm thick slick could result in short-term dispersant concentrations up to 150 ppm to depths of 10 m.

The potential toxicity of dispersants to the early life history stages of corals have also been reported including the potential inhibition of fertilisation and larval settlement in *Acropora tenuis* (Harrison, 1999). Settlement and survival of *Porites astreoides* and *Montastraea faveolata* larvae have been shown to decrease with increasing concentrations (50 ppm and 100 ppm) of Corexit 9500 (Goodbody-Gringley *et al*., 2013) and in Acropora millepora exposed to Corexit 9527 (Negri and Heyward, 2000).

A number of dispersants have been identified as being potentially toxic to macroalgae. A review by Lewis and Pryor (2013) reports a range of toxicities to different dispersants from 0.7 ppm of Corexit 9500, 20 ppm of Corexit 9527 and up to 27,000 ppm for other products impacting on germination of brown algae. Studies on adult plants only report sublethal impacts.

Similar studies have reported dispersants having toxic effects on seagrasses. Corexit 9527 and Ardrox 6120 both effected seagrass photosynthesis within the first hour of exposure. In laboratory samples, Shell VDC was reported to result in photosynthetic stress of *Zostera capricorni* after 10 hours of exposure; however *in situ* samples were less sensitive showing no photosynthetic impact from dispersant and oil and dispersant mixtures (Macinnis-Ng and Ralph, 2003).

Toxicity Effects of Chemical Dispersants on Pyrenees Crude

Two dispersants were selected by BHP for toxicity assessment with Pyrenees crude; Slickgone NS and Ardrox 6120, due to their efficacy on Pyrenees crude and the amount stockpiled in Australia and more broadly across the region. Although Finasol OSR 52 did not form part of the ecotoxicity testing covered in an assessment by Jacobs (2015), sufficient information was available to allow a comparative toxicity assessment to be undertaken for each of the three dispersants. The aim of assessment (Jacobs, 2015) was to assess the toxicity of the following:

- Unweathered and weathered Pyrenees crude;
- Unweathered Pyrenees crude and dispersant (Slickgone NS);
- Weathered Pyrenees crude and dispersant (Slickgone NS);
- Unweathered Pyrenees crude and dispersant (Ardrox 6120); and
- Weathered Pyrenees crude and dispersant (Ardrox 6120).

The toxicity tests were undertaken on a broad range of taxa of ecological relevance for which accepted standard test protocols are well-established. These ecotoxicology tests are mainly focused on the early life stages of test organisms, when organisms are typically at their most sensitive to hydrocarbons. The toxicity tests were conducted on eight mainly tropical species, representatives from five major taxonomic groups and four trophic levels.

The NOECs of unweathered Pyrenees crude with dispersant Slickgone NS ranged from 60 to 4,058 ppb (Table 9-5). The 95% species protection trigger value of unweathered Pyrenees crude with dispersant Slickgone NS was 55.42 ppb (Table 9-9). According to the GESAMP (2002) classification, unweathered Pyrenees Crude with Slickgone NS has moderate to negligible chronic aquatic toxicity.

The NOECs of weathered Pyrenees crude with dispersant Slickgone NS ranged from 20.12 to 5,707 ppb (Table 9-6). The weathered Pyrenees crude with dispersant Slickgone NS was slightly more toxic with a species protection trigger value of 22.02 ppb (Table 9-9). According to the GESAMP (2002) classification, weathered Pyrenees crude with Slickgone NS has moderate to negligible chronic aquatic toxicity.

The NOECs of unweathered Pyrenees crude with dispersant Ardrox 6120 ranged from 125 to 3,570 ppb (Table 9-7). This was the least toxic oil and dispersant combination with a 95% species protection trigger value of 115.15 ppb (Table 9-9). According to the GESAMP (2002) classification, unweathered Pyrenees Crude with Ardrox 6120 has low to negligible chronic aquatic toxicity.

The NOECs of weathered Pyrenees crude with dispersant Ardrox 6120 ranged from 70 to 13,500 ppb (Table 9-8). The weathered Pyrenees crude with dispersant Ardrox 6120 was more toxic than the unweathered Pyrenees Crude with Ardrox 6120, with a species protection trigger value of 76.60 ppb (Table 9-9). According to the GESAMP (2002) classification, weathered Pyrenees crude with Ardrox 6120 has moderate to negligible chronic aquatic toxicity.

None of the dispersant/oil combinations appeared to be particularly toxic to fish, as only high concentrations (>1,500 ppb) affected fish health and biomass. For the weathered and unweathered Pyrenees crude with dispersant Slickgone NS and the weathered Pyrenees crude with Ardrox 6120, the highest toxicity was to sea urchin fertilisation. Weathered Pyrenees crude with dispersant Slickgone NS was also toxic to microalgal growth. In all cases, the toxicity of the weathered oil with dispersants was higher than those of the unweathered oil and dispersants and the toxicity of the crude oil with Slickgone NS was higher than that of the toxicity of the crude oil with Ardrox 6120.

Table 9-5: Summary of toxicity tests for unweathered Pyrenees crude and dispersant (Slickgone NS) (ppb)

Test	LOEC	NOEC	EC_{50} or IC_{50}	BurrliOZ Input Value
Microalgal Growth	300	130	363.5	130
Macroalgal Germination Success	1474	510	1411.3	510
Sea Urchin Fertilisation	120	60	200.6	60
Sea Urchin Larval Development	2937	1530	4059.7	1530
Milky Oyster Larval Development	240	120	200.7	120
Amphipod Survival	1530	632	2042.4	204.24
Fish Imbalance	8711	4058	6752.8	4058
Fish Growth	8711	4058	6988	4058

Table 9-6: Summary of toxicity tests for weathered Pyrenees crude and dispersant (Slickgone NS) (ppb)

Test	LOEC	NOEC	EC_{50} or IC_{50}	BurrliOZ Input Value
Microalgal Growth	150	75	152.4	75
Macroalgal Germination Success	1652	653	1558.4	653
Sea Urchin Fertilisation	150	75	104.9	75
Sea Urchin Larval Development	2785	1383	1903.5	1383
Milky Oyster Larval Development	1383	160	506.4	160
Amphipod Survival	160	150	201.2	20.12
Fish Imbalance	10953	5707	7906.3	5707
Fish Growth	10953	5707	8051.1	5707

Table 9-7: Summary of toxicity tests for unweathered Pyrenees crude and dispersant (Ardrox 6120) (ppb)

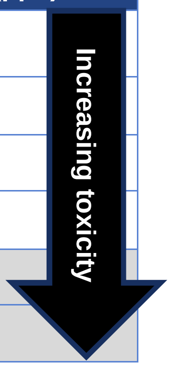
Test	LOEC	NOEC	EC_{50} or IC_{50}	BurrliOZ Input Value
Microalgal Growth	275	125	252	125
Macroalgal Germination Success	3200	1410	2578	1410
Sea Urchin Fertilisation	7140	3570	6413.4	3570
Sea Urchin Larval Development	3570	1710	2461.1	1710
Milky Oyster Larval Development	3570	1710	4258.3	1710
Amphipod Survival	3640	1890	2789.3	278.93
Fish Imbalance	5480	3120	6046.6	1560
Fish Growth	3120	< 3120	6808.2	3120

Table 9-8: Summary of toxicity tests for weathered Pyrenees crude and dispersant (Ardrox 6120) (ppb)

Test	LOEC	NOEC	EC_{50} or IC_{50}	BurrliOZ Input Value
Microalgal Growth	620	266	966.6	266
Macroalgal Germination Success	2290	1050	1769.6	1050
Sea Urchin Fertilisation	140	70	188.2	70
Sea Urchin Larval Development	2000	620	2405.3	620
Milky Oyster Larval Development	8900	3890	7720.4	3890
Amphipod Survival	2000	620	1686.3	168.63
Fish Imbalance	20311	13500	16558.9	13500
Fish Growth	13500	3460	16394.4	3460

Table 9-9: Trigger values derived from species sensitivity distribution curves for weathered and unweathered Pyrenees crude and chemically-dispersed (Slickgone NS and Ardrox 6120)

Treatment	Level of Species Protection	Derived Trigger Value for TRH concentrations (ppb)
Unweathered Pyrenees crude + Ardrox 6120	95%	115.15
Weathered Pyrenees crude (24 h) + Ardrox 6120	95%	76.60
Unweathered Pyrenees crude + Slickgone NS	95%	55.42
Weathered Pyrenees crude (24 h) + Slickgone NS	95%	22.02
Unweathered Pyrenees crude	95%	94.00
Weathered Pyrenees crude	95%	21.44



It is noteworthy that the combination of weathered Pyrenees crude and Ardrox 6120 was up to 3.5 times less toxic than weathered crude alone (Table 9-9), i.e. the ‘do nothing option’, and consequently, dispersant application is potentially a key response tool in the highly unlikely event of a loss of well containment.

Net Environmental Benefit Analysis of Dispersant Application

Prior to any application of dispersant, a NEBA will be undertaken to confirm whether the potential harm of dispersed oil is less than leaving the oil untreated. Operational considerations include:

- Application of subsea dispersant at the source of the release;
- Simultaneous operations and operational safety;
- Health and safety aspects of handling dispersants;
- Assessment of environmental risks of applying dispersants;
- Spotter aircraft required to assist vessels to locate the oil (unless the oil slick is thick);
- Spraying time of aircraft which may be limited if the slick is a long way offshore; and
- Permission from State authority for the use of dispersants when within 3 nm from shore.

A Strategic NEBA assessment based on a worst-case discharge during the well intervention activities demonstrates a net environmental benefit associated with dispersant application (Section 9.3).

Daily Operational NEBA Process

An overview of the daily Operational NEBA process is provided below, which includes consideration of the potential impacts and risks to sensitive receptors, such as Ningaloo Marine Park. On Day 1, the steps that would be followed include:

1. Is the oil amenable to dispersion? Is the oil within the window of opportunity when chemical dispersants are effective? This has been calculated to be within 48 hours based on laboratory results but conditions on the day may make it more or less amenable. The film thickness on the surface must also be greater than 10 µm for effective surface application. For subsea dispersant application the dispersant should be released within the technical specifications for the equipment utilised.
2. Are there other response strategies which the resources may be better employed? Whilst dispersant is a recommended strategy, other response strategies may be considered to be more suitable on the day.
3. Does modelling indicate that there are environmental sensitivities at risk from the oil, both surface and if it was dispersed? Initial modelling can be obtained through the AMOSC contract with RPS-APASA within 4 hours. The models will provide predicted trajectory routes for surface, entrained, dissolved and surface accumulated oil with or without dispersants. Consideration as to what sensitivities (as described in Section 4) are predicted to be impacted by the oil if not dispersed and with what may be impacted if it was dispersed;
4. Is there sufficient separation from the environmental sensitivities? Whilst the dispersant application zone has set a sufficient buffer from key coastal sensitivities, conditions on the day may require an assessment of the extent of the application zone. For example, if weather conditions were driving surface oil ashore immediately after release (requires wind speed and direction >12 knots, NE to NW, described in detail below), then dispersant application may be reduced to a 10 km radius of the release allowing an increased buffer of to the boundary of the Ningaloo Marine Park. This may permit surface dispersant operations whilst allowing sufficient time for dilution before entering the vicinity of the reef system.
5. Are there temporal/seasonal windows of ecological sensitivity that require evaluation (as described in Section 4):

   a) *Coral spawning*

   Coral spawning peak periods are known in WA in March / April. Dispersants would be applied outside of this period, but during coral spawning season, dispersant operations will be controlled such that no aerial dispersant will be applied on any surface oil that occurs within 5 km of a coral spawning slick, as determined by aerial dispersant controllers, while vessel-based dispersant operations will not occur in areas where coral spawn is visible from the vessel.

   b) *Turtle nesting*

   If modelling predicts contact with ‘High value’ turtle nesting areas, dispersant may be applied so as to provide a positive environmental benefit by reducing the volume of oil ashore on high-value nesting beaches, e.g. Jurabi, and limiting interaction with shoreline accumulated oil.

   c) *Migratory birds*

   If migratory birds are known to be in a potential area of impact, then dispersant operations may be considered more desirable to reduce the risk to oiled wildlife and/or oiling of intertidal foraging habitats.

   d) *Whale and whale shark migration periods*

   During periods of whale and whale shark migration consideration is required to balance the trade-off between exposure of surface oil compared with dispersed oil on whales and whale sharks. This will be dependent on the location of the surface slick and observations of migratory animals.

6. Evaluate the environmental trade-offs between applying or not applying dispersants to ensure that the environmental trade-off provides a positive outcome.
7. Do the operational conditions (wind, waves etc.) allow surface application in a safe and effective manner? Vessel and aircraft have operational constraints, which may not allow the safe and effective application of dispersant on the day.
8. Other stakeholder considerations (i.e. DoT and their advice from the ESC). BHP will consider advice from the DoT OSRC during the response.

Oil Spill Trajectory Modelling

As previously mentioned in Section 8.2.3, oil spill modelling undertaken for the worst-case loss of well containment scenario included deterministic simulations being run with and without the inclusion of a subsea dispersant injection (SSDI) plan. This was undertaken for the worst-case 21-day crude spill release duration, as well as for a 2-day release duration, which is considered to be a more likely timeframe for to achieve halting the release (refer to previous Section 8.2.2 and Table 8-3). The 2-day release duration assumes the same daily release rate of crude oil as the 21-day release scenario, but reduces the total volume of oil released down to 183.8 m^3).

This spill response strategy, SSDI involves injecting dispersant into the crude flow release via a pre-existing line that connects the LWI vessel and the SID. The model was set to commence SSDI 4 hours after the start of a subsea crude release, to allow sufficient time for decision-making and approvals to implement. The model included an application rate of 1:100 (1 part dispersant to 100 parts liquid crude) and a dispersant efficacy of 75%. Dispersant application was set to be continuous from hour 4 until the end of week 2 (for the 21-day release scenario) or the end of day 2 (for the 2-day release scenario). To determine the fate of the oil, the model was set to run for 56 days in total i.e. a further 35 days following the 21-day release scenario, and a further 54 days following the 2-day release scenario.

The results of the affect of subsea dispersant application based on the realisation resulting in the greatest accumulation of oil on shorelines are presented in Table 9-10 and discussed below.

21-Day Crude Release of 91.9 m^3/day

The deterministic simulation indicates the majority of shoreline oiling arrived at the Ningaloo Region from day 12, reaching a peak load of 90 tonnes at day 16, and gradually reducing via weathering processes to 45 tonnes after 8 weeks. The application of SSDI yields minor reductions of the mass of oil on the sea surface, with concomitant minor increases in the mass of entrained oil droplets relative to the ‘without SSDI’ simulation. The reduction in surface oil resulted in a minor benefit to shoreline loading, reducing the peak load from 90 tonnes (without SSDI) to 80 tonnes (with SSDI) (Table 9-10).

2-Day Crude Release of 91.9 m^3/day

The predicted peak shoreline load for this scenario is 1.75 tonnes across all shorelines, which is a significant reduction compared to the 21-day release scenario (90 tonnes peak load) (Table 9-10). The modelling predicted a negligible increase to peak shoreline loading across all shorelines with the application of SSDI, with only very minor reduction into the mass of oil on the sea surface, and concomitant minor increases to the mass of entrained oil droplets relative to the ‘without SSDI’ simulation. The modelling results predict that the application of dispersant over the first two days of a release does not materially affect the hydrocarbon dynamics between days 12–17 when the majority of shoreline loading is predicted to occur.

Table 9-10: Comparison of results for the worst-case volume ashore based on 1,930 m^3 release of crude from a loss of well containment

Shoreline Statistics		Comparison of simulations results based on specific criteria	
		Peak load on shorelines	
21-Day Release Predicted maximum moderate threshold volume of oil contacting shore (m^3) (Ningaloo Region)	No Dispersant	90 tonnes	Reduction of 11%
	Dispersant	80 tonnes	
2-Day Release Predicted maximum moderate threshold volume of oil contacting shore (m^3) (across all shorelines)	No Dispersant	1.75 tonnes	Negligible increase
	Dispersant	1.86 tonnes	

Temporal / Seasonal Windows of Ecological Sensitivity

The Operational NEBA must consider the temporal or seasonal window of ecological sensitivity and assess any receptors that occur within that window, which require evaluation. In addition, it must assess operational reports from field teams and environmental monitoring to determine the presence and/or extent of environmental receptors occurring during the spill. These reports may swing the evaluation one way or the other.

Environmental Trade-offs of Dispersant Application

The removal of surface oil by surface and subsea dispersant application reduces the risk to seabirds, shorebirds, marine mammals, mangroves and tourist beaches from contamination, and contributes to achieving the performance outcome of preventing impacts to sensitive receptors. The assessment of using dispersants is, however, not solely dependent on the potential benefits of dispersed oil on surface receptors. In general, the application of dispersant decreases the spatial extent of surface oil, and potential contact with surface/shoreline environmental values or receptors, at the expense of increased spatial exposure to entrained oil. However, as shown in Table 9-11, the receptors in the oil spill EMBA could potentially be affected by dispersant application in different ways (both positively and negatively).

The environmental benefits evaluation must compare the trade-offs between surface and entrained oil. The output of this process is best represented by a traffic light system to visualise the trade-off between geographical points of interest, and the environmental values, sensitivities and receptors, and the application of dispersants / no dispersants (Table 9-11).

A positive environmental benefit can be interpreted when an Orange box (impact) is followed by either a Green (no impact) or Yellow box (reduced impact) following dispersant application; in this situation, the spatial extent of the oil spill EMBA no longer intersects a particular receptor (Green) or the spatial extent of the oil spill EMBA is reduced (Yellow) with dispersants (Table 9-11).

Similarly, Orange box (impact) with no dispersants followed by another Orange box (impact) with dispersants indicates that dispersant application has no benefit, i.e. the impact would still occur irrespective of dispersant application (Table 9-11).

A negative environmental benefit can be interpreted when a Green box (no impact) is followed by an orange box (impact) or an orange box (impact) is followed by a red box (increased impact); in this situation, the spatial extent of the oil spill EMBA now intersects a particular receptor (Orange) or the spatial extent of the oil spill EMBA is increased (Red) with dispersants (Table 9-11).

An environmental trade-off analysis will be carried out as part of the daily Operational NEBA and dispersants will not be applied unless there is a positive environmental benefit.

Table 9-11: Environmental trade-offs associated with dispersant application

Trade-off	No Dispersant	With Dispersant
Positive benefit	Impact	No impact
	Impact	Reduced impact
No benefit	Impact	Impact
Negative benefit	No impact	Impact
	Impact	Increased

Note: Green – not impacted by hydrocarbons, Orange – impacted by hydrocarbons; Yellow – reduced spatial impact to receptor; Red – increased spatial impact to receptor

Summary of Operational NEBA Process

In summary, the process of the daily Operational NEBA for approving dispersant application is described below:

1. Determine that oil is amenable to be dispersed and within the window of opportunity when chemical dispersants are effective. Efficacy tests confirm effectiveness of available dispersants;
2. Obtain oil spill trajectory model and determine what environmental sensitivities are in the predicted path of the spill. Consider model outputs that contain both with and without dispersant application;
3. Determine the temporal/seasonal window of ecological sensitivity and assess any receptors that occur within that window, which require evaluation);
4. Assess operational reports from field teams and environmental monitoring to determine presence and/or extent of environmental receptors;
5. Evaluate the environmental trade-offs between applying or not applying dispersants to ensure that the environmental trade-off provides a positive outcome;
6. Assess the operational conditions (wind, waves etc.) to determine that dispersant application operations will occur in a safe and effective manner; and
7. Provide a recommendation to the BHP Incident Commander, taking into consideration any recommendations from the WA Hazard Management Agency (HMA).

Oil Spill Preparedness

Dispersant Approval – Emergency Use

The dispersants used will be approved under the Australian Government National Plan arrangements as listed on the Oil Spill Control Agents (OSCA) register or the transitional list, or otherwise approved through the dispersant selection process summarised below (Figure 9-1).

Consistent with selection of hazardous materials at facilities, where a product may be discharged to the environment, an assessment must be completed before the product is approved for mobilisation and subsequently approved for application.

The following dispersants will be automatically approved for mobilisation:

- Dispersants listed on the National Plan OSCA List;
- Dispersants listed on the National Plan transitional list;
- With reference to the UK's Offshore Chemical Notification Schedule (OCNS) CHARM Model Algorithm Definitive Ranked List of Approved Products, dispersant with a HQ of Gold or Silver or Group E or D (CEFAS, 2001); and

- Substances listed on the OSPAR List of Substances Used and Discharged Offshore which are considered to Pose Little or No Risk to the Environment (PLONAR).

Table 9-12 provides the dispersants currently approved to mobilise. Table 9-13 provides a risk assessment for transitional listed dispersant that may have been purchased after 1 Jan 2012 but held in a dispersant stockpile by one of BHPs OSRA's.

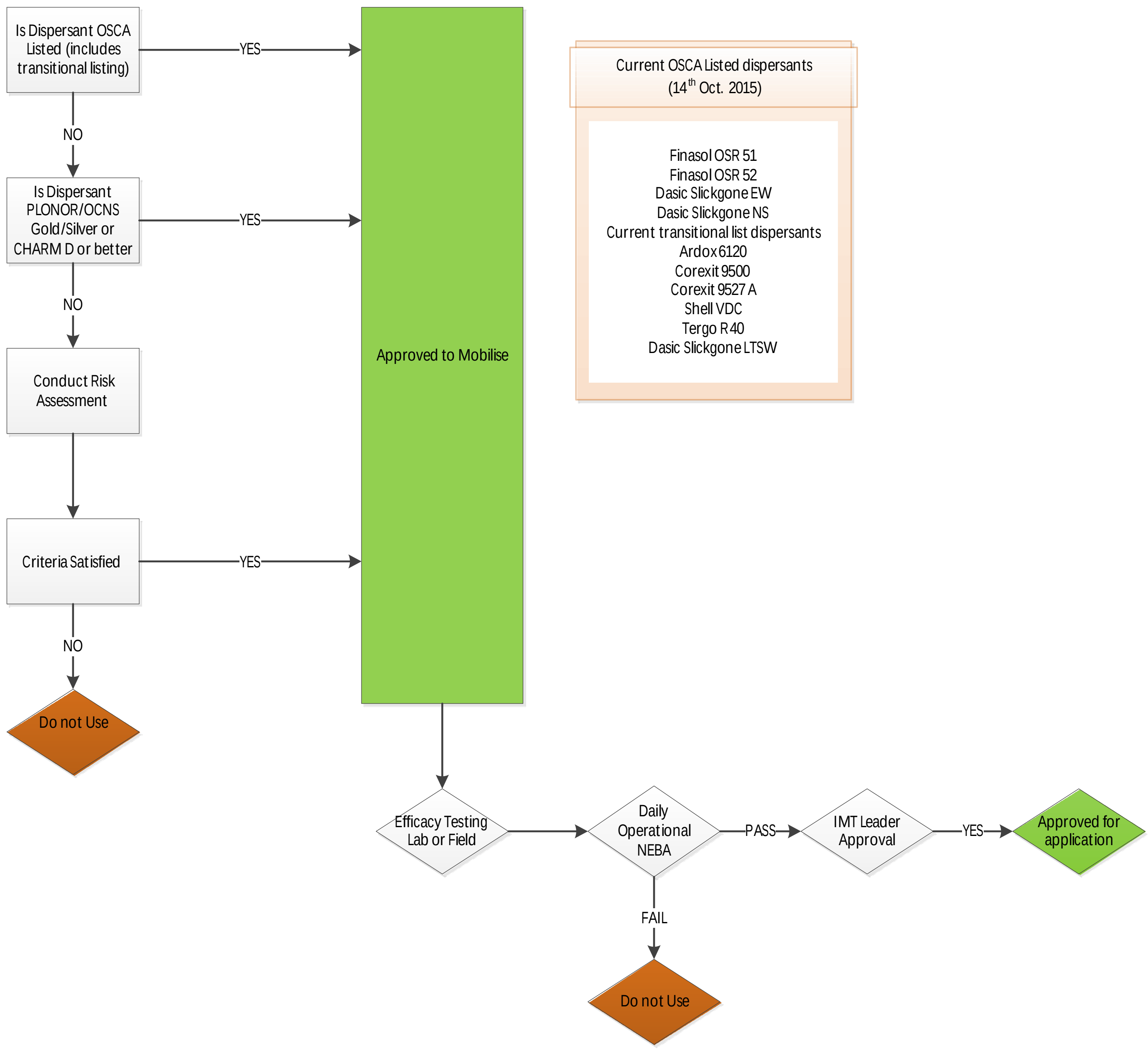


Figure 9-1: Process for the approval to mobilise and apply dispersants

Table 9-12: Dispersants currently approved to mobilise

Dispersant	OSCA Listed	OSCA transitional listed	Ecotox Tested against Pyrenees Crude	Efficacy tested against Pyrenees Crude/Pass	Risk Assessment PASS (only required if not OSCA or transitional listed)	Approved to mobilise	BHP stocks	AMOSC stocks	AMSA Stocks	OSRL Stocks
Finasol OSR 51	Yes				NA	Yes				
Finasol OSR 52	Yes			Yes/Pass[1]	NA	Yes				Yes
Dasic Slickgone EW	Yes				NA	Yes			Yes	
Dasic Slickgone NS	Yes		Yes[2]	Yes/Pass[3]	NA	Yes		Yes	Yes	Yes
Dasic Slickgone LTSW		Yes			NA	Yes			Yes	
Ardrox 6120		Yes	Yes[4]	Yes/Pass[5]	Pass	Yes	Yes[6]		Yes	
Corexit 9500A		Yes		Yes/Pass[7]	Pass	Yes		Yes		Yes

Note 1: Intertek Geotech (2014); Note 2: Jacobs (2015); Note 3: Department of Primary Industries (2004); Note 4: Macinnis-Ng *et al* (2003); Note 5: Lewis & Pryor (2013); Note 6: BHP Stockpile of Ardrox 6210 purchase in 2014.

Table 9-13: Risk assessment for transitional Listed Dispersants that may have been purchased after 1 Jan 2012 but held in a dispersant stockpile by one of BHPs OSRA's

	Fish	Crustacean	Test Source	Other Information	Approved to mobilise
Corexit 9500A	*Menidia beryllina* (96h) - 25.20 ppm	*Mysidopsis bahia* (48h) 32.33 ppm *Acartia tonsa* (48h) 34 ppm *Artemi* (48h) 20.7 ppm	US EPA test results SDS SDS	Component substances have a potential to bioaccumulate. Organic portion is expected to be inherently biodegradable - SDS (via AMSA Nat Plan Annex 4).	Yes
Ardrox 6120	Not available	Not available	Jacobs (2015)	Refer to Jacobs (2015). 95% species protection ppb increased with combination of Ardrox 6120 and Pyrenees crude from 71.40 µg/L to 115.15 µg/L (unweathered) and 21.44 µg/L to 76.6 µg/L (weathered).	Yes

Dispersants Environmental Performance

Table 9-14 provides the environmental performance outcomes, performance standards and measurement criterial for the Dispersants response strategy.

The initiation criteria, course of action, resources, supporting documentation and termination criteria associated with each response strategy are detailed in the BHP *Crosby-3H1 Light Well Intervention Oil Pollution Emergency Plan (OPEP) (PYHSE-ER-0006)* (Appendix G).

Table 9-14: Environmental performance – Dispersants

RS3 Dispersants			
Environmental Performance Outcome	**Implementation of dispersant application to enhance biodegradation of hydrocarbons to reduce impact of surface and shoreline accumulated hydrocarbons on sensitive receptors.**		
Response Strategy	**Control Measure ID**	**Performance Standard**	**Measurement Criterial**
Dispersants	**PS RS3.1**	Dispersant application to be reviewed and managed in accordance with the Incident Action Plan (IAP).	IAPs.
	PS RS3.2	Mobilisation of vessels/ aircraft and equipment to conduct dispersant application, where Operational NEBA identified a net environmental benefit of initiating the response strategy.	Communication and flight logs to demonstrate mobilisation to site. Documentation of completed Operational NEBA.
	PS RS3.3	Permission for dispersant application in or around State waters will be obtained from DoT prior to application.	Approval correspondence from DoT prior to application of dispersants in or around State waters.
	PS RS3.4	Spill fate modelling initiated within 2 hours of incident notification to support Operational NEBA. Within 4 hours of notification, oil spill modelling agency to provide oil spill trajectory modelling report; and Oil spill modelling agency to undertake any additional modelling requirements as per daily IAP.	Trajectory modelling request form issued within 2 hours of spill notification. Trajectory modelling received within 4 hours of notification.
	PS RS3.5	Implement Operational Response Guideline 2 – Dispersant Strategies: Safety, Application, Resources and Effectiveness (AOHSE-ER-0042) in the decision-making processes for dispersant use, including: • A quick-effectiveness test (QET) will be carried out following a spill (based on the National Plan Dispersant Effectiveness Field Test Kit (Nat-DET)) to confirm the use of the dispersants available; and	Documentation of the outcomes of the QET. Operational NEBA and IAP document decision framework for use of dispersant.

RS3 Dispersants			
Environmental Performance Outcome	**Implementation of dispersant application to enhance biodegradation of hydrocarbons to reduce impact of surface and shoreline accumulated hydrocarbons on sensitive receptors.**		
Response Strategy	**Control Measure ID**	**Performance Standard**	**Measurement Criterial**
		• Operational NEBA for applying dispersant will be undertaken as part of the IAP for the duration of the response to inform the windows of opportunity for dispersant application.	
	PS RS3.6	Contract with AMOSC who maintain a call-off contract with RPS-APASA* to provide spill modelling as required in place prior to the commencement of LWI activity. *Alternative oil spill modelling agencies may be selected dependent on operational requirements.	Documentation of Contract with AMOSC who maintains call-off contract with RPS-APASA*. *Alternative oil spill modelling agencies may be selected dependent on operational requirements.
	PS RS3.7	AMOSC / OSRL contracts Mutual Aid MoUs and other third party agreements for provision of equipment (e.g. dispersants/ supplies and resources (e.g. air attack supervisors) in the event of a loss of hydrocarbons incident in place during the operations.	AMOSC / OSRL contracts, Mutual Aid MoUs and other third party agreements in place during operations.
	PS RS3.8	Aerial dispersant aircraft will be available for use onsite within 12 hours of notification. Aircraft mobilisation will be initiated from the IMT through the AMSA Environment Protection Response Duty Officer via AusSAR and will be available to leave base within four hours of notification.	Communication and flight logs to demonstrate mobilisation to site. Records of activation.
	PS RS3.9	Chemical dispersant confirmed to be acceptable for use in the marine environment.	Only dispersants on the OSCA Register or transitional list, or otherwise approved by BHP to be used.
	PS RS3.10	Dispersant application within the window of opportunity (nominally 48 hours) for efficient dispersal use and to the leading edge of spill.	Flight / vessel logs of dispersant runs. Logs of type and amount of dispersant applied.
	PS RS3.11	Dispersant Application Zone with a 50 km radius around the Pyrenees Facility and not to intercept the Ningaloo Marine Park boundary and not in water depths <50 m.	Flight/ vessel logs records of dispersant application.
	PS RS3.12	Dispersant efficacy testing to confirm the use and viability of the dispersants available on site.	Efficacy test results.

RS3 Dispersants			
Environmental Performance Outcome	**Implementation of dispersant application to enhance biodegradation of hydrocarbons to reduce impact of surface and shoreline accumulated hydrocarbons on sensitive receptors.**		
Response Strategy	**Control Measure ID**	**Performance Standard**	**Measurement Criterial**
	PS RS3.13	If EPBC Act-listed migratory species such as humpback whales or whale sharks are observed in the immediate vicinity of dispersant operations as determined from situational awareness reports from the RS2 Monitor and Evaluate response strategy and/or from the platforms applying dispersant, dispersant operations will cease until the animal has not been sighted for 30 minutes, unless advised otherwise by the DoT OSRC.	Operational NEBA, situational awareness reports from RS2 Monitor and Evaluate, and IAP document decision framework for use of dispersant.
	PS RS3.14	Dispersant will not be applied if consideration of the temporal (i.e. seasonal) windows of ecological sensitivity for environmental values discussed in Section 4, coupled with the outcomes of the daily Operational NEBA, indicate that there would be no net environmental benefit on 'Extreme' or 'High Priority' receptors (as described in Section 2 of the OPEP).	Operational NEBA and IAP document decision framework for use of dispersant.
	PS RS3.15	Environmental monitoring.	Reports documenting results of environmental monitoring.
	PS RS3.16	Volumes of dispersants applied will be recorded.	Spill reports and incident response reports detail volumes of dispersant applied.
	PS RS3.17	Response strategy activities continued until termination criteria met - Hydrocarbons from loss of well containment controlled and no longer discharging.	Spill reports and incident response reports detail no hydrocarbon discharge.

9.4.4 Spill Response: RS4 Marine Recovery

Summary of Activity

The Marine Recovery response strategy involves the deployment of a booming system by vessels to gather and contain surface oil, while a skimmer is used to retrieve the oil slick from the sea surface and decant it to suitable storage such as barges or internal tanks on vessels. The use of booms can assist with minimising the potential impact by reducing the amount of surface oil thereby preventing it from reaching environmentally sensitive shorelines. Marine Recovery is not suitable for diesel slicks as diesel rapidly spreads and has a high evaporation rate in the first 24 hours. Marine Recovery is not considered to be a primary method for reducing impacts from Level 3 spills, but rather as secondary response strategy. This strategy is highly dependent on favourable weather conditions and sea state, the oil spill characteristics and selection of the correct boom type; however, it has the potential to have an environmental benefit.

Potential Environmental Impacts and Risks

Marine Recovery will require vessels (typically two per boom), booming and skimming equipment, suitably storage containment for retrieved oily waste and trained operators/ personnel. There will be impacts associated with the disposal of the recovered waste crude oil and the cleaning and/ or disposal of boom equipment as well as potential risk of entanglement of marine fauna within the booms or accidental corralling fauna into the surface oil.

Oil Spill Preparedness

BHB can have two complete marine recovery units available for operations from Day 3 of the response and depending on requirements BHP can further scale up to a total of 8 operation units by Day 8 using AMOSC or MoU resources. Gaps in regional capacity can be reduced using national or international resources within 21 days. Marine recovery operations may be limited to sheltered areas when metocean conditions in open water reduce its effectiveness. Vessels may be deployed for either marine recovery operations or vessel dispersant operations – both having the effect of reducing oil on surface. Pre-mobilisation of additional equipment or resources for marine recovery is not justified for the environmental benefit gained.

Effective marine recovery has the environmental benefit of removing hydrocarbons from the water surface and therefore reducing the potential of hydrocarbons impacting shorelines or other sensitive resources. This method can be deployed to recover surface oil in areas where the use of dispersant cannot be used as described in the BHP controls for dispersant application.

The need for a marine recovery operation is to collect surface oil from a spill volume of 1,930 m^3. A marine recovery operation (two vessels with skimmer in a J boom configuration) is estimated to recover between 35 m^3 and 50 m^3 of surface oil per day. Using a marine recovery response strategy to collect the projected surface oil would require 2 marine recovery units operating for approximately 27 days.

Response Arrangements

Equipment

Planning is based on two complete marine recovery units available for operations from Day 3 of the response. There is capacity to further scale up to a total of 8 operation units by Day 8 using AMSA or Mutual Aid resources. The indicative schedule for this operation is provided in Table 9-15.

Table 9-15: Indicative schedule of response arrangements for marine recovery

Activity	Day																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	On-going	TC
Mobilise AMOSC Equipment to Site																		
Mobilise AMOSC Core Crew to Site																		
Mobilise Oil Storage Units																		
Spot Charter Local Vessels (x4)																		
Marine Recovery Units (x2)																		
Spot Charter Standby Vessels (x12)																		
Standby Vessels Available																		
Mobilise Oil Storage Units																		
Train Marine Crew in Marine Recovery																		
Mobilise AMOSC or MOU Equipment																		
Marine Recovery Units (x 6)																		
Mobilisation Plan International Resources																		
Evaluate until termination criteria met																		
Key	Mobilisation					Field Activity					Equipment Standby					TC = until termination criteria met		

Marine recovery with Ro-boom may be used in Exmouth Gulf or other sheltered coastal areas (i.e. nearshore locations around the Ashburton islands along the Onslow or Dampier coastline) where conditions are more suitable for use. This method may also be used as a means to recover surface hydrocarbons where the use of dispersants is no longer effective or not permissible due to BHP operational constraints for dispersant application.

Current AMOSC/AMSA/MOU equipment stockpiles for offshore boom and skimmers to enable the setup of 8 operations units are shown in OPEP Section 5.3 (Marine Recovery) to enable access by the IMT.

Vessels of suitable capacity (tug, AHTS, supply or small utility vessels) for this operation are available on spot market in the NWS region to establish the 2 marine operational units by Day 3 and scale up to 8 units by Day 8. These classes of vessels do not require significant modification before they can be ready for marine recovery operations. AMOSC or National Response Team (NRT) trained operators can be used to train marine crew in the operation of the containment and recovery systems.

Gaps in marine recovery resources can be addressed in the following ways:

- Additional marine recovery equipment such as skimmers and offshore boom can be addressed by access to OSRL equipment which provides for additional 10–20 units;
- Vessels from Fremantle, Darwin or Singapore would be available to mobilise and backfill or supplement vessels obtained from NWS in a 21-day period; and
- Crew experienced in marine recovery operations could be obtained through OSRL, or on-site training of the vessel marine crew or contractors could be undertaken.

In conclusion, BHB can have 2 complete marine recovery units available for operations from Day 3 of the response and to further scale up to a total of 8 operation units if required by Day 8 using AMOSC or MoU resources. Gaps in regional capacity can be reduced using national or international resources within 21 days.

Logistical Constraints

The following operational constraints limit the contribution to the offshore marine recovery:

<u>Metocean Conditions</u>: The worst-case hydrocarbon EMBA for the marine recovery response is primarily in the open ocean in a region where for 55% of the year, winds exceed 10 kts and the average significant wave height ranges (based on BHP Wave Rider Buoy Data – Pyrenees Field July 2013 – April 2014) from 1.4 to 2.1 m; environmental conditions that are generally considered to be unfavourable for offshore recovery methods such as J-boom configurations using Ro-boom. Alternative containment systems such as NOFI current buster are rated for use up to 40 kts and seas up to 6 m and BHP has access to this type of boom through its arrangements with AMOSC and Mutual Aid equipment available on Barrow Island.

Modelling conducted in the inner reef areas by RPS-APASA indicate the physical oceanographic conditions are not suitable for marine recovery operations due to strong tidal currents.

<u>Use of Vessel Resources for other Response Needs</u>: The vessels used for marine recovery operations can also be deployed for vessel dispersant operations.

Given that marine recovery operations in the response area can be restricted by weather and/or oceanographic conditions, these resources may either be assigned to vessel dispersant activities or the collection of hydrocarbon in locations where dispersants cannot be used or in sheltered waters where the efficiency may be higher. If marine dispersant activities are stood down due to effective dispersant operations, the vessels will be tasked for marine recovery.

Whatever method is being deployed, the overall objective of removal of surface hydrocarbons is being achieved.

<u>Availability of Core Group Responders</u>: AMOSC Core Group responders experienced in the marine recovery operation may also need to be deployed to other response activities. To enable the expansion of marine recovery operational unit's core group personnel or AMOSC contractors/trainers would be used to train marine crews in the use of marine recovery. The estimated duration of the training is half a day prior to the unit being operational.

<u>Storage and Processing of Skimmed Oil/Water Mixture</u>: Disposal of recovered oil/water can be taken to existing waste storage facilities in Dampier or to the Pyrenees Facility. To improve the efficiency of the marine recovery strategy, storage of recovered oil/water can utilise the recovery vessel storage tanks, supplemented by IBC's (or iso-containers on larger vessels). Gaps in storage capacity or to reduce transit times can be overcome by either:

- The use of decanting (in accordance with MARPOL requirements and AMSA guidelines). Decanting at the point of collection will limit environmental impact as the water would already be in contact with hydrocarbons and additional oil can be removed from the environment; and
- Establishing temporary storage transfer on barges or other vessels adjacent to recovery operations and using other vessels to transfer collected oil from the transfer location to disposal or processing locations.

In conclusion, marine recovery operations may be limited to sheltered areas when metocean conditions in open water reduce its effectiveness. Vessels may be deployed for either marine recovery operations or vessel dispersant operations, both having the effect of reducing oil on surface.

Marine Recovery Environmental Performance

Table 9-16 provides the environmental performance outcomes, performance standards and measurement criterial for the Marine Recovery response strategy.

The initiation criteria, course of action, resources, supporting documentation and termination criteria associated with each response strategy are detailed in the BHP *Crosby-3H1 Light Well Intervention Oil Pollution Emergency Plan (OPEP) (PYHSE-ER-0006)* (Appendix G).

Table 9-16: Environmental performance – Marine Recovery

RS4 Marine Recovery			
Environmental Performance Outcome	**Implementation of marine recovery activities to reduce volume of surface hydrocarbons to reduce contact with sensitive receptors.**		
Response Strategy	**Control Measure ID**	**Performance Standard**	**Measurement Criterial**
Marine Recovery	**PS RS4.1**	Marine recovery to be reviewed and managed in accordance with the IAP.	IAPs.
	PS RS4.2	Mobilisation of vessels, equipment and resources to conduct marine recovery in areas where surface oil predicted to make contact with sensitive environmental receptors and where Operational NEBA identified a net environmental benefit of initiating the response strategy.	Spill modelling reports submitted and logged by IMT. Documentation of completed Operational NEBA.
	PS RS4.3	Initiate marine recovery response strategy - deployment of booms within 24 hours of IMT notification, with full deployment achieved within 48 hours.	Incident response reports. Boom deployment detailed in marine log books.
	PS RS4.4	Reduce impacts to marine flora and fauna from marine recovery response strategy activities by ceasing operations if: • If EPBC Act-listed Threatened/Migratory marine fauna is observed in the immediate area. • Visible coral spawning slicks are observed in the area of operations.	IAPs detail areas for initiation of planned marine recovery. Marine logs outline any reasons for cessation of marine recovery operations.
	PS RS4.5	Crude oil waste retrieved to be managed in accordance with the Waste Management Plan and volumes of recovered oil recorded.	Waste records/ manifests.
	PS RS4.6	AMOSC/ OSRL contracts, Mutual Aid MoU's and other third party agreements for provision of equipment/ supplies and resources to supervise marine recovery	Records of AMOSC / OSRL contacts and other third party agreements.

RS4 Marine Recovery			
Environmental Performance Outcome	**Implementation of marine recovery activities to reduce volume of surface hydrocarbons to reduce contact with sensitive receptors.**		
Response Strategy	**Control Measure ID**	**Performance Standard**	**Measurement Criterial**
		response strategy in place during operations.	
	PS RS4.7	OSV contract in place during operations.	Records of contract in place during operations.
	PS RS4.8	IMT to mobilise people and equipment to achieve the IAP performance outcome(s).	Incident response reports.
	PS RS4.9	Spill surveillance reports and spill trajectory modelling predictions incorporated into IAP preparation process for response strategies.	IAPs. Incident response reports. Spill modelling reports submitted and logged by IMT.
	PS RS4.10	If EPBC Act-listed migratory species such as humpback whales or whale sharks are observed in the immediate vicinity of operations as determined from situational awareness reports from the RS2 Monitor and Evaluate response strategy and/ or from the vessel platforms, operations will cease until the animal has not been sighted for 30 minutes.	Operational NEBA, situational awareness reports from RS2 Monitor and Evaluate, and IAP document decision framework for activation of marine recovery.
	PS RS4.11	Marine recovery will not be implemented if consideration of the weather conditions, and/ or temporal (i.e. seasonal) windows of ecological sensitivity for environmental values discussed in Section 4 and coupled with the outcomes of the daily Operational NEBA, indicate that there would be no net environmental benefit on 'Extreme' or 'High Priority' receptors (as described in Section 2 of the OPEP).	Operational NEBA and IAP document decision framework for use of marine recovery.
	PS RS4.12	Response strategy activities continued until termination criteria met.	Incident response reports from 'Monitor and Evaluate' activities and observation logs detail surface oil slick has been removed to extent that continuation of the operations is no longer considered to be effective and / or surface oil slick is no longer deemed a potential threat to sensitive environmental receptors.

9.4.5 Spill Response: RS5 Shoreline Protection

Summary of Activity

The Shoreline Protection response strategy involves the deployment of protection and deflection booms (by AMOSC/ OSRL) which assist in minimising the amount of oil contacting shorelines. In the event of a hydrocarbon spill event and if the modelling suggests that sensitive shorelines and receptors are at risk of contact, protective and deflective booms will be deployed to deflect a slick away from a known sensitivity towards an area where collection can be more effective without impacting high value habitat areas. Alternatively, slicks can be deflective to shorelines of lower environmental value where the oil can be collected, or if appropriate, identification of nearby suitable sacrificial habitat.

This response strategy will involve the deployment of vessels, equipment and personnel and its success is dependent on weather and sea state conditions. To be effective, a crude thickness of 25 microns is required.

Sensitive shorelines that require protection and deflection by a potential oil spill will be identified and prioritised through the IAP and Operational NEBA process. This will be carried out in line with advice from environmental advisors and stakeholder groups (e.g. DoT and Department of Biodiversity and Conservation and Attractions (DBCA)).

Potential Environmental Impacts and Risks

This response strategy will involve the deployment of vessels, equipment and personnel. The installation of booms and associated equipment could result in damage to sensitive habitats and disturbance of fauna (e.g. trampling of mangroves, emergent reefs, turtle nesting beaches; and damage to emergent reefs by vessels used to deploy nearshore booms and anchoring impacts), entanglement of marine fauna within booms, accidental corralling fauna into surface oil, accidental deflection of surface oil to sensitive shorelines and environmental receptors, and damage to aboriginal registered sites of cultural significance from shoreline accumulation and deployment of protection and deflection booms.

The environmental sensitivity of shorelines that may be impacted by a potential Level 3 oil spill is a key consideration in determining priorities for shoreline response. The sensitivity of shorelines may vary depending on the time of year, as some shorelines in the region are used as turtle and bird nesting areas.

Oil Spill Preparedness

BHB can protect extreme sensitivity areas where functional shoreline protection can be implemented prior to the predicted arrival time of first oil. During the response SCAT teams and specialists will continue to monitor opportunities to deploy additional shoreline protection strategies above and beyond what has already been identified as suitable for protection. BHP would continuously replenish the shoreline protection stockpile to maximise the potential to use this method. Pre-mobilisation of additional equipment or resources or improving access along the coastline for shoreline protection is not justified for the environmental benefit gained.

Numerical modelling indicates that the area most likely to be impacted by an oil spill (where shoreline loading is >100 g/m^2 threshold) is the region between North West Cape and Coral Bay, with offshore islands (Muiron Islands and Barrow island) and the Onslow Region also predicted to be contacted.

The need is to install shoreline protection equipment prior to the presence of hydrocarbon at locations where deployment can be safely and practicably achieved. The earliest shoreline oiling would be expected to appear is Day 2 (Murion Islands). The capacity for the shoreline protection will be maintained until the termination criteria for RS5 Shoreline Protection has been achieved.

It should be noted that shoreline protection and shoreline clean-up measures for Barrow island are established and maintained by Chevron. Chevron’s Oil Pollution Emergency Plan arrangements would be enacted following joint consultation with Chevron and the DoT. The need for activation would be identified during the implientation of RS2 Monitor and Evaluate response strategy as part of the Crosby-3H1 Oil Pollution Emergency Plan (OPEP). Should data indicate potential shoreline contact with Barrow Island or any nearby receptors, Chevron would be notified and mobilised via existing arrangements by the DoT as the Controlling Agency.

Response Arrangements

In 2014, BHP, Quadrant Energy (now Santos) and Woodside engaged AMOSC to develop Tactical Response Plans for shoreline protection and clean-up for the key sensitives at risk. The areas that were identified as suitable for shoreline protection due to their sensitivity were:

- The inlet to Mangrove Bay; and
- Yardie Creek.

The feasibility of implementing functional shoreline protection at Mangrove Bay and Yardie Creek is considered high as the locations have been ground-truthed to determine the specific equipment needs and site-specific response plans have been developed.

Equipment

There is sufficient equipment in the Exmouth AMOSC stocks of Zoom Boom (450 m), Beach Guardian (500 m) to undertake first strike shoreline protection at Yardie Creek and Mangrove Bay. First strike response resources will be mobilised on Day 1, be in place by Day 2, and can be scaled up for a higher category, if needed. BHP trained oil spill responders can be deployed from the Perth office and be on site within 24 hours. Arrangements are in place with an Exmouth logistics contractor to collect and transport equipment to Mangrove Bay and Yardie Creek.

Personnel

BHP is planning a shoreline protection response matched to the consequence of a worst-case volume ashore. Arrangements are flexible and scalable in time to mobilisation. Modelling has indicated the minimum time to contact of oil above the moderate exposure value of >100 g/m^2 is ~1.9 days (without dispersant application) at shorelines of the Ningaloo Region and 2.1 days at the Muiron Islands. BHP can mobilise its core group personnel, AMOSC core group personnel and international skilled resources (OSRL), if needed, within 24 hours to protect the key environmental sensitivities (such as those located on North West Cape and Muiron Islands) that may be impacted in this short timeframe.

BHP has arrangements in place with providers of a temporary contract workforce to scale-up post first strike. This is described in further detail in Section 10.6. Shoreline protection operations will continue until the termination criteria for RS5 Shoreline Protection has been achieved.

Logistical Constraints

The following operational constraints limit the contribution to shoreline protection:

<u>Multiple use of logistics contractor to support other operations</u>: The initiation of multiple response strategies in Exmouth has the potential to cause conflicts on the available logistic contractors movement of equipment required for the first strike shoreline protection. The equipment required to deploy shoreline protection can be delivered to the location by either the logistics contractors or the first strike teams themselves with the use of utility vehicles and trailers if trucks were deployed for other strategies (i.e. moving dispersant stocks). It has been assessed that this would not be a conflict to the required deployment timeframe.

<u>Access to areas requiring shoreline protection</u>: There is access to coastline from Exmouth through to Yardie creek using paved roads with access tracks to most beaches. From Yardie Creek to Coral Bay, and the Eastern Coastline of the Exmouth Gulf to Onslow, there is limited 4WD access. Vehicles for managing the logistics in these areas would be required such as 4WD buses and trucks. Transit times would expect to be longer. Access to the nearshore islands would be via barge or small vessel.

<u>Locations amenable to shoreline protection</u>: In 2014, BHP, Quadrant Energy (now Santos) and Woodside engaged AMOSC to develop Tactical Response Plans for shoreline protection and clean-up for the key sensitives at risk from a large hydrocarbon spill. The conclusions identified that many areas on the coast were not suited to shoreline protection:

- The reliability of deployment effectiveness of shoreline protection equipment at the locations exposed directly to the Indian Ocean or high currents in the inner reef area is limited;

- The exposed coastline at Jurabi, Turquoise Bay and the Muiron islands are not suitable for shoreline protection methods. Shoreline booming would be suitable at times for enhanced collection but this was determined to be short lived between tides.
- During the response, SCAT teams and specialists will continue to monitor opportunities to deploy additional shoreline protection strategies above and beyond what is described in the Tactical Response Plans. BHP would continuously replenish the Exmouth shoreline protection stockpile to maximise the potential to use this method.

In summary, BHP has access to shoreline protection equipment, trained personnel and supporting staff that are sufficient and appropriate for shoreline protection operations. Up to 200 unskilled workers are available and ready to respond to first oiling associated with the minimum time to shoreline contact scenario. Trained personnel requirements will be filled from the AMOSC Core Group, and international resources. BHP has pre-identified protection priorities, equipment and resource requirements, access and constraints within tactical response plans that will enable efficient measures to be implemented.

Shoreline Protection Environmental Performance

Table 9-17 provides the environmental performance outcomes, performance standards and measurement criterial for the Shoreline Protection response strategy.

The initiation criteria, course of action, resources, supporting documentation and termination criteria associated with each response strategy are detailed in the BHP *Crosby-3H1 Light Well Intervention Oil Pollution Emergency Plan (OPEP) (PYHSE-ER-0006)* (Appendix G).

Table 9-17: Environmental performance – Shoreline Protection

RS5 Shoreline Protection			
Environmental Performance Outcome	**Implementation of shoreline protection activities to reduce surface hydrocarbons reaching sensitive shoreline receptors.**		
Response Strategy	**Control Measure ID**	**Performance Standard**	**Measurement Criterial**
Shoreline Protection	**PS RS5.1**	Shoreline protection operations to be reviewed and managed in accordance with the IAP.	IAPs.
	PS RS5.2	Mobilise 200 unskilled workers to conduct shoreline protection in areas where surface oil predicted to make contact with sensitive environmental receptors and where Operational NEBA identified a net environmental benefit of initiating the response strategy.	Call off National Contract Panel (Hays, Chandler McLeod, One Key, Programmed, Scotford and Fennessy) via Minerals Australia.
			Call off direct Hays Corporate Account.
	PS RS5.3	Mobilisation of vessels and equipment to conduct shoreline protection in areas where surface oil predicted to make contact with sensitive environmental receptors and where Operational NEBA identified a net environmental benefit of initiating the response strategy.	Spill modelling reports submitted and logged by IMT.
			Documentation of completed Operational NEBA.
	PS RS5.4	Initiate shoreline protection response strategy - deployment of booms within	Incident response reports

RS5 Shoreline Protection			
Environmental Performance Outcome	**Implementation of shoreline protection activities to reduce surface hydrocarbons reaching sensitive shoreline receptors.**		
Response Strategy	**Control Measure ID**	**Performance Standard**	**Measurement Criterial**
		24 hours of IMT notification, with full deployment achieved within 48 hours.	Daily field reports submitted to the IMT.
	PS RS5.5	Use North West Cape Sensitivity Mapping (AOHSE-ER-0036), cultural heritage maps and shoreline tactical response plans to reduce impacts to marine flora and fauna, and aboriginal registered sites of cultural significance, from shoreline protection response strategy. For areas outside the mapping areas noted above: • Utilise the BHP GIS database and/or the DoT OSRA and; • Conduct observations/ surveys prior to deployment of equipment and personnel to develop a deployment/ operations plan, which includes avoidance of impacts to wildlife, minimisation of ground disturbance, protection of sensitive areas, and consultation with DBCA and local stakeholders. Activities not to proceed if: • EPBC Act-listed Threatened/Migratory marine fauna is observed in the immediate area. • Aboriginal registered sites of cultural significance are located in the immediate area without consultation with (and authority where required) the WA Department of Planning, Lands and Heritage.	IAPs detail areas for initiation of planned shoreline protection. No EPBC Act-listed Threatened/Migratory marina fauna sighted and recorded in observation logs. Records of IAPs and field reports include review and management of heritage values.
	PS RS5.6	AMOSC and OSRL contracts and other third party agreements for provision of equipment/ supplies and resources for shoreline protection response strategy in place during operations.	Records of AMOSC and OSRL contracts and other third party agreements.
	PS RS5.7	IMT to mobilise people and equipment to achieve the IAP performance outcomes.	Incident response reports.
	PS RS5.8	Shoreline protection equipment including boats will be selected that are fit for purpose and no anchoring of vessels or booms will occur on emergent reefs or other fragile/ sensitive benthic habitats.	Contracts for use of shoreline protection equipment with OSRAs. Incident response reports.

RS5 Shoreline Protection			
Environmental Performance Outcome	**Implementation of shoreline protection activities to reduce surface hydrocarbons reaching sensitive shoreline receptors.**		
Response Strategy	**Control Measure ID**	**Performance Standard**	**Measurement Criterial**
	PS RS5.9	Spill surveillance reports and spill trajectory modelling predictions incorporated into IAP preparation process for response strategies.	IAPs. Incident response reports Spill modelling reports submitted and logged by IMT.
	PS RS5.10	Trained operators to monitor and evaluate the integrity of boom deployment.	Boom maintenance checks and operational surveillance records.
	PS RS5.11	Implement environmental monitoring to determine the ongoing acceptability of the environmental risk associated with the application of shoreline protection methods.	Monitoring records document ongoing review of the environmental risk and acceptability of shoreline protection methods.
	PS RS5.12	If EPBC Act-listed threatened/migratory species such as humpback whales or whale sharks are observed in the immediate vicinity of operations as determined from situational awareness reports from the RS2 Monitor and Evaluate response strategy and/or from the vessel platforms, operations will cease until the animal has not been sighted for 30 minutes	Operational NEBA, situational awareness reports from RS2 Monitor and Evaluate, and IAP document decision framework for activation of shoreline protection.
	PS RS5.13	Shoreline protection will not be implemented if consideration of the weather conditions, and / or temporal (i.e. seasonal) windows of ecological sensitivity for environmental values discussed in Section 4, coupled with the outcomes of the daily Operational NEBA, indicate that there would be no net environmental benefit on ‘Extreme’ or ‘High Priority’ receptors (as described in Section 2 of the OPEP).	Operational NEBA and IAP document decision framework for use of shoreline protection.
	PS RS5.14	Response strategy activities continued until termination criteria met.	Incident response reports from RS2 Monitor and Evaluate activities and observation logs detail trajectory of surface oil slick is such that it is no longer deemed a potential threat to sensitive environmental shoreline receptors.

9.4.6 Spill Response: RS8 Shoreline Clean-Up

Summary of Activity

The Shoreline Clean-up Response Strategy will be implemented for Level 2 or Level 3 spills. Where shoreline protection and deflection is not possible or unsuccessful, shoreline clean-up activities will be implemented. The Shoreline Clean-up Response Strategy is logistic and labour intensive, requiring multiple vessels, equipment, clean-up crews and waste management. Shoreline clean-up involves the physical removal of stranded oil from shorelines via a range of techniques including:

- Natural recovery;
- Sediment relocation;
- Mechanical clean-up using heavy machinery;
- Debris removal via manual bagging;
- Absorbents;
- Pumps and vacuums;
- Low-pressure flushing; and
- High-pressure flushing.

BHP will use the information gained from implementation of the RS2 Monitor and Evaluate response strategy (Section 9.4.2), namely the spill trajectory modelling, to predict shorelines that will be impacted and will require priority shoreline clean-up activities. Through information gathered and assessed by the IMT and DoT, the trajectory of the spill towards the specific coast will be confirmed and the shoreline clean-up strategy will be implemented. Following identification of environmental sensitive receptors, it will be of the highest priority that BHP will establish a nearshore and onshore response to manage the impacts that may occur to those sensitive shoreline receptors.

The shoreline clean-up response strategy will consider the following factors:

- Shoreline characteristics (substratum type, beach type, shoreline exposure, biological/ social/ heritage/ economic values; characteristics of the oil (i.e. degree of weathering); amount of oil present, distribution of the oil on the shoreline; shoreline sediment type);
- Logistic considerations (availability of access – personnel, equipment; waste removal); availability of equipment and labour; availability of waste storage areas);
- Operational risk assessment of potential shoreline clean-up methods will be captured leading to the development of Operational NEBAs;
- Damage to Aboriginal registered sites of cultural significance from shoreline clean-up activities; and
- The requirement for other Operators to enact their OPEP arrangement for sensitive receptors at their location of operations (for example, Chevron for Barrow Island).

The DoT is the Statutory Agency for shoreline response in WA, with support from the DBCA. BHP will develop daily Incident Action Plans (IAPs) as a first priority, and an Operational NEBA will also be carried out for shoreline protection and clean-up in consultation with the DoT. The specific clean-up techniques will be risk assessed and refined during development of the IAP to suit the circumstances of the incident response. The sensitivity of shorelines may vary depending on the time of year, such as shorelines and beaches used by birds and turtles for nesting. This will be considered during the Operation NEBA process.

Based on the IAP, BHP will establish and deploy Shoreline Clean-up and Assessment Technique (SCAT) teams for assessment of the shoreline and developing recommended clean-up strategies for the IMT planning and operations group. SCAT team members will include members trained in oil spill response measures and environmental and coastal sensitivities of the region. Ideally, each SCAT team will include a representative from the appropriate state agency (DoT/DBCA).

The SCAT teams will undertake systematic surveys of the shoreline that will be segmented into sections. The SCAT teams will then provide sketches and reports which will include recommendations for the most appropriate clean up strategy for the shoreline segment. This information will feed back to the IMT who will then prioritise areas for clean-up and allocate resources.

The SCAT teams will utilise techniques to determine appropriate termination end points for response in consultation with the appropriate State Agency (DoT/ DBCA). The endpoints can be determined by either:

- Qualitative field observations – to describe the presence or absence of stranded oil and/or the character of such oil;
- Quantitative field measurement methods – based on visual measurements and observations of the quantity of oil;
- Analytical measurement methods – typically require the collection of representative field samples and subsequent laboratory analysis; or
- Interpretive impact assessment methods – based on an evaluation of system impacts (i.e. NEBA).

Through the designated Control Agency, BHP will arrange for the call-up of the necessary personnel and logistics associated with maintaining those crews at the impact location, which includes the support arrangements to ensure the health, safety and welfare of the shoreline crews. This includes availability of PPE, sun shelter, first aid supplies, catering, drinking water, ablutions, decontamination facilities, accommodation, transport and communications to support the number of personnel expected to be required at the impact location.

Potential Environmental Impacts and Risks

The physical clean-up activities associated with shoreline response strategy could result in trampling of shoreline habitats by response clean-up crew, heavy machinery and vessel anchoring damaging shoreline habitats and emergent reef features and Aboriginal registered sites of cultural significance; flushing and pressure washing procedures damaging habitats and alteration of beach profiles by removal/ relocation of sediment. The use of equipment, machinery and clean-up personnel in some coastal environments, e.g. mangroves, turtle/ bird nesting beaches could potentially cause more damage than the stranded hydrocarbons themselves, thereby reducing the recovery and net environmental benefit of the clean-up strategy. Shoreline clean-up activities also present a risk of cross-contamination between oiled and non-oiled areas or further spreading of hydrocarbons.

Net Environmental Benefit Analysis of Shoreline Clean-Up

Environmentally sensitive shorelines, cultural heritage sites and shoreline receptors that may be impacted by a potential oil spill is a key consideration in determining priorities for shoreline response and clean-up activities. This section outlines the overarching approach to the identification of shore-based oil spill response and clean-up priorities in the event of spill incidents. Table 9-18 outlines the sensitivity of coastal features, appropriate protection and clean-up procedures. Table 9-19 identifies proposed protection and clean-up approaches for these sensitive coastal features. The associated environmental risk assessment of the identified protective measures and preferred clean-up methods is provided Table 9-20. The outcomes from Table 9-18 and Table 9-20, along with the Operational NEBA, inform the IAP.

Table 9-18: Coastal features classification: sensitivity, protection and clean-up methods

Coastal Feature	Sensitivity *	Comments	Protective Measure	Clean-up Method (Table 9-19)		
				Preferred	Possible	Avoid
Sites of Cultural Significance	S1	Potential damage to Aboriginal registered sites of cultural significance from shoreline clean-up activities and shoreline response operations.	2, 3	1, 7	6, 14	5, 8, 9, 10, 11, 12,13
Mangroves & Tidal Flats	S1	Extremely low energy areas. Oils may penetrate muddy substrate rapidly and deeply and can persist for years. Associated tidal flats are very important for wading birds. These areas should receive top protection and clean-up priority.	2, 3	1, 7	3, 6, 14	5, 8, 9, 10, 11, 12,13
Intertidal Limestone Reef & Corals	S2	Unless tide is low, most corals will not be directly exposed to floating oil. However, turbulent mixing from waves can result in contact and adhesion of oil to reef areas.	1, 2, 3, 4	1, 3, 7	8	5, 6, 9, 10, 14
Sandy Beaches	S3 S1*	Sand beaches are relatively low in ecological diversity except during times of turtle and bird nesting. Higher clean-up priority should be given to turtle nesting and amenity beaches. High potential for oil penetration.	1, 3	1, 3, 6, 7, 8, 13	9, 14	5, 10, 11
Sheltered Rock Shores	S3	Landed oil will weather quickly and may accumulate in pools and cracks.	1, 3	7	3, 8, 9	5,10,11
Shingle, Rock and Sand Mixed Beaches	S4	High potential for oil penetration and persistence.	1, 3	7, 9	8, 14	5, 10, 11, 12
Exposed Rock Shores and Cliffs	S4	Wave reflection may keep oil offshore. Moderate diversity and organisation quickly. Oil will accumulate in tidal pools and cracks.		7	1, 3, 9, 12	5, 10, 11
Marina, Jetties, Piers	S4	Very low likelihood of marina or pier areas being affected. To be cleaned as circumstances dictate.	1, 3	1, 3, 6, 9, 10	11, 12	5

Sensitivity Codes:

S1: Extreme Sensitivity: High Protection and clean-up priority
S2: High Sensitivity: Protection and clean-up priority as resource use & circumstances dictate
S3: Moderate Sensitivity: Protection and clean-up priority as resource use and circumstances dictate
S4: Low Sensitivity Low protection and clean-up priority
*Sandy beaches have an extreme sensitivity during turtle and bird nesting, which occurs at a number of sandy beaches in the region.

Table 9-19: Protection and clean-up options

1. Containment and recovery using booms	8. Manual clean-up of oil, or movement of substratum
2. Divert to less sensitive shore	9. Low pressure seawater flushing
3. Man-made sorbent methods	10. High pressure flushing
4. Earth barriers	11. Hot water steam cleaning
5. Chemical dispersant	12. Low pressure warm seawater wash
6. Skimmers, vacuums	13. Mechanical clean-up of oil, removal or movement of substrate
7. Natural recovery, allow to weather naturally	14. Bioremediation

Table 9-20: Environmental risks of shoreline protective and preferred clean-up method

Protection and Clean-up Options Method Reference (Table 9-19)	Method	Environmental Risks	Likelihood	Severity	Residual Risk	Acceptability
1	Containment and recovery booms	• Wildlife entrainment, disturbance injury and entanglement during deployment and use of equipment and personnel; and • Contamination of ground or surface water resulting from management of waste.	0.1	3	0.3	Tolerable
2	Diversion to a less sensitive shoreline	• Contamination and accumulation of oil on the less sensitive shore; and • Wildlife entrainment, disturbance, injury and entanglement during deployment and use of equipment.	3	10	30	ALARP
3 6	Man-made sorbents Skimmers and vacuums	• Contamination of ground or surface water resulting from management of waste; and • Wildlife entrainment, disturbance injury and entanglement during deployment and use of equipment and personnel.	0.1	10	1	Tolerable
4 8	Earth barriers Manual clean-up and/or movement of substratum	• Ground and vegetation disturbance and/or compaction to sensitive coastal landforms through use of machinery and earth moving, resulting in erosion and potential sedimentation of surface water; • Wildlife entrainment, disturbance, injury and entanglement during deployment and use of equipment and personnel; and • Contamination of ground or surface water resulting from management of waste.	1	3	3	Tolerable
7	Natural recovery, allow to weather naturally	• Prolonged and ongoing contamination and visible oil on both the shore and in the marine sediments and water column.	3	10	30	ALARP
9 10	Low pressure flushing High pressure flushing	• Contamination of surface water with oily water; • Drive oil deeper into substratum; • Erosion of substratum; and • Damage and/or death to sensitive shoreline flora and fauna via action of water, and	1	3	3	Tolerable

Protection and Clean-up Options Method Reference (Table 9-19)	Method	Environmental Risks	Likelihood	Severity	Residual Risk	Acceptability
		deployment of equipment and personnel.				
13	Mechanical clean- up of oil, removal or movement of substrata	• Vegetation clearing and damage, soil compaction; • Hydrocarbon leaks from equipment; • Drive oil deeper into substratum; • Erosion of substratum; • Damage and/or death to sensitive shoreline flora and fauna via action of water, and deployment of equipment and personnel.	1	3	3	Tolerable

Oil Spill Preparedness

Shoreline clean-up operations are needed to remove hydrocarbons from shorelines as expeditiously as possible to reduce the duration of exposure of sensitive shoreline biota and habitats to accumulated oil.

The priority coastal types for shoreline clean-up include sandy beaches, tidal mudflats and mangroves, and sites of cultural significance. Priority will be given to resourcing the shoreline clean-up response at known environmental sensitivities if a spill occurs during windows of increased ecological sensitivity (Table 4-10), e.g. peak migratory periods for shorebirds and / or turtle nesting season.

The needs for a shoreline clean-up operation require capacity to respond to stranded oil in different phases. Pre-cleaning areas of predicted oiling, removal of bulk oil, and polishing for final treatment, as described below:

- Pre-cleaning of beaches aims to minimise oiled waste by clearing debris from shorelines to well above the high tide mark, wherever safe and practicable to do so;
- Removal of bulk oil aims to recover as much of the hydrocarbon as expeditiously as possible to prevent remobilisation and secondary impacts to unaffected areas or those cleaned previously. It also has the environmental benefit of reducing the potential for hydrocarbon contact with wildlife; and
- Polishing and final treatment aims at removing residual oil and stains.

The need for polishing and final treatment would continue until the RS8 Shoreline Clean-up termination criteria have been met supported by relevant termination criteria from environmental monitoring (i.e. IAP – sediment quality).

<u>*Response Arrangements*</u>

Equipment

The processes that are in place to ensure the appropriate kinds of equipment to undertake the range of shoreline clean up techniques are identified and available are presented below. Shoreline clean-up operations will be preceded by shoreline assessments undertaken by SCAT teams. The SCAT teams will provide recommendations (and priorities) on the clean-up methods required to be implemented. SCAT teams will consist of trained oil spill responders and they will have access to reference guides that can assist in their decision making (i.e. OSRL Shoreline operations guide, POSOW Oiled shoreline clean-up manual).

This information will be provided to the BHP IMT (Planning section). The Planning section will liaise with the Logistics and Operations sections on providing the various equipment and personnel to undertake the clean-up operation. As shown in the table, mobilisation timeframes are compatible with the timeframes for expected hydrocarbons to contact shorelines. The shoreline clean-up teams will remain onsite until the relevant termination criteria from the environmental monitoring response strategies (i.e. IAP – sediment quality) are achieved.

Table 9-21 indicates the type of equipment that is required to implement the shoreline response strategy. First strike capability is available in Exmouth, which can be made available to BHP in the timeframes listed in the table.

Table 9-21: Equipment required to implement shoreline clean-up

Equipment	Location	Availability	Comments
AMOSC Shoreline equipment containers (inc. decontamination kit and wheelbarrows)	Harold Holt Exmouth	Day 1	
AMOSC skimmers and near shore boom	Harold Holt Exmouth	Day 1	Priority for booms is to shoreline protection (where feasible) then enhanced recovery (cleanup)
AMOSC skimmers and near shore boom	Fremantle	Day 2	
AMOSC Shoreline equipment containers (inc. decontamination kit and wheelbarrows)	Geelong	Day 3	
AMOSC skimmers and near shore boom	Geelong	Day 3	
National Plan Shoreline equipment/skimmers etc.	National	Day 3	
OSRL skimmers and near shore boom	Singapore	Day 4	
Additional boom, skimmers and other spill response equipment	International	Day 7	Direct purchase from suppliers/vendors
Flushing equipment pumps, hoses etc.	Onslow, Karratha, Port Headland, Perth	Day 2	BHP service contracts (i.e. Coates hire)
Vacuum recovery	Karratha, Port Headland, Newman, Perth	Day 2	BHP service contracts (i.e. Veolia)
Mechanical equipment, bobcats, loaders, graders bulldozer, tractors etc.	Exmouth, Onslow, Karratha, Carnarvon, Perth	Day 2 (local) Day 3 (regional)	BHP service contracts (i.e. BGC contracting, NTC Contracting, NRW)
Shoreline equipment resupply/additional (i.e. rakes, bags, shovels, sorbents, wheelbarrows, PPE)	Perth	Day 2	BHP supply contracts. (i.e. Perth Petroleum Services)
Chevron Barrow Island nearshore boom/ shoreline equipment	Barrow Island	Day 1	Chevron Barrow Island Oil Spill arrangements

AMOSC, the DoT and Chevron (for Barrow Island) have shoreline clean-up and decontamination kits that can be utilised in the first strike capability. The gap in the amount of equipment available to be used to establish additional staging areas and to perform clean-up operations can be closed by supplying through existing supplier and logistical arrangements. The equipment can be readily obtained from hardware/industrial suppliers and delivered to Exmouth to meet the arrival time of additional responders.

Mechanical equipment to support shoreline response includes bobcats, front end loaders, bulldozers and other general civil and earthmoving equipment. This would primarily be used for transporting collected oil from the manual teams and transporting back to the staging/waste recovery area. This equipment can also be used for mechanical recovery and clean-up (where suitable). This will be sourced through arrangements with local and regional earthworks contractors initially and can be supplemented by larger earthmoving companies (i.e. NTC Contracting, NRW, BGC). Table 9-22 provides the indicative schedule for shoreline clean-up operations.

Table 9-22: Indicative schedule for shoreline clean-up operations

Activity	Day																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	On-going	TC
Mobilise BHP/ AMOSC Core Crew																		
Identify Response Location of highest priority protection based on trajectory																		
Advance party establish location																		
Mobilise equipment to response locations																		
Mobilise unskilled labour (200)																		
Remove beach debris above high tide make from priority areas																		
Commence oil recovery from priority areas																		
SCAT Team surveillance																		
Establish additional beach clean-up sectors																		
Mobilise unskilled labour from Perth																		
Key	Mobilisation					Field Activity					IMT Response					TC = until termination criteria met		

Personnel

A work force of shoreline responders supported by equipment and logistical arrangements will be required to address these potential volumes ashore.

BHP has performed an assessment of personnel needs to meet the worst-case volume ashore for the existing Pyrenees Operations Oil Pollution Emergency Plan. The assessment assumed a manual clean-up volume of 1 m^3 of oiled sediment per person a day (Owens Response Group, AMOSC) based on the industry standard to determine various effectiveness of removing the bulk oil. Actual shoreline clean-up rates will be dependent on a number of factors such as the shoreline type, distribution of the hydrocarbon on the beach, debris, method of clean-up utilised, environmental conditions (weather) and logistical arrangements.

BHP has arrangements in place with providers of a temporary contract workforce to scale up post first strike at a rate of 200 workers/day up to 500 workers as part of the sustained response, until the needs of the spill (including the worst-case volume ashore scenario) are met. BHP has arrangements in place with providers of a temporary contract workforce to scale up post first strike (described in further detail in Section 10.7).

The gap in shoreline personnel being able to collect the bulk oil coming ashore will have the environmental impact of more oil having the potential to impact wildlife or to remobilise. This impact will be minimised by focusing response efforts in areas where wildlife are most abundant or identified as known high sensitivity (refer to Table 4-10). The operational NEBA takes into account seasonal variability, which will be further informed by operational monitoring from SCAT teams. The operational NEBA will inform the IAP and assign clean-up priorities accordingly.

In summary, BHP is planning a shoreline clean-up response matched to the consequence of a worst-case volume ashore. BHP has access to shoreline clean-up equipment, trained personnel and supporting staff that are sufficient and appropriate for shoreline clean-up operations. This response strategy can be mobilised and implemented by Day 2 as part of the first strike. Up to 200 unskilled workers are available and ready to respond to first oiling associated with the minimum time to shoreline contact scenario. Shoreline clean-up operations will continue until the termination criteria for RS8 Shoreline Clean-up has been achieved.

Logistical Constraints:

The following operational constraints limit the effectiveness of shoreline clean-up:

Accommodation: Availability of accommodation is a major constraint for the response. As detailed in Section 10.6, BHP has analysed the accommodation availability and options to increase availability for responders. Whilst Exmouth (and Onslow) has the potential to house a large influx of people, there are limitations on the amount of accommodation that would be deemed immediately suitable for a shoreline workforce being required to perform manual clean-up and other physical work. BHP would work with the Shires/providers to increase the availability of current accommodation in these locations as well as the alternative options referred to in Section 10.6. A Barrow Island response will be coordinated by Chevron and will utilise in-situ accommodation.

Movement of personnel: Movement of personnel from their accommodation or transit point to the clean-up location can impact the effectiveness of the response. If the clean-up location requires a long commute the amount of effectiveness from the shoreline crews diminishes as the amount of time spent in the actual operation is reduced.

Weather: Storms may impede actual operations on the day or access to certain locations due to flooding. Shoreline crews will need to work around tidal movements on the beaches. Clean-up activities will be arranged around tidal cycles.

Access to areas requiring shoreline clean-up: There is access to coastline from Exmouth through to Yardie creek using paved roads with access tracks to most beaches. Access to the nearshore islands would be via barge or small vessel.

Shoreline Clean-up Environmental Performance

Table 9-23 provides the environmental performance outcomes, performance standards and measurement criterial for the Shoreline Clean-up response strategy.

The initiation criteria, course of action, resources, supporting documentation and termination criteria associated with each response strategy are detailed in the BHP *Crosby-3H1 Light Well Intervention Oil Pollution Emergency Plan (OPEP) (PYHSE-ER-0006)* (Appendix G).

Table 9-23: Environmental performance – Shoreline Clean-Up

RS8 Shoreline Clean-Up			
Environmental Performance Outcome	**Implementation of shoreline clean-up activities to remove stranded hydrocarbons in order to reduce impacts to sensitive shoreline receptors and facility habitat recovery.**		
Response Strategy	**Control Measure ID**	**Performance Standard**	**Measurement Criterial**
Shoreline Clean-Up	**PS RS8.1**	Shoreline Clean-up to be reviewed and managed in accordance with the IAP.	IAPs.
	PS RS8.2	Undertake a preliminary IAP and Operational NEBA within 24 hours of an incident, to inform mobilisation of shoreline clean-up response requirements.	IAPs.
			Operational NEBA.
	PS RS8.3	Implement shoreline clean-up response strategy in accordance with: • Optional shoreline protection methods of different coastal types (refer to Table 9-18 and Table 9-20);	Shoreline Assessment reports.
			Post incident monitoring reports.
			Documentation of surveys prior to deployment of

RS8 Shoreline Clean-Up			
Environmental Performance Outcome	**Implementation of shoreline clean-up activities to remove stranded hydrocarbons in order to reduce impacts to sensitive shoreline receptors and facility habitat recovery.**		
Response Strategy	**Control Measure ID**	**Performance Standard**	**Measurement Criterial**
		• North West Cape Sensitivity Mapping (AOHSE-ER-0036). For areas outside the mapping areas noted above: • Utilise the BHP GIS database and/or the DoT OSRA; and • Conduct observations/ surveys prior to deployment of equipment and personnel to develop a deployment/ operations plan, which includes avoidance of impacts to wildlife, minimisation of ground disturbance, protection of sensitive areas, and consultation with DBCA and local stakeholders.	equipment and personnel to avoid impacts to wildlife, minimisation of ground disturbance, protection of sensitive areas, and consultation with DBCA and local stakeholders.
	PS RS8.4	All necessary regulatory approvals in place prior to implementation of shoreline clean-up activities.	Correspondence logs.
	PS RS8.5	Reduce impacts to Aboriginal registered sites of cultural significance, from Shoreline Clean-up response strategy activities by not undertaking: • If Aboriginal registered sites of cultural significance are located in the immediate area without consultation with (and authority where required) the WA Department of Planning, Lands and Heritage.	Records of IAPs and field reports include review and management of heritage values.
	PS RS8.6	Mobilise First Strike Team to Exmouth or Onslow within 24 hours following notification by IMT.	Incident response reports.
	PS RS8.7	Mobilise temporary contract workforce/unskilled personnel to conduct Shoreline Clean-up response at a minimum rate of 200 personnel/day up to 500 persons to sustain response operations	Call off National Contract Panel (Hays, Chandler McLeod, One Key, Programmed, Scotford and Fennessy) via Minerals Australia. Call off direct Hays Corporate Account.
	PS RS8.8	Mobilise vessels and equipment to conduct Shoreline Clean-up response initiated by IMT following outcomes of first IAP and maintained regularly in IAP objectives.	Logs of IAPs and NEBA assessments. Shoreline Assessment reports.

RS8 Shoreline Clean-Up			
Environmental Performance Outcome	**Implementation of shoreline clean-up activities to remove stranded hydrocarbons in order to reduce impacts to sensitive shoreline receptors and facility habitat recovery.**		
Response Strategy	**Control Measure ID**	**Performance Standard**	**Measurement Criterial**
			Post incident monitoring reports.
	PS RS8.9	AMOSC and OSRL contracts and other third party agreements for provision of equipment/ supplies and assistance for shoreline clean-up in place during operations.	Records of AMOSC and OSRL contracts and other third party agreements.
	PS RS8.10	Prevent further surface water contamination by conducting all flushing clean-up activities to a contained area.	Operational plans and reports indicate deployment of booms, skimmers and/or sorbent to the area receiving the flushing wastewater.
	PS RS8.11	Implement environmental monitoring to determine the ongoing acceptability of the environmental risk associated with the application of shoreline clean-up methods.	Monitoring records document ongoing review of the environmental risk and acceptability of shoreline clean-up methods.
	PS RS8.12	No machinery to be used in mangroves. No machinery to be used within 20 m of an identified turtle nest.	Records of IAPs and field reports demonstrate no machinery used in mangroves or within 20 m of an identified turtle nest.
	PS RS8.13	Response strategy activities continued until termination criteria met.	Analysis by the SCAT team, and approved by the Incident Commander in consultation with stakeholders, has determined that continued shoreline clean-up response is not environmentally and socially beneficial to identified sensitive shorelines and shoreline receptors.

9.4.7 Spill Response: RS9 Natural Recovery

Summary of Activity

Natural recovery, as the title suggests, makes use of the natural degradation and weathering processes to breakdown and remove surface oil and stranded hydrocarbons. Effectively this response strategy means that no direct action is taken other than to monitor and evaluate the oil spill trajectory, the rate of dispersion of the diesel or crude oil, and the rate of habitat/ community recovery. As such, no additional risks or impacts will occur, other than those already described previously.

9.4.8 Spill Response: RS10 Environmental Monitoring

Summary of Activity

Post-spill environmental monitoring will be initiated for all spills to support the oil spill response strategies and to understand any effects on sensitive receptors. Monitoring programs, as described in the Oil Spill Monitoring Guidelines developed by Australian Maritime Safety Authority (AMSA, 2003), that are specific to the oil spill incident will be implemented.

BHP's environmental monitoring is optimised through the efficient implementation of robust sampling designs from the onset of a potential incident. BHP environmental monitoring procedures have been developed as a formal means of establishing the processes and procedures to ensure that BHP is capable of monitoring effects of oil spills on the marine environment that may occur during exploration, production and operational activities. They also act as a valuable tool to access the effectiveness of the response strategies and thereby feed into the on-going planning of the response strategies.

Specifically, the environmental monitoring procedures describe the work instructions for daily monitoring activities, any specifications of the analytical laboratory, such as sample handling and storage procedures, reporting of results and QA/QC procedures. They also inform the effectiveness of response strategies and feed into the on-going planning of the response strategies.

Table 9-24 provides a summary of the environmental receptors that would be monitored in the event of a spill incident on the basis of their sensitivity. It also provides the corresponding monitoring procedure that would be provided to the external consultant undertaking the work, noting that the same company may not necessarily be contracted for all monitoring scopes.

Table 9-24: Summary of environmental receptors, description of monitoring and applicable BHP monitoring procedure controlled document

Receptor	Sensitivity Ranking	Baseline Data	Impact Monitoring	Initiation Criteria	Monitoring Procedure
Water Quality	High	No	Reactive post-spill pre-impact	Level 2 and Level 3 spills	BHP *Incident Action Plan – Monitoring of Oil Hydrocarbons in Marine Waters, Sediments and Effects on Benthic Infauna* (AOHSE-ER-0037)*
Shoreline Sediment Quality (*incorporates Rocky Shorelines*)	High	No	Reactive post-spill pre-impact	Level 3 spills; (Level 2 spills if RS2 Monitor and Evaluate indicates receptor at risk of contact)	BHP *Incident Action Plan – Monitoring of Oil Hydrocarbons in Marine Waters, Sediments and Effects on Benthic Infauna* (AOHSE-ER-0037)*
Benthic Infauna (*incorporates Migratory Shorebird Habitat, Sandy Beaches, Intertidal Zone, Mixed Beaches*)	High	No	Reactive post-spill pre-impact	Level 3 spills; (Level 2 spills if RS2 Monitor and Evaluate indicates receptor at risk of contact)	BHP *Incident Action Plan – Monitoring of Oil Hydrocarbons in Marine Waters, Sediments and Effects on Benthic Infauna* (AOHSE-ER-0037)*
Avifauna	High	Yes – access to regional datasets such as Shorebird 2020	Post-spill	Level 3 spills; (Level 2 spills if RS2 Monitor and Evaluate indicates receptor at risk of contact)	BHP *Incident Action Plan –Seabirds and Migratory Shorebirds* (AOHSE-ER-0038)*
Marine Mammals (e.g. whales, dolphins, dugongs) and Megafauna (whale sharks)	High	Yes – access to industry funded programs WAMSI publicly available data	Post-spill	Level 3 spills; (Level 2 spills if RS2 Monitor and Evaluate indicates receptor at risk of contact)	BHP *Incident Action Plan – Marine mammals and Megafauna* (AOHSE-ER-0039)*
Benthic Habitats (Corals, Macroalgae and Seagrass)	High	Yes – WAMSI hyperspectral data for benthic habitat map and coral recruitment data	Post-spill	Level 3 spills; (Level 2 spills if RS2 Monitor and Evaluate indicates receptor at risk of contact)	BHP *Incident Action Plan –Benthic Habitats and Benthic Primary Producers* (AOHSE-ER-0040)*
Marine Reptiles - Turtles	High	Yes – access to community monitoring datasets, e.g. NTP	Post-spill	Level 3 spills; (Level 2 spills if RS2 Monitor and Evaluate warrants initiation of monitoring)	BHP *Incident Action Plan – Marine Reptiles* (AOHSE-ER-0043)*
Commercial and Recreational Fish Species	High	Yes – access to DPIRD data	Post-spill	Level 3 spills; (Level 2 spills if RS2 Monitor and Evaluate indicates receptor at risk of contact)	BHP *Incident Action Plan – Commercial and Recreational Fish Species* (AOHSE-ER-0048)
Fishes	High	No	Post-spill	Level 3 spills; (Level 2 spills if RS2 Monitor and Evaluate indicates receptor at risk of contact)	BHP *Incident Action Plan – Effects of an Oil Spill on Fishes* (AOHSE-ER-0051)

Post-Spill, Pre-Impact Monitoring

BHP has also funded collection of extensive baseline datasets on benthic habitats in the Ningaloo Marine Park using hyperspectral data (bottom reflectance) at 3.5 x 3.5 m pixel resolution (Kobryn *et al*., 2011). The authors of this study stated that "Globally, this data set is one of the most extensive for a coral reef system and covers over 300 km of coastline, extending seamlessly from the 20 m depth contour to 2 km inland." Overall, the majority of benthic cover in the Ningaloo Marine Park comprises macroalgal and turfing algae communities (54%), while hard and soft coral cover (>10% per pixel) represents only 7% of the mapped area (762 km^2). In terms of spatial distribution, Turquoise Bay had the largest proportion of coral cover and Gnaraloo the least (Kobryn *et al*., 2011). Mapping of coastal habitats found there was a distinct difference in vegetation cover from south to the north of the Ningaloo Marine Park, where majority of live shrubs and trees occurred in the northern section of the study area (6,556 km^2). Live shrubs and trees along the coast comprise 0.29% to 6.5% of the study area. Shrubs and trees were mostly confined to drainage channels with two small areas of mangroves identified at Mangrove Bay (Kobryn *et al*., 2011). In summary, the hyperspectral habitat mapping project demonstrates that it is possible to map coral reef and adjacent coastal habitats over large areas such as the Ningaloo Marine Park using remote sensing techniques, and provides evidence of BHP's commitment to understanding the environment in which it operates.

BHP has also partnered with the Ningaloo Turtle Program, which aims to understand long-term trends in marine turtle populations within the Ningaloo Marine Park. This is achieved through the collection of turtle nesting information, including nesting abundance and nesting success at various locations throughout the Ningaloo Marine Park. In summary, data from these partnerships would be used in baseline comparisons to measure the effects, if any, of oil spilt on sensitive receptors in the Ningaloo Marine Park.

Numerical modelling indicates that the amount of time available to undertake any meaningful post-spill pre-impact assessment, based on the worst-case scenario, is about ~2 days prior to shoreline contact of oil at the moderate exposure value of >100 g/m^2, with the deterministic simulation indicating the majority of shoreline oiling arrived at the Ningaloo Region from Day 12. On this basis, the procedure for post-spill pre-impact monitoring would follow the Type I guidelines outlined in AMSA (2003) i.e. prioritising data that can be collected quickly and inexpensively in the field and analysed later (e.g. oil, sediment and water samples). Specifically, post-spill pre-impact monitoring done under these time constraints would prioritise:

- Water Quality – Surface and water column samples (i.e. subsea which incorporates dispersed oil) to prioritise chemical parameters including total petroleum hydrocarbons (TPH and BTEX).

This would be achieved through the mobilisation of CHC helicopters to the Pyrenees Facility to collect the facility chemist for sampling water quality at high priority impact locations if the predicted spill trajectory will have shoreline contact prior to the arrival of the field sampling teams.

The development of post-spill pre-impact sampling designs will use scientific principles such as multiple control locations to allow for comparisons with any impacted locations, as well as sampling before and after the incident with replicated samples and at replicated sites to allow for robust statistical analyses and the assessment of any environmental impacts (as described by Underwood, 1997). The sampling intensity (i.e. number of replicates/sites, will depend on the nature of the oil spill and the sensitivity of the issue being assessed).

Scalability and Flexibility of Sampling Designs for Environmental Monitoring

The overarching aim of the environmental monitoring procedures will be the collection of monitoring data that allows comparisons of post-impact data with baseline data to determine oil spill response efficiency, as well as the extent and effectiveness of remediation of impacted areas. The sampling designs for the monitoring programs will provide adequate cover for situations where baseline data are out of date due to recent changes in sensitive receptors or not relevant to the event that has occurred. Pre-impact monitoring will be designed with post-impact monitoring in mind to provide data that are directly relevant and comparable to the data gathered during post-impact monitoring. In situations where limited or no baseline data are available, post-impact monitoring data will be collected following 'beyond- BACI' principles resulting in data that are amenable to statistical techniques such as asymmetrical analyses of variance following procedures described by Underwood (1994) and Glasby (1997). This type of analysis involves the comparison of the disturbed location to the average of multiple unaffected control or reference locations and is a proven and reliable technique for determination of environmental impacts. BHP would ensure modern statistical approaches were used in assessments of the effects of an oil spill on sensitive environmental receptors where historical baseline datasets were intended to be compared with post-impact data.

Effective oil spill response management will be contingent on knowledge of the distribution of sensitive receptors coupled with access to an oil spill forecast model and situational awareness (i.e. RS2 'Monitor and Evaluate') to inform sampling effort, equipment deployment and field logistics in the post-spill pre-impact period. The sampling designs and field procedures specified in the environmental monitoring procedures follow scientific principles such as multiple control locations to allow for comparisons with any impacted locations, as well as sampling before and after the incident with replicated samples and at replicated sites to allow for robust statistical analyses and the assessment of any environmental impacts (as described by Underwood, 1997). Given that these environmental monitoring procedures have been written for a disturbance that has an extremely low probability of occurrence and is unplanned, specific locations or sampling sites have not been specified in the guidelines. Rather, these would be informed by oil spill trajectory modelling (OSTM) and RS2 Monitor and Evaluate. Thus, by their nature, these sampling designs, and the resources required for their implementation, are flexible and would be scaled either upwards or downwards depending on the nature and scale of the oil spill.

Potential Environmental Impacts and Risks

Environmental monitoring will be labour intensive and involve the deployment of vessels, equipment and personnel. Environmental monitoring may also result in impacts to shoreline habitats and fauna such as damage to intertidal, shoreline and emergent features from trampling by monitoring personnel and grounding/ anchoring of monitoring vessels; and disturbance to fauna causing distress and/ or changes in behaviour.

Oil Spill Preparedness

The resource capacity and on-going scalability in the preparedness for environmental monitoring is outlined in Appendix H. BHP has contracts in place with SGS (24/7 standby arrangement for emergency response), Bennelongia and GHD Pty Ltd who maintain resources and equipment to implement the relevant environmental monitoring. Four personnel are available for immediate deployment to a spill emergency increasing to 25 people by Day 7 and reaching 60 people by Day 14 of the incident.

Environmental Monitoring Environmental Performance

Table 9-25 provides the environmental performance outcomes, performance standards and measurement criterial for the Environmental Monitoring response strategy.

The initiation criteria, course of action, resources, supporting documentation and termination criteria associated with each response strategy are detailed in the BHP *Crosby-3H1 Light Well Intervention Oil Pollution Emergency Plan (OPEP) (PYHSE-ER-0006)* (Appendix G).

Table 9-25: Environmental performance – Environmental Monitoring

<table>
<tr><th colspan="4">RS10 Environmental Monitoring</th></tr>
<tr><td>Environmental Performance Outcome</td><td colspan="3">Implement environment monitoring programs, where RS2 indicates environmental receptors at risk of contact, to support and inform spill response planning, assess the effects of spills and monitor post-spill recovery of sensitive environmental receptors contacted by a spill.</td></tr>
<tr><th>Response Strategy</th><th>Control Measure ID</th><th>Performance Standard</th><th>Measurement Criterial</th></tr>
<tr><td rowspan="11">Environmental Monitoring</td><td>PS RS10.1</td><td>Environmental Monitoring activities to be reviewed and managed in accordance with the IAP.</td><td>IAPs.</td></tr>
<tr><td rowspan="2">PS RS10.2</td><td rowspan="2">Mobilisation of vessels, equipment and personnel to conduct environmental monitoring in areas where hydrocarbons predicted to make contact with sensitive environmental receptors and where Operational NEBA identified a net environmental benefit of initiating the response strategy.</td><td>Spill modelling reports submitted and logged by IMT.</td></tr>
<tr><td>Documentation of completed Operational NEBA.</td></tr>
<tr><td>PS RS10.3</td><td>Initiate mobilisation of environmental monitoring personnel (and equipment/ vessels) to site within 24 hours of notification by Incident Commander.</td><td>Contracts/ Agreements in place for <u>all</u> pre- and post-spill environmental monitoring activities.</td></tr>
<tr><td rowspan="3">PS RS10.4</td><td rowspan="3">Spill surveillance reports and spill trajectory modelling predictions incorporated into IAP preparation process for response strategies.</td><td>IAPs.</td></tr>
<tr><td>Incident response reports.</td></tr>
<tr><td>Spill modelling reports submitted and logged by IMT.</td></tr>
<tr><td>PS RS10.5</td><td>Implementation of environmental monitoring will follow pre-designated plans for establishing work areas, as described in North West Cape Sensitivity Mapping (AOHSE-ER-0036), to protect environmental sensitivities.

For areas outside the mapping areas noted above:
Utilise the BHP GIS database and/or the DoT OSRA; and
Conduct observations/ surveys prior to deployment of equipment and personnel to develop a deployment/ operations plan, which includes avoidance of impacts to wildlife, minimisation of ground disturbance, protection of sensitive areas, and consultation with DBCA and local stakeholders.</td><td>Records of IAPs and field reports include review and management of environmental sensitivities</td></tr>
<tr><td>PS RS10.6</td><td>Vessels used to implement environmental monitoring will be fit-for-purpose and no</td><td>Contracts for use of small vessels with OSRAs.</td></tr>
</table>

RS10 Environmental Monitoring			
Environmental Performance Outcome	**Implement environment monitoring programs, where RS2 indicates environmental receptors at risk of contact, to support and inform spill response planning, assess the effects of spills and monitor post-spill recovery of sensitive environmental receptors contacted by a spill.**		
Response Strategy	**Control Measure ID**	**Performance Standard**	**Measurement Criterial**
		anchoring of vessels will occur on emergent reefs or other fragile / sensitive benthic habitats.	Daily field reports show no anchoring on sensitive habitats.
	PS RS10.7	Access to first strike environmental monitoring responders for water and sediment quality and benthic infauna via 24/7 standby contract with analytical laboratory. Access to scientific field sampling personnel.	Agreements in place with preferred environmental monitoring vendors during operations.
	PS RS10.8	Sampling operations for marine water, sediment quality and benthic infauna to follow procedures outlined in AOHSE-ER-0037 to allow determination of any environmental impacts and inform effectiveness of response strategies. Laboratory analyses will follow: • US EPA Method 8260 (volatile organic hydrocarbons); and • US EPA Method 8015 (total petroleum hydrocarbons).	Chain of custody, laboratory results and analytical technique documented. Records of independent peer review of the taxonomy of benthic invertebrates. Environmental monitoring reports containing assessments of environmental impacts.
	PS RS10.9	Sampling operations for marine mammals and megafauna, avifauna, shallow water benthic habitats, marine reptiles, commercial/ recreational fish species and mobile and site-attached fishes associated with coral reefs, seagrasses, macroalgal beds, deep-water sponge gardens and mangroves will follow procedures outlined in AOHSE-ER-0038, AOHSE-ER-0039, AOHSE-ER-0040, AOHSE-ER-0043, AOHSE-ER-0048 and AOHSE-ER-0051 to allow determination of any environmental impacts and inform effectiveness of response strategies.	Environmental monitoring reports containing assessments of environmental impacts.
	PS RS10.10	Environmental monitoring operations will avoid cultural heritage sensitivities. Consultation with (and authority where necessary) the WA Department of Planning Lands and Heritage will be required for entry to these sensitivities.	Record of IAPs and field reports include review and management of heritage values.

RS10 Environmental Monitoring			
Environmental Performance Outcome	**Implement environment monitoring programs, where RS2 indicates environmental receptors at risk of contact, to support and inform spill response planning, assess the effects of spills and monitor post-spill recovery of sensitive environmental receptors contacted by a spill.**		
Response Strategy	**Control Measure ID**	**Performance Standard**	**Measurement Criterial**
	PS RS10.11	Environmental Monitoring activities continued until termination criteria met.	Report analysis determines that Environmental Monitoring Programs have achieved their endpoint criteria, and approved by the Incident Commander in consultation with stakeholders.

9.4.9 Spill Response: RS11 Oiled Wildlife Response

Summary of Activity

Oiled wildlife response includes pre-oiling activities such as the installation of onshore exclusion barriers (e.g. fencing) to stop shorebirds and terrestrial fauna gaining access to shoreline areas affected by the hydrocarbon spill; hazing techniques, either on the water or on shorelines and may involve a combination of visual and auditory devices to shepherd fauna away from oil slicks or oiled shorelines; and pre-emptive capture and removal of fauna that may otherwise come into contact with oil if they were to stay in the area.

Post-oiling activities will include the collection and rehabilitation to treat oiled fauna at dedicated Oiled Wildlife Response Centres and once treated, to return them to similar suitable habitat.

Potential Environmental Impacts and Risks

Oiled wildlife response will require support vessels, aircraft, trained personnel and a suitable Oiled Wildlife Response Centre for the cleaning and aftercare treatment of oiled wildlife.

Potential risks and impacts from implementation of the Oiled Wildlife Response strategy include:

- Non-oiled fauna may be accidentally driven into surface oil slicks or impacted shorelines during hazing and pre-emptive capture activities resulting in increased numbers of oiled wildlife;
- During hazing and pre-emptive capture activities, oiled fauna may be accidentally driven into surface oil slicks or impacted shorelines rather than away from oil during hazing activities;
- Inappropriate equipment and capture techniques resulting in distress, fatigue, injury and/ or the separation of faunal groups (adult/juvenile pairs);
- Inadequate/ inappropriate cleaning and husbandry techniques/ conditions resulting in distress, disease and/ or injury; and
- Release of captured wildlife to inappropriate relocation areas.

The overall aim of the Oiled Wildlife Response Strategy is to mitigate the effects of oil on wildlife. Specifically, the response strategy seeks to define a system that addresses the overall aim focussing on the following key objectives:

- Respond safely and efficiently to oiled wildlife;
- Protect the health and welfare of wildlife threatened or impacted by oil;

- Co-ordinate field reconnaissance of at risk or impacted wildlife;
- Prevent or minimise exposure of wildlife to oil where possible;
- Recover oiled wildlife in a safe and effective manner;
- Prioritise the treatment of species of conservation value when resources are limited;
- Establish an effective system for the treatment and rehabilitation of oiled wildlife;
- Release wildlife back into the wild as healthy, contributing members of a population; and
- Identify and remove dead oiled wildlife from the coastal environment.

Specific wildlife permits are now required from the DBCA for activities involving the protection and treatment of wildlife during an Oiled Wildlife Response, including those listed below:

- Hazing: deterring wildlife from entering oiled sites;
- Pre-emptive capture: capturing and holding (or translocating) wildlife;
- Recovery of oiled wildlife from the environment;
- Treatment and rehabilitation of oil impacted wildlife;
- Release of rehabilitated wildlife;
- The humane euthanasia of oiled animals as necessary (under veterinary direction); and
- The retrieval of dead oiled wildlife from the marine and coastal environment.

Oil Spill Preparedness

Numerical modelling indicates the area most likely to be impacted by an oil spill is the region around North West Cape. BHP's response strategy covers a broader region north and south of this area where oiled wildlife may occur. The need is to have capacity to mobilise a response to oiled wildlife from Day 1 ready to receive first casualties. The capacity for the OWR will be sustained until the termination criteria for RS11 Oiled Wildlife Response (refer to OPEP Section 4) is achieved. Populations of wildlife that occur in the area are variable. BHP is planning to respond to the highest level (Level 6) OWR response, as defined in Table 6 of the Western Australia Oiled Wildlife Response Plan (WAOWRP), but will continue to increase resources beyond this level if the spill demands more facilities and personnel to treat oiled wildlife.

The environmental benefit of the Oiled Wildlife Response Strategy is the humane treatment of oiled wildlife through mitigation of impacts from oil. The priority areas for wildlife protection include Ningaloo Marine Park World Heritage listed area, turtle nesting locations and migratory shorebird habitats. Should a spill occur during turtle nesting season and / or the migratory shorebird season (September to April) priority will be given to resourcing oiled wildlife response at these areas. BHP recognises wildlife abundance varies with differing shoreline types, and consequently, SCAT teams will cover the shorelines across the whole impact area and not just those in the high priority areas.

Response Arrangements

The level of OWR planning used as a reference for the Pyrenees operations personnel numbers and equipment requirements is Level 6, as defined in Table 9-26.

Table 9-26: Oiled wildlife response planning level

OWR level	Duration of OWR	Birds general	Birds OWR complex #	Turtles - hatchlings / juveniles / adults	Dolphins / Whales	Pinnipeds	Mammals terristrial	Reptiles	Dugongs
Level 1	<3 days	1-2 birds per day or < 5 total	No complex birds	None	None	None	None	None	None
Level 2	4-14 days	1-5 birds per day or <20 total	No complex birds	< 20 hatchlings no Juveniles or adults	None	None	None	None	None
Level 3	4-14 days	5-10 birds per day or < 50 total	1-5 birds per day or <10 total	< 5 juv/adults, < 50 hatchlings	None	< 5 seals	< 5	< 5 - no crocodiles	None
Level 4	>14 days	5-10 birds per day or < 200 total	5-10 birds p/day	< 20 juv/adults < 500 hatchlings	< 5 or known habitats affected	5-50 seals	5-50 mammals	5-50 reptiles	Dugong habitat affected only
Level 5	>14 days	10-100 birds per day or > 200 total	10-50 birds per day	>20 juv/adults, > 500 hatchlings	>5 dolphins	> 50 seals	> 50 mammals	>50 reptiles	Dugongs oiled
Level 6	>14 days	>100 birds for day	10-50 birds per day	>20 juv/adults, > 500 hatchlings	>5 dolphins	> 50 seals	> 50 mammals	>50 reptiles	Dugongs oiled
# Threatened species, protected by treaty, or specialist feeders									

Source: WAOWRP V1.1 (2014)

Equipment

Site selection of OWR facilities would be prioritised at Exmouth / Onslow, which covers the likely region of expected oiled wildlife. Initially, BHP would mobilise and construct 1 x OWR Washing and Rehabilitation Facility capable of treating 500 oiled wildlife units. AMOSC are the custodians of OWR equipment in Australia and can provide the OWR capabilities as detailed in Table 9-27. The need for additional OWR Washing and Rehabilitation facilities would be determined from:

- Monitoring the load of the oiled wildlife in the facility;
- SCAT reports for locations and numbers of oiled wildlife in the field; and
- SCAT reports using predictions from the OSTM that may impact unaffected populations.

At 75% capacity of the OWR facility, or based on the need from SCAT reports, BHP would commence mobilisation of resources and construction of another OWR Facility.

A list of suppliers of oiled wildlife response equipment, and contractors in WA, is provided in Appendix G and Appendix K of the Pilbara Region Oiled Wildlife Response Plan (PROWRP). Through its arrangements with AMOSC, BHP has access to equipment sufficient to construct 2 x OWR Washing and Rehabilitation facilities to treat 1,000 oiled wildlife units. This includes contracts with vendors to construct the facility. If the spill demanded a larger oiled wildlife response, additional response equipment would be purchased in an ongoing basis from suppliers/contractors, as detailed in the Appendices of the PROWRP.

BHP Materials and Logistics team has evaluated the list of equipment / suppliers and the potential for long lead items. Any gaps in the equipment requirements to meet the needs of the oiled wildlife response, whatever level it may be, will be filled by the ongoing procurement of oiled wildlife equipment using the lists and suppliers identified above, and/or sourcing more equipment from international response agencies including OSRL, if equipment within Australia was exhausted.

The reliability and effectiveness of BHP's oiled wildlife response equipment is considered to be matched to the level of consequence of the spill. Table 9-28 provides an indicative schedule of oiled wildlife response arrangements.

Table 9-27: Oiled wildlife response equipment, from PROWRP

Resource	Location	Provider / Owner	Units	Deployment	Capacity
OWR Kit	Exmouth, Karratha, Dampier, Barrow Is., Broome, Fremantle	AMOSC, AMSA, DBCA, Chevron (Mutual Aid)	10	Within 24 hrs of incident notification	1 unit caters for approximately 100 wildlife units
OWR (20 ft.) Container	Geelong, Fremantle	AMOSC	2	Within 24 hrs of incident notification	Approx. 500 wildlife units
OWR Container	Dampier	AMSA	1	Activated at short notice of National Plan oiled wildlife equipment through DoT.	Approx. 500 wildlife units

Table 9-28: Indicative schedule of oiled wildlife response arrangements

Activity	Day															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	On-going	TC
Notify AMOSC / DBCA / AMSA																
Mobilise AMOSC (x2) OWR containerised washing and rehabilitation facilities and trained OWR resources																
Mobilise AMOSC, Mutual Aid and National Plan Oiled Fauna Kits, first strike kits and trained OWR resources																
BHP GIS Team to advise on the location of any aboriginal registered sites of cultural significance																
Operational NEBA to identify environmental sensitivities for preferred OWR site and staging areas																
Operational NEBA to identify environmental sensitivities and locations of ongoing oiled wildlife surveys, incorporated into IAP, ongoing throughout response																
Mobilise unskilled labour																
Mobilise vets, wildlife carers, wildlife rehabilitation resources																
First strike OWR kits operational																
Commence construction of the OWR Washing and Rehabilitation facility #1 as per details in WAOWRP and PROWRP.																
OWR Wash and Rehabilitation facility #1 operational and ready to receive oiled wildlife																
Oiled wildlife recovery teams deployed to assigned shoreline segments for wildlife reconnaissance, as described in the IAP																
Evaluate capacity of OWR facility and determine needs for more personnel / equipment / additional OWR facility																
Mobilise additional support (Sea Alarm, OSRL etc.) as necessary																
Commence construction of OWR Washing and Rehabilitation facility #2 as per details in WAOWRP and PROWRP.																
Mobilise AMSA OWR container																
Commence training courses for specialist roles in OWR Organisation Structure, ongoing throughout response																
OWR facility #2 operational																
Key	Mobilisation				Field / office activity				Equipment standby					TC = termination criteria met		

Personnel

Implementation of the OWR by BHP would involve mobilisation of trained personnel from the AMOSC Core Group using response plans as described in the WAOWRP and PROWRP arrangements. Resources from the DBCA pool of trained personnel would also be requested. Table 9-29 summarises the roles and resource capacity required to establish an OWR Washing and Rehabilitation facility. BHP has access to additional resources capable of covering these roles, providing scalability to establish and resource 2 x OWR Wash and Rehabilitation Facilities capable of treating up to 1,000 oiled wildlife units, if needed.

Table 9-29: Resources required for OWF washing and rehabilitation facility

Training Level	Response Function	Roles	OWR Facility 1	OWR Facility 2	Source
OWR Skill Level 4	Wildlife Advisors	Wildlife Advisors	2	4	AMOSC OWR Core Group/ DBCA
	Wildlife Resource Coordinators	Wildlife Resource Coordinators			
	Wildlife Field Coordinator	Wildlife Field Coordinator, Deputy Field Coordinator			
OWR Skill Level 3	Functional Unit Supervisors	Planning Officers, Logistics Officer, Finance/Admin Officer, Operations Officer	4	8	AMOSC OWR Core Group/ DBCA
OWR Skill Level 2	Division Leaders	Reconnaissance; Field Rescue Staging Area; Facilities, Rehabilitation Coordinators, Communications officer	18	36	AMOSC OWR Core Group/ DBCA
OWR Skill Level 1	Responders	Drying/washing team; Rescue/collection team; Rehabilitation team; Intake team; Transport Team	90	180	Unskilled labour hire (e.g. BHP contracted resource provider)
	Vets	Vets, Carers, Rehabilitation	4	4-8	Local / WA
	Other specified skills		4		External resources to be confirmed
TOTAL			**122**	**236**	

Source: WAOWRP V1.1; 18/08/2014

A gap in the ability to sustain the oiled wildlife response is access to trained specialists, e.g. vets, and oiled wildlife responders. To fill the gap in trained specialists, veterinarians across the region, State and within Australia would be sourced (Table 9-30). An example of the vets available in the region and WA is provided in the table below. Wildlife specialists from across Australia would be sourced if the spill demanded a large personnel response. Similarly, gaps in the trained personnel numbers would be filled from either:

- International skilled resources and including OSRL and Sea Alarm;
- Initiation of training courses in Perth to upskill responders prior to mobilisation to site (2 days); and
- For the unskilled labour, training has been included in the mobilisation schedule.

The reliability and effectiveness of the oiled wildlife responders is considered to be matched to the level of consequence of the spill.

Table 9-30: List of resources for oiled wildlife response

Service Provider	OWR Capacity
Unskilled / voluntary labour	No – to be trained
AMOSC Core Group (OWR)	Yes
DBCA	
OSRL	Yes
Sea Alarm	Yes
Karratha Vet Hospital	Yes
Karratha Mobile Vet	Yes
Exmouth Cape Vets	Yes
Wildlife Rehabilitation Chelonia Broome	Yes
Pilbara Wildlife Carers	Yes
Murdoch Vet Hospital Perth	Yes
Kimberley Wildlife Rehabilitation (Vet Centre and Rescue Kununurra)	Yes

Source: PROWRP V1.1 (2014)

A key risk for the oiled wildlife response is that fauna will be affected by inappropriate handling, treatment or transport. This has been addressed by the development of the WAOWRP and the regional PROWRP plans written jointly by AMOSC and the DBCA who are subject matter experts on handling of injured wildlife, ensuring that industry has response plans that are based on the latest and most up-to-date scientific knowledge. BHP will access trained personnel who will be leading the response and specialist equipment through its existing agreement with AMOSC. These controls will minimise the risk of inappropriate methods or equipment being used in the response. The proposed controls for the oiled wildlife response strategy will mitigate the potential environmental impacts of implementing this response strategy ensuring the environmental benefits of the strategy outweigh impacts associated with its implementation or, conversely, non-implementation.

Oiled Wildlife Response Logistical Considerations

AMSA/DoT will be notified immediately in all instances where injured wildlife is found. AMSA/DoT will advise the response actions required.

A survey for possible sites to establish an oiled wildlife response operation on the Exmouth Peninsula has identified the disused Horizon Energy Station as a potential location for locating the Oiled Wildlife Rehabilitation Centre for a spill impacting the Exmouth Peninsula (OPEP Section 4). Upon retrieval from shoreline, the affected animals would be transported by road to Exmouth for rehabilitation. Animals collected from marine environment shall be collected at the Marine Staging Areas at Tantabiddi Boat ramp and/or Exmouth Harbour and transported to Exmouth for rehabilitation (OPEP Section 4).

Depending on the scale oiled wildlife response, additional equipment and resources can be obtained through OSRL and Sea Alarm, which provide:

- 24/7 readiness to assist Members worldwide;
- Mobilisation procedures for wildlife response assistance;
- Maintaining wildlife response equipment for the different OSRL bases;
- Mobilisation procedures for the wildlife equipment;
- Advice and assistance with managing oiled wildlife response incidents;
- Assist with finding qualified wildlife responders that can be contracted by OSRL members to respond to a particular wildlife incident;

- Assist with the integration of the contracted wildlife responders into the response; and
- Develop awareness and preparedness amongst wildlife response organisations in relation to assistance of OSRL Members.

Sea Alarm is widely recognised as an independent and impartial facilitator and is able to bridge gaps between industry, governments and NGOs during and between oil spill incidents.

In summary, mobilisation, construction and implementation of the BHP OWR strategy with specialist equipment and trained resources are sufficient, timely and appropriate for the mitigation of potential impacts to oiled wildlife and match the consequences of a worst-case spill because:

- The response will be based on WA State (DBCA) approved plans;
- OWR Wash and Rehabilitation facilities can be built and mobilised in a timely manner, e.g. immediate access to First Strike OWR kits (10 kits each capable of treating 100 units) with the main OWR facility operational and ready to receive oiled wildlife by Day 5, with sufficient equipment surplus to initial requirements to construct a second facility being mobilised early in response and available onsite, if needed; and
- Response strategies detailed within the WA State (DBCA) approved plans will be implemented by trained specialists and oiled wildlife responders using appropriate equipment.

Oiled Wildlife Response Environmental Performance

Table 9-31 provides the environmental performance outcomes, performance standards and measurement criterial for the Oiled Wildlife Response strategy.

The initiation criteria, course of action, resources, supporting documentation and termination criteria associated with each response strategy are detailed in the BHP *Crosby-3H1 Light Well Intervention Oil Pollution Emergency Plan (OEPE) (PYHSE-ER-0006)* (Appendix G).

Table 9-31: Environmental performance – Oiled Wildlife Response

RS11 Source Control – Oiled Wildlife Response			
Environmental Performance Outcome	**Implement oiled wildlife response in accordance with the Western Australian Oiled Wildlife Response Plan (WAOWRP) and Pilbara Region Oiled Wildlife Response Plan (PROWRP) to protect or reduce impacts to marine fauna during a spill event by removal and relocation or treatment and release.**		
Response Strategy	**Control Measure ID**	**Performance Standard**	**Measurement Criterial**
Oiled Wildlife Response	**PS RS11.1**	Oiled Wildlife Response operations to be managed in accordance with the IAP.	IAPs.
	PS RS11.2	Mobilisation of vessels to conduct Oiled Wildlife Response in areas where surface oil predicted to travel and make contact with sensitive environmental receptors and where Operational NEBA identified a net environmental benefit of initiating the response strategy.	Spill modelling reports submitted and logged by IMT.
			Documentation of completed Operational NEBA.
	PS RS11.3	Lead response personnel are trained and experienced for the activities to which they are assigned.	Training records.
	PS RS11.4	Mobilisation of containerised oiled wildlife wash facility (via AMOSC contract) within 24 h of notification by Incident Commander.	Contract with AMOSC for mobilisation to Exmouth and access to equipment.

RS11 Source Control – Oiled Wildlife Response			
Environmental Performance Outcome	**Implement oiled wildlife response in accordance with the Western Australian Oiled Wildlife Response Plan (WAOWRP) and Pilbara Region Oiled Wildlife Response Plan (PROWRP) to protect or reduce impacts to marine fauna during a spill event by removal and relocation or treatment and release.**		
Response Strategy	**Control Measure ID**	**Performance Standard**	**Measurement Criterial**
	PS RS11.5	Initiate mobilisation of national and international oil spill responders within 24 h of notification by Incident Commander.	Contract/ Agreement in place for first responder oiled wildlife personnel available for mobilisation to Exmouth.
	PS RS11.6	Capacity to respond to oiled wildlife will be in place within 72 h of arrival to site of oiled wildlife response resources.	Records of IAP conducted for the period of response incorporating Oiled Wildlife Response.
	PS RS11.7	Prior confirmation that Oiled Wildlife Response Centre has capacity to receive and treat oiled fauna.	Oiled Wildlife Response Centre communication log.
	PS RS11.8	Activation and implementation of oiled wildlife response will follow pre-designated plans for establishing works areas, as described in Western Australian Oiled Wildlife Response plan (WAOWRP); and Pilbara Region Oiled Wildlife Response Plan (PROWRP).	Oiled wildlife logs demonstrate that the WAOWRP and PROWRP processes and procedures have been followed.
	PS RS11.9	Response strategy activities continued until termination criteria met.	Incident response reports from RS2 Monitor and Evaluate activities and observation logs detail surface oil slick has been broken up to extent that continuation of the operations is no longer considered to be effective and / or surface oil slick is no longer deemed a potential threat to sensitive environmental receptors.
	PS RS11.10	Oiled wildlife operations will avoid cultural heritage sensitivities. Consultation with (and authority where necessary) the WA Department of Planning, Lands and Heritage will be required for entry to these sensitivities.	Records of IAPs and field reports include review and management of heritage values.
	PS RS11.11	Oiled wildlife response capability to be maintained for the duration of the response and rehabilitation.	Records of animals relocated, treated, released and deceased.

9.4.10 Spill Response: RS12 Forward Command Post

Summary of Activity

Constant monitoring and evaluation by people on-location is a mandatory strategy required for real-time decision-making during a spill event. The objective of this response strategy is to assist the IMT in planning the oil spill response activities in the spill zone by assisting in the development of incident action plans, oversee field operations, manage rosters and provide situational briefings/debriefings. Personnel within the forward command post will also maintain liaison with local emergency service organisations, industry, and other government departments active in the spill zone. The forward command post will be established at Harold E Holt Naval Communications Base or the Exmouth SES Offices, or another appropriate building.

Potential Environmental Impacts and Risks

There are no relevant environmental risks and impacts associated with mobilising BHP employees and third party contractors to Exmouth to establish a Forward Command post outside of standard BHP HSE requirements.

Forward Command Post Environmental Performance

Table 9-32 provides the environmental performance outcomes, performance standards and measurement criterial for the Forward Command Post response strategy.

The initiation criteria, course of action, resources, supporting documentation and termination criteria associated with each response strategy are detailed in the BHP *Crosby-3H1 Light Well Intervention Oil Pollution Emergency Plan (OPEP) (PYHSE-ER-0006)* (Appendix G).

Table 9-32: Environmental performance – Forward Command Post

RS12 Forward Command Post			
Environmental Performance Outcome	**Forward command post will be maintained to prevent environmental impact to sensitive environmental receptors.**		
Response Strategy	**Control Measure ID**	**Performance Standard**	**Measurement Criterial**
Forward Command Post	**PS RS12.1**	Mobilise BHP personnel, third party contractors mobilised to Exmouth or Onslow within 24 hours of notification by the BHP Incident Commander.	IMT communication logs demonstrate mobilisation to site within 24 hours of notification by the BHP Incident Commander.
	PS RS12.2	Maintain capability to monitor spill location and coordinate response activities on the ground via location of key personnel at the forward command post for the duration of the oil spill response.	IMT communication logs demonstrate that forward command post has been maintained for the duration of the oil spill response.

9.4.11 Spill Response: RS13 Waste Management

Summary of Activity

In the event that shoreline contact was made and as part of Shoreline Clean-up, BHP will use Veolia (North West Waste Alliance) who are capable of collection, transport, treatment and disposal of oil wastes generated by a large scale emergency response situation.

Potential Environmental Impacts and Risks

During an oil spill clean-up, the disposal of waste material must not pose any threat to the health and safety of people or the environment, and must be carried out in accordance with relevant state legislation. The type and amount of waste generated will depend on the spill itself and its location. It is important to note that the volumes of oily waste recovered from shorelines may be significantly greater than the volume of oil spilled. Typical waste volumes generated will be influenced by a bulking factor of:

- For offshore recovery there is a 1:10 increase in waste volume generation due to water being collected with the oil and emulsification occurring; and
- For shoreline clean-up there is a 1:10 increase of waste volume generation due to collection of sand and detritus from the high water mark and surrounding environment.

Table 9-33 identifies the types of waste likely to be generated from a spill from the operations.

Table 9-33: Response strategies and their effect on waste generation

Response Strategy	Effect on Waste Stream	Type of Waste Generated
Dispersant Application	Waste concentrations are minimal as the oil is suspended in the water column and allowed to biodegrade naturally.	• No hydrocarbon waste is generated • Personal protective equipment (PPE) • Empty dispersant drums/ considerations
At Sea Response Operations	Recovery operations will potentially give rise to a large quantity of waste oil and water for treatment. The volume of the storage systems available must be consistent with the recovery capacity of the skimmers. The type of oil spilled will have an effect on the resultant waste; viscous and waxy oils in particular will entrain debris and can create large volumes of waste. They can also present severe handling difficulties.	• Oiled equipment/vessels • Oiled PPE and workforce • Recovered oil • Oily water • Oiled vegetation • Oiled sorbent materials • Oiled flotsam and jetsam • Animal carcasses
Shoreline Clean-up	The type of spilled oil will often have a profound effect on the amount of oily waste generated. Waste segregation and minimisation techniques are critical to ensure an efficient operation. These should be established at the initial recovery site and maintained right through to the final disposal site otherwise waste volumes will spiral out of control. Waste sites should be managed in such a way as to prevent secondary pollution.	• Oiled equipment/vessels • Oiled PPE and workforce • Recovered oil • Oiled vegetation • Oily water • Oiled sorbent materials • Oiled beach material, sand • Oiled flotsam and jetsam • Animal carcasses • Oiled transport

For any spill likely to produce significant amounts of waste, a Waste Management Plan will be developed to ensure that:

- Oily waste is properly handled and stored;
- Oil and oily debris is adequately segregated, treated and stored at the point of collection;
- Oil and oily debris is rapidly collected and taken to designated sites for storage, treatment or disposal; and
- Treatment or disposal practices ensure that the waste poses no future threat to the environment.

In addition, the Waste Management Plan will identify how waste volumes will be minimised (Table 9-34).

Table 9-34: Waste management hierarchy

Waste Management Hierarchy	
Reduction	Efficient response strategies selected for oil spill clean-up to ensure that the minimum material is used and/or contaminated during the process.
Reuse	This is the reuse of an item for its original purpose, i.e. clean-up equipment should be cleaned and reused in place of disposable items. An example might be the cleaning of PPE so that it can be reused.
Recovery	This is the production of marketable product for waste, e.g. taking waste oil to a refinery for conversion into other useable products. This will be directly affected by the quality of the recovered product, i.e. highly contaminated material is less likely to be suitable for recycling.
Refuse	Refuse is the final and least desirable option. If none of the above methods can be carried out for whatever reasons the waste must be disposed of effectively though some means. This may be the case for highly mixed wastes of oils, plastics, organic debris, water, sediments etc. which cannot be separated.

The basis for such a Waste Management Plan will include a demonstration of:

- Temporary on-site waste storage:
  - Care will be taken in the selecting a location for a temporary waste handling base to allow for waste separation. Local authorities and waste management contractors will be consulted regarding the selection of suitable disposal routes, local regulations and may provide local facilities.
- Segregation of waste:
  - Wherever possible, wastes will be segregated in accordance with the preferred segregation. It may be required to separate oil from associated water, sediment and debris, in order to minimise volumes. It is preferable that this is not attempted on the spill site.
- Onsite handling:
  - Attention will be given to the prevention of leaching or spillage of oil from vehicles or containers. Onsite handling equipment is available via MAC, Dampier Port Authority, DoT OSRC, AMOSC or AMSA.
- Offsite transport and storage:
  - Only State licensed waste contractors will be used. Care will be taken that all vessels, vehicles, or containers used for the transport of oily wastes are effectively sealed and leak-proof.
- Waste treatment and disposal options:
  - The disposal method most appropriate in an incident will depend on several factors, including the nature and consistency of the waste, the availability of suitable sites and facilities, the costs involved, as well as regulatory restrictions.
- Waste separation:
  - Waste separation is usually undertaken offsite at a designated waste processing area.

- Disposal:
  - Waste must be disposed of in accordance with WA regulations.
- Establishing a field decontamination facility:
  - The size and complexity of field decontamination facilities required will depend on the character of the oil and on the scale and nature of the clean-up being implemented.

Monitoring and Reporting of Waste

The Onshore Materials Logistics Co-ordinator will be responsible for maintaining a Waste Management Register for all waste generated from the shoreline response strategy. The designated Waste Contractor will monitor measure and record all waste streams that are disposed of onshore.

Measurement as required by Waste Contractor Conditions, including without limitation:

- Types of waste collected (e.g. liquid oily waste);
- Quantities of types of wastes collected (e.g. tonnes, litre);
- Destination of waste collated (named authorised disposal facility);
- Method of waste disposal (e.g. landfill, recycling); and
- Quantity of recyclable waste by type.

The Materials and Logistics Supervisor shall ensure that adequate waste disposal records are being maintained by the Waste Contractor, and that the Waste Reference Number for all waste is communicated to the Onshore Materials Logistics Coordinator for updating the Waste Management Register once waste is disposed.

Waste management reporting will be in compliance with the following reporting requirements:

- Environmental Protection (Controlled Waste) Regulations 2004;
- BHP Our Requirements HSEC Reporting;
- National Pollutant Inventory annual reporting of emissions and discharges relating to resource consumption e.g. waste effluent; and
- In addition to reporting all waste generated from a spill event, it will also be tracked upon mobilisation of the waste contractor using the Controlled Waste Tracking System (CWTS). This is an online user system provided by DBCA to enable the electronic tracking of controlled waste loads across the State. Upon request DBCA generates user profiles that enable access to components of the CWTS that are specific to waste generators, carriers and/or waste disposal sites (treatment plants) and enable them to complete their statutory obligations online.

Oil Spill Preparedness

Veolia (North West Waste Alliance) have provided an Emergency Response capability statement which outlines its capabilities and capacity to deal with an oil spill scenario from BHP activities. BHP has arrangements in place with Veolia (North West Waste Alliance) for the provision of waste management services during a spill incident.

Veolia have performed and continue to perform a variety of emergency response tasks involving a wide range of hazardous materials. Hydrocarbon spills comprise the majority of emergency response tasks, and Veolia have a wealth of experience in this area. In addition to a range of waste bin collection vehicles and trailer and tanker transport, Veolia operate a fleet of vacuum loading heavy vehicles, with capacities ranging from 3,000 to 25,000 L.

Based on the road travel time from Karratha to Exmouth of approximately 7 hours, it is reasonable to state that Veolia will be able to provide BHP with waste storage and transport of waste facilities within 24 hours of mobilisation.

Veolia has a combined North West team of >150, team members state wide, national fleet of over 2,000 specialised vehicles and workforce of more than 3,500. The Veolia mobilisation and shutdown team is able to deliver crews of up to 100 operators anywhere in the country within 72 hours of call out and 24/7 access to a global technical team. Veolia also undertake treatment and disposal services for oil wastes.

Waste Management Environmental Performance

Table 9-35 provides the environmental performance outcomes, performance standards and measurement criterial for the Waste Management response strategy.

The initiation criteria, course of action, resources, supporting documentation and termination criteria associated with each response strategy are detailed in the BHP *Crosby-3H1 Light Well Intervention Oil Pollution Emergency Plan (OPEP) (PYHSE-ER-0006)* (Appendix G).

Table 9-35: Environmental performance – Waste Management

RS13 Waste Management			
Environmental Performance Outcome	**Prevent impacts to sensitive shorelines, shoreline receptors and sites of cultural heritage through the implementation of waste management that complies with waste treatment, transport and disposal regulations and in accordance with waste management hierarchy.**		
Response Strategy	**Control Measure ID**	**Performance Standard**	**Measurement Criterial**
Waste Management	**PS RS13.1**	Waste management to be reviewed and managed in accordance with the IAP.	IAPs.
	PS RS13.2	Undertake a preliminary IAP and Operational NEBA within 24 hours of an incident, to inform mobilisation of waste management response requirements. Mobilisation of equipment and personnel to conduct Waste Management response within 24 hours of notification by IMT following outcomes of first IAP and maintained regularly in IAP outcomes.	IAPs. Operational NEBA.
	PS RS13.3	Contracts and other third party agreements for provision of equipment/ supplies and assistance for waste management in place during operations.	Logs of IAPs and NEBA assessments.
	PS RS13.4	Crude oil waste retrieved to be managed in accordance with the Waste Management Plan. Implement environmental monitoring to determine the ongoing acceptability of the environmental risk associated with waste management methods. Waste management operations will avoid cultural heritage sensitivities. Consultation with (and authority where necessary) the WA Department of Planning, Lands and Heritage will be required for entry to these sensitivities.	Records of contracts and other third party agreements in place during operations.

RS13 Waste Management			
Environmental Performance Outcome	**Prevent impacts to sensitive shorelines, shoreline receptors and sites of cultural heritage through the implementation of waste management that complies with waste treatment, transport and disposal regulations and in accordance with waste management hierarchy.**		
Response Strategy	**Control Measure ID**	**Performance Standard**	**Measurement Criterial**
	PS RS13.5	Response strategy activities continued until termination criteria met.	Waste records/ manifests.
	PS RS13.6	Waste management to be reviewed and managed in accordance with the IAP. Undertake a preliminary IAP and Operational NEBA within 24 hours of an incident, to inform mobilisation of waste management response requirements.	Monitoring records document ongoing review of the environmental risk and acceptability of waste management.
	PS RS13.7	Mobilisation of equipment and personnel to conduct Waste Management response within 24 hours of notification by IMT following outcomes of first IAP and maintained regularly in IAP outcomes.	Records of IAPs and field reports include review and management of heritage values.
	PS RS13.8	Contracts and other third party agreements for provision of equipment/ supplies and assistance for waste management in place during operations.	Analysis by the SCAT team, and approved by the Incident Commander in consultation with stakeholders, has determined that continued waste management is not environmentally and socially beneficial to identified sensitive shorelines and shoreline receptors.

9.5 Hydrocarbon Spill Response ALARP Assessment

9.5.1 Demonstration of ALARP

In considering the approach to demonstrate ALARP for an emergency event, the focus is upon examining ways in which it is possible to mitigate the consequences of the event and in particular what is reasonable to have in place in terms of preparedness for a spill. In the case of demonstrating ALARP for oil spill response, it is necessary to define the objective for which ALARP option will be evaluated.

This section provides detailed ALARP assessment of the adequacy of resourcing available to support the identified suitable response spill strategies listed in previous Table 9-2. In developing the performance standards that apply to each Response Strategy, BHP has considered the level of performance that is reasonable to achieve for each control measures and the ‘effectiveness’ of the control measures.

The effectiveness of the control measures is assessed considering the following criteria and follows the definitions in NOPSEMA’s Control Measures and Performance Standards Guidance Note (NOPSEMA, 2012), with ranking provided in Table 9-36:

- Availability: the status of availability to BHP;

- Functionality: a measure of functional performance;
- Reliability: the probability that the control will function correctly;
- Survivability: the potential of the control measure to survive an incident;
- Independence / Compatibility: the degree of reliance on other systems and/ or controls, in order to perform its function.

Table 9-36: Evaluation criteria for ranking effectiveness

Evaluation Criteria	Effectiveness Ranking	
	Low	**High**
Availability	BHP does not have equipment/ resources on standby, or contracts, arrangements, and/ or MoU's in place for the provision of equipment/ resources. BHP has internal processes and procedures in place to expedite timely provision of equipment/ resources.	BHP has equipment/ resources on standby, and/ or contracts, arrangements, or MoU's in place for the provision of equipment/ resources.
Functionality	Implementation of the control measure does not greatly reduce the risk/ impact.	Implementation of the control measure has material difference in reducing the risk/ impact.
Reliability	The control measure is not reliable (e.g. has not been tried and tested in Australian waters) and/ or low assurance can be given to its success rate / effectiveness.	The control measure is reliable (e.g. has been tried and tested in Australian waters) and / or high assurance can be given to its success rate / effectiveness.
Survivability	Control measure has a low operating timeframe and will need to be replaced regularly throughout its operation period in order to maintain its effectiveness.	Control measure has a high operating timeframe and will not need to be replaced regularly throughout its operation period in order to maintain its effectiveness.
Independence/ Compatibility	Control measure is reliant on other control measures being in place and / or the control measure is not compatible with other control measures in place.	Control measure is not dependent on other control measures being in place and / or control measure can be implemented in unison with other control measures.

Each control was then evaluated taking into consideration the environmental benefit gained from implementation compared with its practicability (i.e. control effectiveness, cost, response capacity and implementation time) to determine if the control was either:

- Accept and implement; or
- Reject.

This traffic light system is used in the ALARP demonstration tables where the 'do nothing' option is rejected, along with a Scalable Option that generally involves mobilising spill response resources and equipment to site and on standby either alongside the Pyrenees Facility, or located in Dampier or Exmouth. Accepted controls in all the ALARP demonstration tables indicate those that would be implemented as part of the response.

Appendix H provides BHP's ALARP assessment for resourcing for spill response strategies.

ALARP Summary

The Operational NEBA is the primary tool used during spill response to select spill response strategies that have the least net impact to environmental strategies and an overall net environmental benefit. The NEBA response strategy evaluation process is a decision support tool that is used as a spill occurs to aid interpretation of spill response activities, particularly where both positive and negative impacts have the potential to arise then the sensitivity with the higher prior becomes the preferred response option. For spill response under the control of BHP, the IMT apply the Operational NEBA process to identify the response options that are preferred for the situation oil type and behaviour, environmental conditions, direction of plume and protection priority of sensitive receptors.

This will ensure that at the strategy level, the response operations reduce additional environmental impacts to ALARP. Spill response activities will be conducted in offshore and coastal waters using vessels and aircraft. The greatest potential for additional impacts from implementing spill response is considered to be to wildlife in offshore waters from oiled wildlife response activities, and to shoreline habitats and fauna receptors within shallow waters or on shorelines from shoreline clean-up activities.

Given the types of activities considered appropriate to responding to a worse-case spill and the scale of operations, standard control measures adopted by BHP for spill response to reduce the level of additional impacts are considered to reduce these impacts to ALARP. This includes working with the relevant Control Agency for spill response and applying the process and standards e.g. for oiled wildlife response as included within the WA Oiled Wildlife Response Plan.

A detailed ALARP evaluation was undertaken by BHP to determine what additional control measures could be implemented to reduce the level of impacts and risks. No additional controls, beyond those identified during the detailed ALARP assessment can reasonably be implemented to further reduce the risk of impacts. It is considered therefore that the impacts and risks of the spill response activities are reduced to ALARP.

9.5.2 Demonstration of Acceptability

BHP considers a range of factors when determining that a level of impact and risk to the environment is broadly acceptable, as summarised in Table 9-37.

Table 9-37: Demonstration of acceptability for spill response strategies

Acceptability Criteria	Acceptability Criteria	Demonstration
Codes and Standards	Is the impact or risk being managed in accordance with relevant Australian or International legislation, Ministerial Conditions or standards?	Impacts and risks associated with spill response activities are well understood through available information. Control measures implemented will minimise the potential impacts from spill responses activities to protected areas and their values, and to species identified in Recovery Plans and Conservation Advice.
Ecologically Sustainable Development (ESD)	Is the proposed impact consistent with the principles of ESD?	BHP undertakes petroleum activities in a manner that is consistent with its Charter values and Code of Business Conduct. In determining the level of acceptability of spill response activities, and guided by the Charter value of Sustainability, BHP has identified, assessed and controlled risks to minimise environmental impacts. BHP considers that this approach is consistent with the principles of ESD.
Internal Context		
BHP Charter and HSEC Management System compliance	Is the proposed impact or risk consistent with the requirements of BHP Our Requirements, Petroleum Standard and HSEC Management Systems?	Spill response will be in compliance with BHP Charter values and management systems.
Professional judgement	Is the impact or risk being managed in accordance with industry best practice?	Controls identified in this plan are consistent with industry best practice and guidelines. Accepted controls that will be implemented are provided in tables in Section 9.4 and Appendix H.
ALARP	Are there any further reasonable and practicable controls that can be implemented to further reduce the impact or risk?	All reasonable and practicable controls have been assessed (refer to tables in Section 9.4 and Appendix H). BHP considers that control measures and performance standards for spill

Acceptability Criteria	Acceptability Criteria	Demonstration
		response activities reduce the impacts and risks to ALARP.
External Context		
Environmental best practice	Are controls in place to manage the impacts and risk to the environment that are commensurate with the nature and scale of any environmental sensitivities of the receiving environment?	The environmental performance outcomes, performance standards and measurement criteria that determine whether the outcomes and standards have been achieved are commensurate with the environmental significance of the receiving environment.
Stakeholder views	Do stakeholders have concerns / issues, and if so, have controls been implemented to manage their concerns / issues?	Stakeholders have been consulted about the petroleum activity (Section 5) and no stakeholder concerns have been raised regarding this aspect. In the event of a spill, BHP will liaise with relevant regulatory bodies (e.g. DoT, DNP, DBCA, AMSA) to ensure ongoing consultation regarding spill response information.

Acceptability Summary

BHP will ensure all preventative controls are in place to reduce the risk of a hydrocarbon spill occurring during the well intervention activities and the likelihood of the loss of hydrocarbons is extremely low when considering industry statistics and the preventative controls in place. Well intervention operations are standard activities on production wells occurring elsewhere in Australian waters and in particular on the North West Shelf. BHP has undertaken extensive planning and assessment in the selection of the spill response options presented based on:

- the nature and scale of the worst-case hydrocarbon pollution events;
- the accessibility, the availability and the location of appropriate spill response equipment; and
- the predicted timings of contact of hydrocarbons and loadings of hydrocarbons to sensitive environmental receptors, and the capability and scalability of spill response resources.

BHP has a sound knowledge of the relevant environmental values and sensitivities at risk from hydrocarbon spill events and indirectly from spill response activities in particular of the shallow water and coastal benthic habitats of Ningaloo Reef and Muiron Islands from work in part-funded by BHP.

BHP has assessed the spatial and temporal impacts and risks and environmental benefit gained from the implementation of spill response activities, which would be considered on a daily basis as part of the Operational NEBA. The decision to implement spill response activities will be made by the BHP Incident Commander taking into account the outcomes of the daily Operational NEBA, which will incorporate daily situational awareness reports from the RS2 Monitor and Evaluate response strategy, as well through liaison with other OSR HMA such as the DoT OSRC.

The proposed control measures for preventing and minimising the risks and impacts associated with implementation of spill response activities are comprehensive and consistent with all relevant codes and standards and good oilfield practices. No concerns have been raised by stakeholders regarding response activities. BHP undertakes regular consultation with relevant stakeholders about its operations/ activities providing them with sufficient and reasonable opportunities to raise any new concerns or issues for the duration of this activity. BHP considers that control measures presented for spill response activities reduce impacts and risks to an acceptable level.

10 Implementation Strategy

In accordance with Regulation 14 of the Environment Regulations, the Environment Plan must contain an implementation strategy for the petroleum activity and monitoring, recording and reporting arrangements. The implementation strategy presented in this section provides specific practices and procedures to ensure:

- All the environmental impacts and risks of the petroleum activity will be continually identified and reduced to a level that is ALARP;
- Control measures identified in the EP are effective in reducing the environmental impacts and risks of the activity to ALARP and to acceptable levels;
- That environmental performance outcomes and environmental performance standards are met;
- Arrangements are in place to respond to, and monitor, impacts of oil pollution emergencies; and
- Arrangements for on-going consultation with relevant authorities, persons and organisations are in place and maintained through the activity.

10.1 Systems, Practices and Procedures

10.1.1 BHP HSEC Management System

The BHP Petroleum HSEC Management system defines the boundaries within which all activities are conducted. It provides a structured framework to set common requirements, boundaries, expectations, governance and assurance for all activities. It also supports accountabilities and responsibilities as defined in the organisational structure. The overarching objective of the BHP Petroleum HSEC Management system is to aspire to zero harm to people, communities and the environment, and achieve leading industry practice. The structure of the BHP Petroleum HSEC Management system is hierarchical (Figure 10-1).

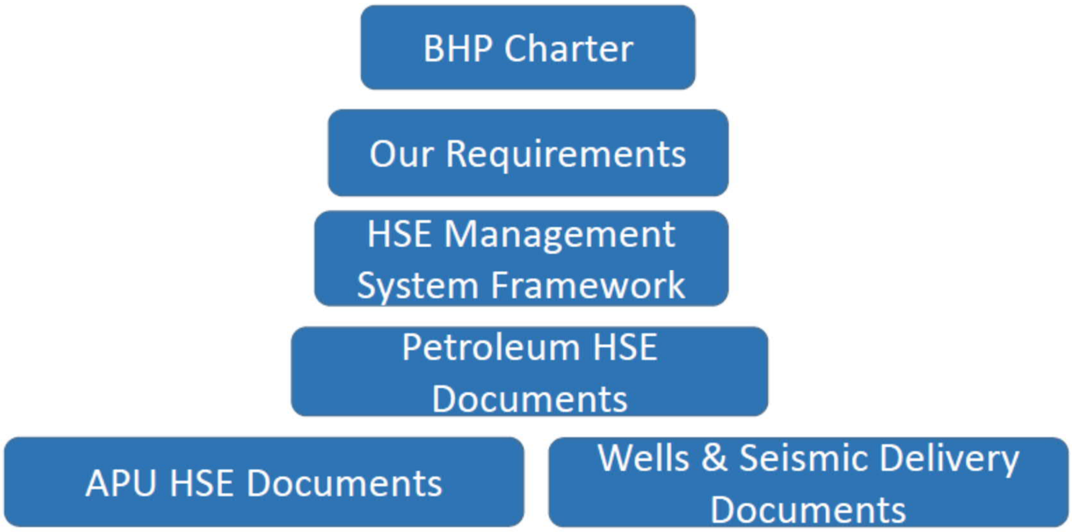


Figure 10-1: BHP Petroleum Management System

The documents in Figure 10-1 address specific areas (e.g. corporate performance reporting, risk management, incident investigation) where it is important that activities are conducted consistently across the organisation.

The top level of the triangle shown in Figure 10-1 is the BHP Charter; a copy of the Charter is provided in Appendix A. The Charter details BHP's values and directs the approach to all activities in BHP. It includes value statements on each of sustainability, integrity, respect, performance, simplicity and accountability. It also provides a means of aligning BHP's values with strategic direction and measures of success. The Charter is supported by BHP's Code of Business Conduct and Working with Integrity. The Charter is signed by the BHP Chief Executive Officer.

The BHP Our Requirements detail and define business planning, risk management, and assurance expectations of key process areas. They also serve as audit protocol against which all groups in BHP are assessed. Categories of Our Requirements include (for example) HSEC, Human Resources, Legal, Corporate Affairs, Supply, and Information Management.

Direction for environmental performance in BHP is established by the Environment and Climate Change – Our Requirements. The BHP Charter provides a public statement and commitment to zero harm through planning and execution. The Crosby-3H1 LWI activities will be undertaken in accordance with the objectives of this Charter, which includes compliance or exceedance with regulatory requirements, setting of objectives and targets and continual improvement. The Charter will be available to all personnel involved in the petroleum activity through the intranet, and hard copies where appropriate.

The HSEC Management System framework establishes the foundation for continual improvement through the application of consistent requirements across all aspects of the petroleum activity including:

- Identification of statutory obligations and commitments to ensure maintenance of licence to operate;
- Implementation of petroleum risk management processes, including this Environment Plan;
- Establish and maintain the competencies for personnel, and provision of training to promote expected behaviours;
- Management of all contractors and suppliers of petroleum goods and services; and
- Completion of reviews, and reporting outcomes of these reviews.

The BHP Petroleum HSE Standard details the mandatory HSEC performance requirements as described in the HSEC related Our Requirements and are met through the HSEC Management System framework. They address specific performance requirements that define functional and governance expectations. The controls apply to the entire lifecycle of petroleum activities, processes and products. Contractors are required to comply with the controls, and partners and suppliers are encouraged to adopt the intent and nature of the performance requirements. The controls cover the following broad areas and are regularly monitored through scheduled audit and verification activities:

- Hazards and risk management;
- Crisis and emergency management;
- Security;
- Health and hygiene;
- Aviation;
- Marine operations;
- Fatal risks;
- Environment; and
- Data reporting.

10.2 Environment Plan Organisation, Roles and Responsibilities

A defined chain of command with the roles and responsibilities for key BHP and contractor personnel in relation to Environment Plan implementation, management and review are described below in Table 10-1 and shown in Figure 10-2. It is the responsibility of all BHP employees and contractors to ensure that the BHP's Petroleum HSEC related Our Requirements and the BHP Charter (Appendix A) are applied in their areas of responsibility.

Table 10-1: Key personnel and environmental responsibilities

Title	Environmental Responsibilities
Office-based Roles	
BHP Head of Drilling & Completions (D&C) Australia	• Technical Authority and Manager of team of well construction professtionals to support production phase; • Ownership transfer for well construction, completion, workover, intervention and abandonment operations; and • Sufficient resources are provided to implement the commitments made in this EP.
BHP Drilling Superintendent	• Supervision of D&C operations including management of change; and • Ensures compliance with company policies, standards and statutory requirements.
BHP Drilling/ Completions Engineering Manager (or equivalent)	• Accountable for the development of well designs and associated programs; and • Ensures compliance with company policies, standards and statutory requirements.
BHP Field Operations Manager	• Ensure compliance with the BHP Charter and Management Standards; • Sufficient resources are provided to implement the commitments made in this EP; • Vessel contractors are provided with the EP and are made aware of the requirements for their activities; • Ensure Facility Operator reports HSE incidents to regulatory authorities as required; and • Assist the Incident Management Team in the development of a response strategy in the event of a spill incident.
BHP HSE Manager	• Ensure compliance with BHP's Charter and Management Standards, this EP and regulatory responsibilities; and • Environmental incidents or breaches of environmental performance outcomes, standards or measurement criteria, are reported in line with BHP's incident reporting requirements.
BHP HSE Specialist	• Liaise with the Field Operations Manager, person in charge (PIC) and Vessel Master to ensure compliance to legislation, procedures, standards and commitments; • Carry out environmental education and inductions; • Ensure compliance with this EP, regulatory and HSE responsibilities; • Participate in the hydrocarbon spill response drills; • Complete environmental audits to ensure compliance with this EP; and • Report environmental recordable incidents to NOPSEMA.
Contractor Manager	• Prepare, maintain and implement of Contractor HSE Management Plans and Procedures; • Ensure compliance with this EP, regulatory and HSE responsibilities relevant to their scope of work; and • Maintain clear lines of communication with the BHP Field Operations Manager.
Field-based Roles	
Drilling Supervisor (or equivalent)	• Responsible for management and supervision of well engineering activities at the well site; • Ensures operations are conducted according to the approved programme requirements; and • Management of change during operations.
BHP Client Site Representative(s)	• Monitor and audit the works to ensure compliance with this EP and the regulatory and HSE responsibilities; and • Ensures environmental incidents or breaches of environmental performance outcomes, standards or measurement criteria are reported in line with BHP's incident reporting requirements.

Title	Environmental Responsibilities
Contractor Offshore Construction Manager	• Technical aspects of LWI activities; • Liaison with Company Site Representative(s) on all aspects of offshore execution; • Reporting progress
Vessel Master	• Manage activities and safety on-board vessel for the duration at sea, and operate under BHP Marine Controls, relevant Commonwealth Acts and regulations; • Ensure vessel operations are undertaken as per this EP and any approval conditions; • SOPEP drills are conducted as per vessel's schedule; • Report environmental incidents or reaches of objectives, standards or criteria on vessel, are in line with BHP's incident reporting requirements; and • Recordable incident reporting.
All crew	• Work in accordance with accepted HSE obligations and practices; • Comply with this EP, and all regulatory and project obligations applicable to their assigned role; • Report any hazardous condition, near miss, unsafe act, accident or environmental incident immediately to their supervisor; • Report sightings of marine fauna and marine pollution; • Attend HSE meetings and training/ drills when required; and • Understand their obligation to 'stop-the-job' due to HSE concerns.

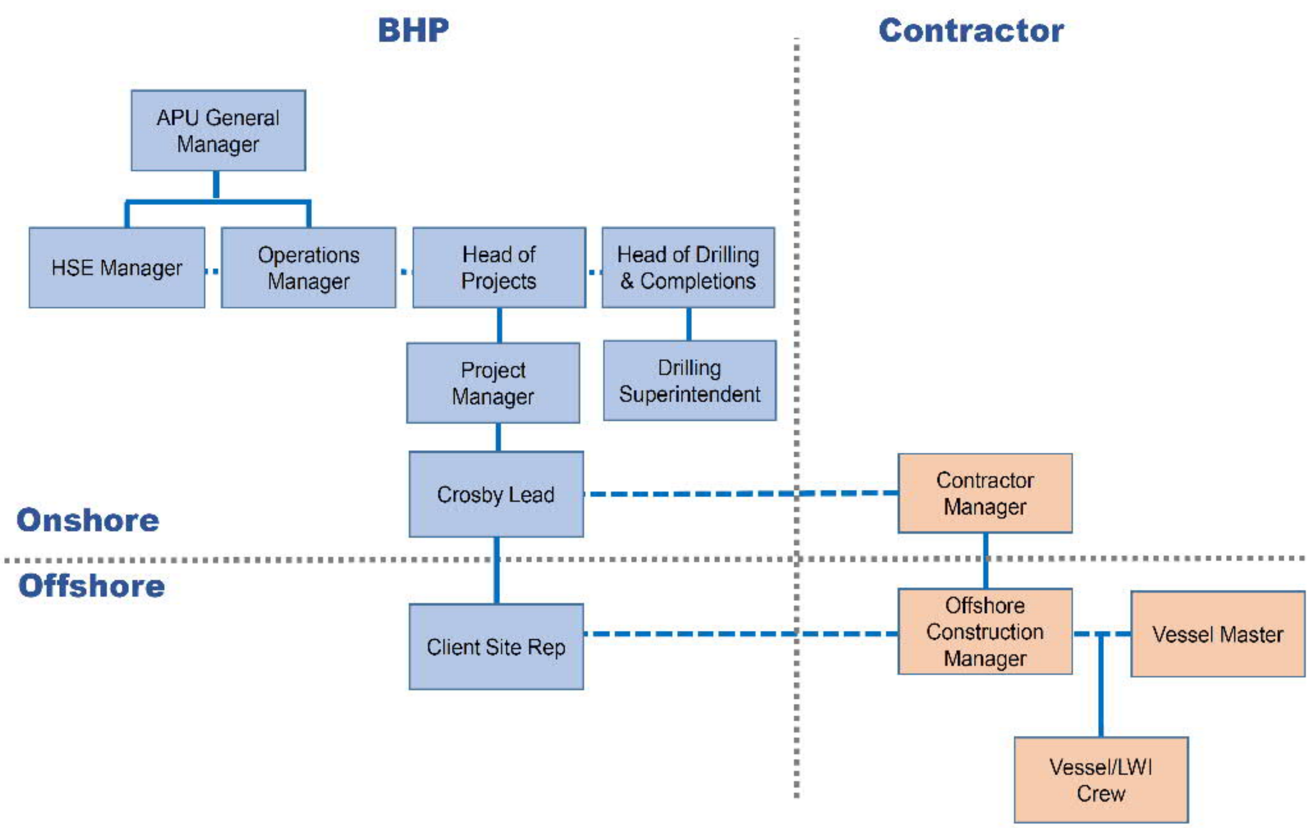


Figure 10-2: Organisation chart for Crosby-3H1 LWI

10.3 Training and Competency

10.3.1 Competence, Environmental Awareness and Training

BHP's HSEC Management System framework establishes the foundation for continual improvement through the application of consistent requirements across all aspects of petroleum activities including the establishing and maintenance of the competencies for personnel, and provision of training to promote expected behaviours.

All personnel on the vessel are required to be competent and suitably trained to undertake their assigned positions. This may be in the form of 'On the Job' or external training. The vessel contractor is responsible for identifying training needs and keeping records of training undertaken. Environmental awareness inductions (Section 10.3.2) are required to be undertaken by all vessel personnel as part of their induction to undertaking petroleum activity.

10.3.2 Campaign Specific Environmental Awareness

Inductions are provided to all relevant personnel before the mobilisation to or on arrival at the activity location. This induction covers the HSE requirements and environmental information specific to the location of the activities. The induction will include the following environmental information:

- General description of the activity location, including any environmentally sensitive areas;
- BHP HSEC Management System Framework – BHP Charter;
- Adherence to standards and procedures, and the use of Job Safety Analysis and Permit to Work hazard identification and management process;
- Incident reporting process;
- Spill management including prevention, response and clean-up, location of spill kits and reporting requirements;
- Waste management requirements and process (segregation of landfill, recycle and hazardous wastes) and location of bins;
- Reporting of vessel interactions; and
- Reporting procedure for sightings of cetaceans and whale sharks including the location of marine fauna sighting datasheets.

All personnel who undertake the induction are required to sign an attendance sheet, which is retained by the vessel contractor.

A copy of Environment Plan performance standards and measurement criteria is provided to the Vessel Master.

10.3.3 Contractor Management

For BHP contractors, HSE risks in contracts are managed in accordance with the requirements outlined in BHP HSEC Management Standards. As part of the contractor management process, BHP implements pre- and post-contract award processes and activities aimed at ensuring that contracts consistently and effectively cover the management of HSE in line with BHP's Petroleum HSEC related Our Requirements, the BHP Charter, and BHP HSEC Management Standards.

10.3.4 Marine Operations and Assurance

Systems and procedures are in place to ensure all marine operations for the Crosby-3H1 well intervention activities are conducted in accordance with environmental regulatory requirements and BHP marine controls, which cover management of marine operations and contracting of vessels.

The Marine Management Process require a number of audits be completed prior to hiring a vessel and marine operations suppliers to be audited and verified prior to engagement. This includes a search of Offshore Vessel Inspection Database (OVID) for all relevant records and certification, and/or additional audits for the following as identified in the risk assessment process:

- Marine Management Process;

- Dynamically positioned vessel review;
- Containment audit to ensure contained transport, storage and discharge of petroleum based and chemical products;
- Lifting and rigging audit; and
- Emergency response audit.

10.4 Monitoring, Auditing and Management of Non-Conformance and Review

10.4.1 Monitoring Environmental Performance

Environmental performance is required to be consistent with BHP HSEC Standards and commitments made in this EP. The on-going environmental performance of contractors is the responsibility of key personnel described in Table 10-1. Key data that will be monitored and recorded during the Crosby-3H1 LWI activities are summarised in Table 10-2.

Table 10-2: Monitoring and record keeping summary

Parameter	Monitoring	Record Keeping	Frequency
Seabed Disturbance	Recovery of dropped objects where practicable to do so and where recovery will provide a net environmental benefit	Documentation of dropped object retrieval	As required
Marine Fauna Interactions	Cetacean sightings and interactions (secondary to primary work activities/ responsibilities)	Fauna Sighting Datasheet. Incident Report Form. Monthly Incident Report; and Environmental Performance Report.	As required. As required. Monthly.
Introduced Marine Species	Management of biofouling	Marine Management process to be completed prior to hire of vessels	Prior to on-hire
		Record and review of IMS risk assessment by the Environmental Specialist for newly contracted vessels and immersible equipment entering the operational area.	Prior to on-hire
		Locally sourced vessels that can demonstrate that they have only operated within the North West Bioregion for a period of less than 3 years since they were last assessed as low risk as the result of an in-water or out-of-water IMS inspection (by an approved biofouling inspector). This includes vessels that have exited the southeast bioregion for periods of less than seven consecutive days, yet remained within state (WA) or offshore (>12 nm).	Prior to on-hire
		Records of in-water or out-of-water inspection demonstrate that the inspection is carried out by an approved biofouling inspector	Prior to on-hire
	Management of ballast	Approved Ballast Water Management Plan (BWMP). Approved ballast water management certificate (IBWMC). Ballast water records.	Prior to entering Australian waters
Waste	Sewage and grey water	Vessel log	End of activity
		Maintenance records for sewage/grey water equipment	End of activity
	Hazardous and non-hazardous solid waste	Garbage Record Book	End of activity
		Maintenance records demonstrate functioning macerator onboard Vessel	End of activity
	Oily water – Bilges and machinery spaces	Oil Record Book	End of activity
	Fuels and oils	Containment and inspections, maintenance records, PMS records, checklists	End of activity
	Hazardous chemicals	Hazardous chemical locker inspection	End of activity
	Loss or discharge to sea of harmful materials	Record log of report to AMSA RCC	As required
Vessel movement interactions	Interactions with shipping and commercial fishing vessels movements	Vessel log. Incidents also recorded in the BHP 1SAP system	As required
Training	Details of crew vessel inductions/drills	Induction Record Sheets/ drill reports	As completed

10.4.2 Record Keeping

Compliance records will be maintained. Record keeping will be in accordance with Regulation 14(7) that addresses maintaining records of emissions and discharges (Table 10-2).

10.4.3 Auditing, Assurance, Management of Non-Conformance and Continuous Improvement

The environmental performance of BHP activities will be reviewed in a number of ways in order to:

- Ensure all significant environmental aspects of the well intervention activities are covered in the EP;
- Ensure that management measures to achieve environmental performance outcomes are being implemented, reviewed and where necessary amended;
- Ensure that all environmental commitments have been met;
- Ensure that impacts and risks will be continuously identified and reduced to ALARP; and
- Identify potential non-conformances and opportunities for continuous improvement.

BHP conducts reviews and audits of their contractors at various stages including pre-award of contract, pre-activity and during activity, in accordance with BHP HSEC Management System performance. The environmental performance of contractors to BHP involved in activities will be reviewed through the following activities including (but not limited to):

- Inspections of vessel contractor’s HSEC Management systems and procedures;
- Pre-activity audits;
- Review of reporting documentation;
- Monitoring of progress;
- Auditing and assurance program;
- Regular review of incident, audit, inspection, observation, safety meeting and daily operations reports;
- Action item tracking and closeout; and
- End of campaign reviews.

The environmental performance of BHP activities will be reviewed through:

- An audit of the vessel carried out by the BHP HSE Specialist or BHP Site Representative before or during the well intervention activities to ensure that procedures and equipment are in place to enable compliance with the EP;
- The audit will be documented and actions tracked through a non-compliance register, which is monitored on a regular basis;
- The Environmental Performance Standards and Measurement Criteria will be distributed to the Vessel Master and monitored on a regular basis by BHP; and
- All environmental mitigation and management commitments from the EP will be documented and a description of compliance with each commitment will be maintained.

Audit findings, close-out reports and feedback from ongoing monitoring allow continuous improvement initiatives to be developed and inform the development of future EPs.

10.4.4 Management of Change

Permanent or temporary changes to organisation, equipment, plant, standards or procedures that have a potential health, safety, integrity and/or environmental impact are assessed and subject to formal review and approval as outlined in BHP HSEC Management Standards. This standard requires the change to be justified and authorised, risk assessed to understand the potential impacts of the change, a plan to be in place that clearly specifies the timescale for the change and any control measures to be implemented and the situation to be reassessed if there is an unexpected change in circumstances. The level of management approval for each change is commensurate with the risk.

Management of changes relevant to this EP, for example timing of the activity, changes to the scope of the activity described in Section 3 of this EP) will be made in accordance with Management of Change procedures outlined in the BHP HSEC Management Standards (refer to previous Section 10.4.4).

The Management of Chance process also allows for the assessment of new information that may become available after the acceptance of the EP, such as new management plans for Australian marine parks, new recovery plans or conservation advice for species, and changes to the EPBC Protected Matters Search results.

The Management of Change will be assessed and subject to formal review to determine if a revision of the accepted EP in force for the cessation activities is required to be submitted to NOPSEMA pursuant to Regulation 17 of the OPGGS (Environment) Regulations.

10.5 Reporting

To meet the environmental performance outcomes and standards outline in the EP, BHP undertake reporting at a number of levels as described in the following sub-sections.

10.5.1 Routine Reporting (External)

Start and End of Activity Notifications

In accordance with Regulation 29, BHP will notify in writing NOPSEMA and DMIRS of the commencement of the petroleum activity at least ten days before the activity commences and again within ten days of the completion of the activity.

Environmental Performance Review and Reporting

Routine external reporting requirements are summarised in Table 10-3.

Table 10-3: Routine external reporting requirements

Report	Recipient	Frequency	Content
Monthly Recordable Incident Reports	NOPSEMA	Monthly, by the 15th of each month.	Notification of a breach of an environmental performance outcome or standard, in the environment plan that applies to the activity that is not a reportable incident. Complete NOPSEMA’s Recordable Environmental Incident Monthly Report form.
Environmental Performance Report	NOPSEMA	Annual, with the first report submitted within 12 months of the commencement of the petroleum activity covered by this EP	In accordance with the Regulation 26C, confirmation of compliance with the Performance Outcomes, Performance Standards and Measurement Criteria of this EP. Reporting period 1 July to 30 June. Report must include sufficient information to enable NOPSEMA to determine whether or not the environmental performance outcomes and performance standards in the EP have been met.

End of the Environmental Plan

The EP will end when BHP notify NOPSEMA that petroleum activity has ended, and all of the obligations under the EP have been completed, and NOPSEMA has accepted the notification, in accordance with Regulation 25A of the Environment Regulations.

Notification will be through completion and submission of NOPSEMA's Regulation 25A – End of operation of environment plan form.

10.5.2 Incident Reporting (Internal)

BHP employees and contractors are required to report all environmental incidents and non-conformance with commitments made in the EP. It is the responsibility of the BHP HSE Manager to ensure that reporting of environmental incidents meets both regulatory reporting requirements and BHP HSEC Standards.

1SAP is used for the recording and reporting of these incidents. Detailed investigations are completed for all actual and high potential environmental incidents. The classification, reporting, investigation and actioning of all incidents including environmental are undertaken in accordance with BHP Petroleum Event and Investigation Management Protocol. Incident (potential or actual) corrective actions are monitored using 1SAP.

10.5.3 Incident Reporting (External) – Reportable and Recordable

Reportable Incidents

A reportable environmental incident is defined in Regulation 4 of the Environment Regulations as:

> *"…**reportable incident**, for an activity, means an incident relating to the activity that has caused, or has the potential to cause, moderate to significant environmental damage"*.

A reportable incident for the Crosby-3H1 LWI activities include, but are not limited to, those that have been identified through the risk assessment process as having a Severity (Consequence) Level of >2 (refer to previous Table 6-3), or at a minimum, an uncontrolled release of hydrocarbons or environmentally hazardous chemicals of more than 80 litres to the marine environment.

In accordance with Regulations 26, 26A and 26AA, BHP will:

- Report all reportable incidents orally to NOPSEMA, as soon as practicable, and in any case not later than 2 hours after the first occurrence of the reportable incident; or if the reportable incident was not detected at the time of the first occurrence, the time of becoming aware of the reportable incident.

  Oral notifications of a reportable incident to NOPSEMA will be via telephone: 1300 674 472.

  The oral notification must contain:

  - All material facts and circumstances concerning the reportable incident known or could be obtained by reasonable search or enquiry; and
  - Any action taken to avoid or mitigate any adverse environment impacts of the reportable incident; and
  - The corrective action that has been taken, or is proposed to be taken, to stop, control or remedy the reportable incident.
- Provide a written record of the reportable incident to NOPSEMA, as soon as practicable after making the oral notification, but within three days after the first occurrence of the reportable incident unless NOPSEMA specifies otherwise. The written report should use a format consistent with NOPSEMA's Report of an Accident, Dangerous Occurrence or Environmental Incident form FM0929.
- Within 7 days of giving a written report of a reportable incident to NOPSEMA, a copy of the same written report must be provided to the National Petroleum Titles Administrator (NOPTA), and the Department of Mines and Petroleum (DMP).

Recordable Incidents

A recordable environmental incident is defined in Regulation 4 of the Environment Regulations as:

> *" **recordable incident**, for an activity, means a breach of an environmental performance outcome or environmental performance standard, in the environment plan that applies to the activity, that is not a reportable incident".*

In terms of the activities within the scope of this EP, a recordable incident is a breach of the performance outcome or performance standards listed in Section 7, Section 8 or Section 9 of this EP.

In the event of a recordable in recordable incident, BHP will report the occurrence to NOPSEMA as soon as is practicable after the end of the calendar month in which it occurs; and in any case, not later than 15 days after the end of the calendar month. If no recordable incidents have occurred, a 'nil incident' report will be submitted to NOPSEMA. Written reporting to NOPSEMA of recordable incidents and 'nil incidents' can be via completion of NOPSEMA's Form FM0928– Recordable Environmental Incident Monthly Report. The report will contain:

- a record of all the recordable incidents that occurred during the calendar month;
- all material facts and circumstances concerning the recordable incidents that are known or can, by reasonable search or enquiry, be found out;
- any action taken to avoid or mitigate any adverse environmental impacts of the recordable incidents;
- the corrective action that has been taken, or is proposed to be taken, to stop, control or remedy the recordable incident; and
- the action that has been taken, or is proposed to be taken, to prevent a similar incident occurring in the future.

Other External Incident Reporting Requirements

In addition to the notification and reporting of environmental incidents defined under the Environment Regulations and BHP HSEC Standards, the following incident reporting requirements also apply:

- In accordance with the *Navigation Act 2012*, any oil pollution incidents in Commonwealth waters will be reported by the Vessel Master to AMSA within 2 hours via the national emergency notification contacts and a written report within 24 hours of the request by AMSA.

  The national 24-hour emergency notification contact details are:

  Freecall: 1800 641 792

  Fax: (02) 6230 6868

  Email: mdo@amsa.gov.au
- All oil pollution incidents in WA State waters will be reported by the Vessel Master to the Oil Spill Response Coordination (OSRC) Unit within the DoT as soon as practicable (within 2 hours of spill occurring) via the 24 hour reporting number (08) 9480 9924. The Duty Officer will then advise whether the following forms are required to be submitted:
  - Marine Pollution Form (POLREP) http://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-PollutionReport.pdf and/ or
  - Marine Pollution Situation Report (SITREP) http://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-SituationReport.pdf
- Any loss or discharge to sea of harmful materials is to be reported by the Vessel Master using the prescribed Pollution Report (POLREP) form to the Rescue Coordination Centre (RCC).
- All oil pollution incidents in WA Port Authority Waters will be reported by the Vessel Master to the relevant WA Port Authority Harbour Master.

- All oil pollution incidents likely to affect WA Waters to be reported by the Vessel Master to the DMIRS Emergency Incident Phone (0419 960 621).
- Director of National Parks (DNP) should be made aware of oil/gas pollution incidences that occur within a marine park or are likely to impact on a marine park as soon as possible. Notification should be made to:

  Marine Compliance Duty Officer on 0419 293 465 (24 hours).

  The notification should include:

  - titleholder details;
  - time and location of the incident (including name of marine park likely to be effected);
  - proposed response arrangements as per the Oil Pollution Emergency Plan (e.g. dispersant, containment, etc.);
  - confirmation of providing access to relevant monitoring and evaluation reports when available; and
  - contact details for the response coordinator.
- In WA State Waters – All suspected or known instances of introduced aquatic pests or disease detected in WA waters to be reported to the Biosecurity Section of DPIRD immediately, using the following contact details:

  Telephone: Fishwatch 1800 815 507

  Email: biosecurity@fish.wa.gov.au
- Any harm or mortality to EPBC Act-listed threatened marine fauna, whether attributable to the activity or not, within 7 days to the Department of Agriculture, Water and the Environment (DAWE) via email at: EPBC.permits@environment.gov.au.
- Any vessel strikes with cetaceans will be reported in the National Ship Strike Database at https://data.marinemammals.gov.au/report/shipstrike.

10.6 Emergency Preparedness and Response

10.6.1 Overview

Under Regulation 14(8), the implementation strategy must contain an oil pollution emergency plan (OPEP) and provide for the updating of the OPEP. In accordance with Regulation 14, the sections below detail the implementation strategy for hydrocarbon spill emergency conditions during the well intervention activities. The section outlines the response framework in the event of a hydrocarbon spill and the emergency response arrangements for a Level 1, 2 or 3 oil spill event (refer to Table 9-1 for definitions) based on the provisional NEBA assessment. Specific BHP practices and procedures are presented to ensure that the environmental impacts and risks of spill response activities will be continuously identified and reduced to ALARP, along with environmental performance outcomes, performance standards and management criteria for spill response activities.

As part of the implementation strategy, BHP has developed an activity-specific OPEP (Appendix G). The implementation strategy includes BHP processes and procedures for how training, competencies and on-going environmental awareness will be maintained for the duration of the activity, for all personnel and contractors involved in spill response activities (resourced by BHP).

10.6.2 Oil Spill Response Arrangements

Incident Jurisdictions

In the event of an oil spill, Control Agencies are assigned to respond to the various levels of spills is outlined in Table 10-4. The 'Statutory Agency' and 'Control Agency' are defined as follows:

Jurisdictional Authority: *the State or Commonwealth Agency assigned by legislation, administrative arrangements or within the relevant contingency plan, to control response activities to a maritime environmental emergency in their area of jurisdiction.*

Control Agency: *is the agency with operational responsibility in accordance with the relevant contingency plan to take action to respond to an oil and/or chemical spill in the marine environment.*

BHP will adhere to the IMT functions and Lead IMT designations as described in Annex 1 of the Offshore Petroleum Industry Guidance Note - Marine Oil Pollution: Response and Consultation Arrangements (September 2018).

Table 10-4: Statutory and lead control agencies for oil spill pollution incidents

Area	Spill Source	Jurisdictional Authority	Lead Control Agency	
			Level 1	Level 2/3
Commonwealth Waters	Offshore Petroleum Activity	NOPSEMA	BHP	BHP
	Vessels	AMSA	AMSA	AMSA
State Waters	Offshore Petroleum Activity	DoT	BHP	DoT
	Vessels	DoT	BHP	DoT
Port Waters	Vessels	Port Authority	Port Authority / DoT	Port Authority / DoT

10.6.3 External Plans

The OPEP (Appendix G) has been developed to meet all relevant requirements of the OPGGS (Environment) Regulations and the following external documents have been used or referred to in the development of the OPEP and the implementation strategy for hydrocarbon spill emergency conditions that may occur during the LWI activities:

- NatPlan - National Plan for Maritime Environmental Emergencies (NatPlan)
  - Sets out the national arrangements, policies and principles for the management of marine oil pollution. It defines obligations the States and various industry sectors in respect of marine oil pollution prevention, preparation, response and recovery.
- AMOSPlan – Australian Industry Cooperative Spill Response Arrangements
  - Managed by AMOSC, it details the cooperative arrangements for response to oil spills by Australian oil and associated industries.
- WA State Hazard Plan – Maritime Environmental Emergencies (MEE)
  - Formally endorsed by the State Emergency Management Committee (SEMC) on 4 October 2019, the MEE details the management arrangements for preparation and response to marine oil pollution incidents in State waters.
- DoT Oil Spill Contingency Plan
  - Details the procedures and arrangements for the management of marine oil pollution emergencies that are the responsibility of the DoT.
  - DoT Offshore Petroleum Industry Guidance Note (IGN) - Marine Oil Pollution (MOP) Response and Consultation Arrangements (available online: https://www.transport.wa.gov.au/imarine/oil-spill-contingency-plans.asp);
- Industry Joint Venture Plans: Various Plans developing general and assisted Oil Spill Response Capabilities
- Western Australian Oiled Wildlife Response Plan (WAOWRP)

- Provides guidance and sets out the management arrangements for implementing oiled wildlife response in State waters. Each region has an Oiled Wildlife Response Plan that gives further details on sensitivities and available resources. The Pilbara Region Oiled Wildlife Response Plan is the relevant regional plan for oiled wildlife associated with Crosby-3H1 well intervention activities.

- AMSA Australian Government Coordination Arrangements for Maritime Environmental Emergencies
  - Provides a framework for the coordination of Australian Governmental departments and agencies in response to a maritime environmental emergency

The OPEP interfaces with National, State and BHP plans as shown in Figure 10-3.

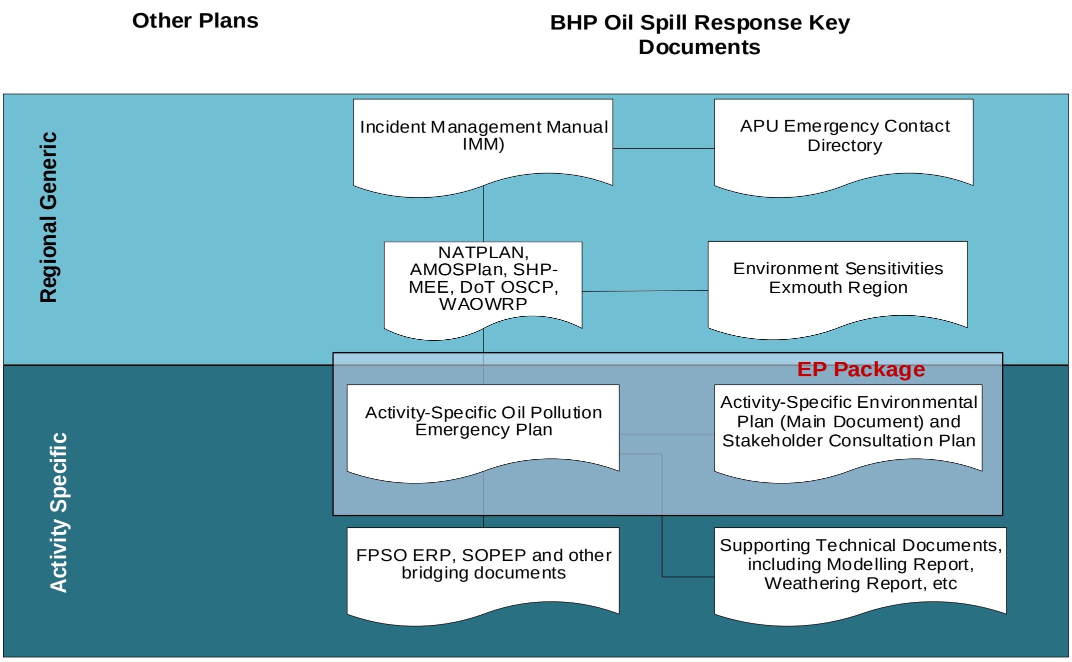


Figure 10-3: National and State plans and integrations with BHP documents

BHP and Contractor Plans

Internal BHP requirements include the need to *Develop Emergency Response plans that are scaled according to the Petroleum activities, associated hazards, material risks and applicable regulatory requirements*.

To support this requirement, the following documents have been developed and implemented:

- Incident Management Manual – Australia (AOHSE-ER-0001);
  - o Incident Management Handbook – (ICS Model);
- APU Emergency Contact Directory (AOHSE-0002-005);
  - o APU IMT Contact Directory (EMQnet);
- Environmental Sensitivities Exmouth Region (AOHSE-ER-0021-008);
- North West Cape Sensitivity Mapping (AOHSE-ER-0036);
- The Crosby-3H1 Light Well Intervention OPEP (PYHSE-ER-0006) (Appendix G);
- Contractor Emergency Response Plans (ERPs), SOPEPs and bridging documents; and
- Tactical Response Plans (TRPs) for identified receptors.

10.6.4 BHP Incident Response

BHP Response Organisation Structure

The BHP Crisis and Emergency Management (CEM) philosophy is based on three levels of response teams (refer to Table 10-5) which allow for a flexible response with the appropriate level of leadership and support, according to the nature of the specific incident.

Table 10-5: BHP response structure

BHP Response Structure	
Team	**Role**
Field Response Team [FRT]	The FRT is responsible for physically controlling incidents in the field, where possible, and communicating known facts to the IMT. The FRT will be a combination of the Pyrenees FPSO Command Team and the crew of the LWI vessel.
Incident Management Team [IMT]	The IMT's role is to provide technical and logistical support to the FRT. It is based in Perth, Australia.
Emergency Management Team [EMT]	The role of the EMT is to provide strategic leadership and support. It is based in Houston, USA.
Teams are progressively activated depending on the severity of an incident.	

The following sections describe the teams listed in Table 10-5 based on the worst-case spill scenarios for the Crosby-3H1 well intervention activities.

Field Response Team

The FRT will be a combination of the Pyrenees FPSO Command Team and the LWI vessel Emergency Response Team. The LWI vessel response will be described in the vessel Emergency Response Plan. The Vessel Master will be in command and will relay immediate emergency response information in the field to the Pyrenees FPSO.

The role of the FRT is to provide local and on scene response by implementing priority objectives and attempts to control or contain the source and make appropriate emergency notifications. The FRT reports to the IMT.

Roles and responsibilities of the BHP mobilised FRT are illustrated in Table 10-6.

Table 10-6: FRT roles and responsibilities

Role	Responsibilities
Emergency Commander	The Emergency Commander has overall responsibility for management of an incident. This will be the Pyrenees FPSO OIM.
On-Scene Commander	The On-Scene Commander is responsible for determining the status of the emergency and providing assistance to the Emergency Commander, as requested This will be the LWI Vessel Master.
Emergency Communications Coordinator	The role of the Emergency Communications Coordinator is to provide a link between all operating responders and to assist them in controlling the incident. This will be a member of the Pyrenees FPSO Command Team.
Emergency Coordinator	The Emergency Coordinator provides technical support during the emergency response and communicates with the Emergency Commander.

APU Incident Management Team

Organisational Chart [Level 1 Spill Response]

The IMT is responsible for the initial spill response for all spills. The on-duty IMT will handle a Level 1 response. The BHP *APU Incident Management Manual (AO-HSE-ER-0001)* outlines the roles and responsibilities of personnel in all response scenarios. Those responsible for an oil spill response are shown in Figure 10-4 with allocated responsibilities detailed in Table 10-7.

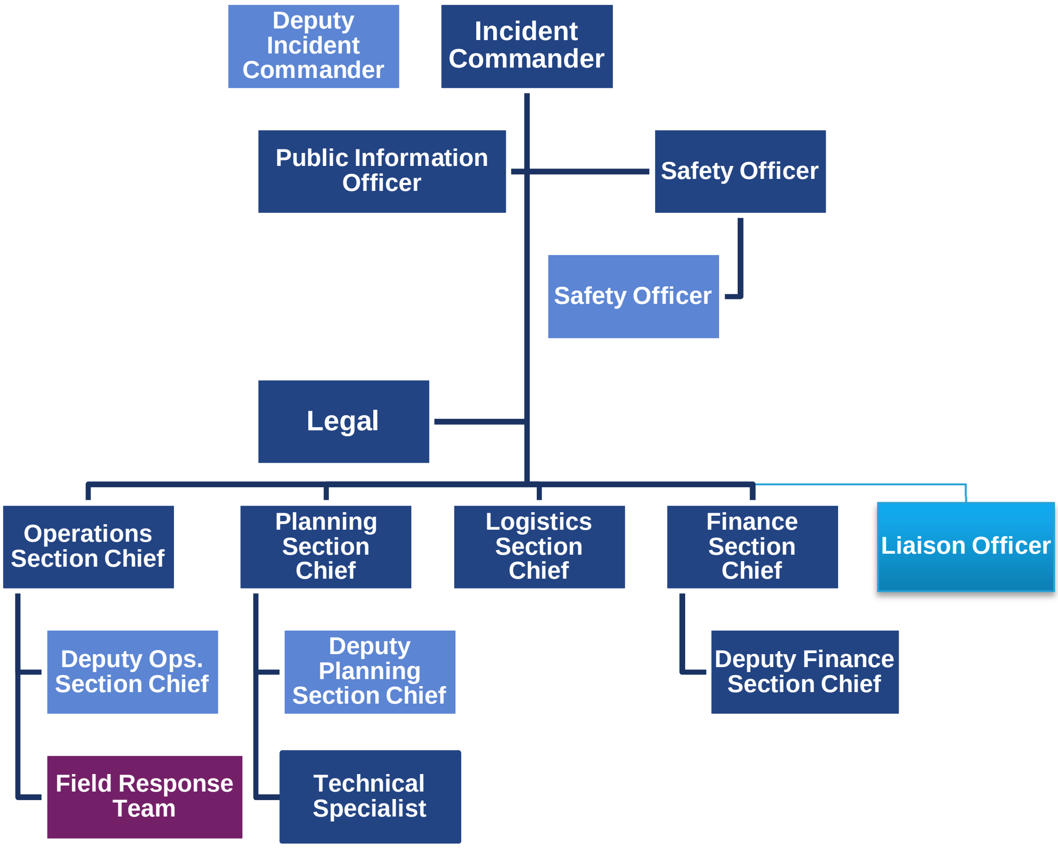


Figure 10-4: APU IMT organisational chart

Table 10-7: IMT roles and responsibilities

Role	Responsibilities
Incident Commander	The Incident Commander directs incident activities, including development and implementation of strategic objectives and liaises with the EMT Leader.
Safety Officer	Safety is responsible for monitoring and assessing hazardous and unsafe actions, in addition to developing measures for assurance of personnel safety, and assessment of any further hazards to the environment.
Public Information Officer	External Affairs is responsible for developing and releasing information about APU incidents to the news media, incident personnel, as well as other appropriate agencies and organisations.
Legal	Provision of legal advice to the Incident Commander relating to response activities, applicable regulatory requirements and any potential liabilities or investigative issues.
Operations	Operations are responsible for all operations directly applicable to the response operations. The Operations Section Chief will act as the Point of Contact between the FRT and the Incident Commander.
Planning	The Planning Section is responsible for collecting, evaluating, and disseminating the tactical information related to the incident, and for preparing and documenting IAPs.
Logistics	Logistics are responsible for directing all of the services and support needs of an incident, including obtaining and maintaining essential personnel, facilities, equipment and supplies.
Finance	Finance track financial expenditures.
Liaison Officer	At the Incident Commanders discretion, a Government Agencies (DoT, DBCA, DFES) can join the IMT team to provide support in the oil spill response planning and disseminate information through the State Combat committee Executive Advisory Group (EAG).

The APU IMT is made up of personnel designated on a roster basis, with each individual available for one week on a 24-hour basis throughout the year, based in Perth. There is a weekly handover and briefing of the operations each week. The APU IMT consists of a number of defined roles, which enables BHP to respond to a variety of incidents. The APU IMT is located in the BHP Perth offices and is fully equipped to manage incidents.

IMT members undergo pre-requisite Incident Management System training (ICS 100 and ICS 200) before fulfilling their position on the IMT. The training follows industry best practice and incorporates BHP CEM procedures and processes.

To supplement the initial training, each IMT member participates in desktop exercises and additional minor and major exercises. The training “desktop” exercises are also arranged during the weekly handover sessions, to test a range of IMT responses including oil spill response.

The APU HSE Manager is responsible for the overall management of the IMT including:

- Training and competency; and
- Ensuring the IMT is adequately resourced.

The IMT consists of key personnel with a broad range of disciplines (e.g. drilling, operations, engineering, maintenance, HSE, supply, external affairs, human resources, finance), together with other support service personnel as necessary.

The IMT has key corporate and external communications responsibilities for:

- Providing tactical and strategic direction, technical expertise and support during an emergency;
- Informing and liaising with relevant emergency services and regulatory authorities as appropriate;
- Managing external communications with media, relatives, contractors, customers, etc.;
- Managing Human Resources and Personnel Response (formerly Relative Response) activities; and

- Documenting all aspects of the emergency response activities and communications.

In the event that response to an oil spill incident requires a prolonged spill response, the IMT Commander may activate Australian Marine Oil Spill Centre (AMOSC) (including its core group members) and Oil Spill Response Limited (OSRL) to augment the IMT's capacity, and request that a Deputy be assigned to the following positions:

- IMT Commander;
- Safety Officer;
- Operations Section Chief;
- Planning Section Chief;
- Logistics Section Chief; and
- Finance Section Chief.

AMOSC or OSRL deputies assigned to the APU IMT will be responsible for providing BHP guidance on the Incident Command Structure (ICS) process and oil spill response strategies. Guidance and support will be available via phone/video conference.

OSRL are an Oil Spill Response Agency (OSRA) based in Singapore and Southampton. BHP has contracted OSRL to provide support during an oil spill response.

APU Incident Management Team – State Waters Response (DoT)

Figure 10-5 outlines the control structure in the event of that the marine oil pollution incident has, or has the potential to, impact State waters.

BHP will use its existing IMT Control Room in Perth. In Western Australia, the following arrangements apply:

1. BHP will be the Controlling Agency for spills from offshore petroleum activities in Commonwealth Waters;
2. AMSA is the Control Agency for vessel spills (Commonwealth Waters); and
3. Western Australian DoT is the Control Agency for a Level 2/3 emergency event in State waters resulting from an offshore petroleum activity (in accordance with changes to the State Hazard Plan – Maritime Environmental Emergency (SHP-MEE)).

This is regardless of whether the source of the spill is located in Commonwealth or State Waters. DoT will send a Liaison Officer to the CEM as shown in Figure 10-5.

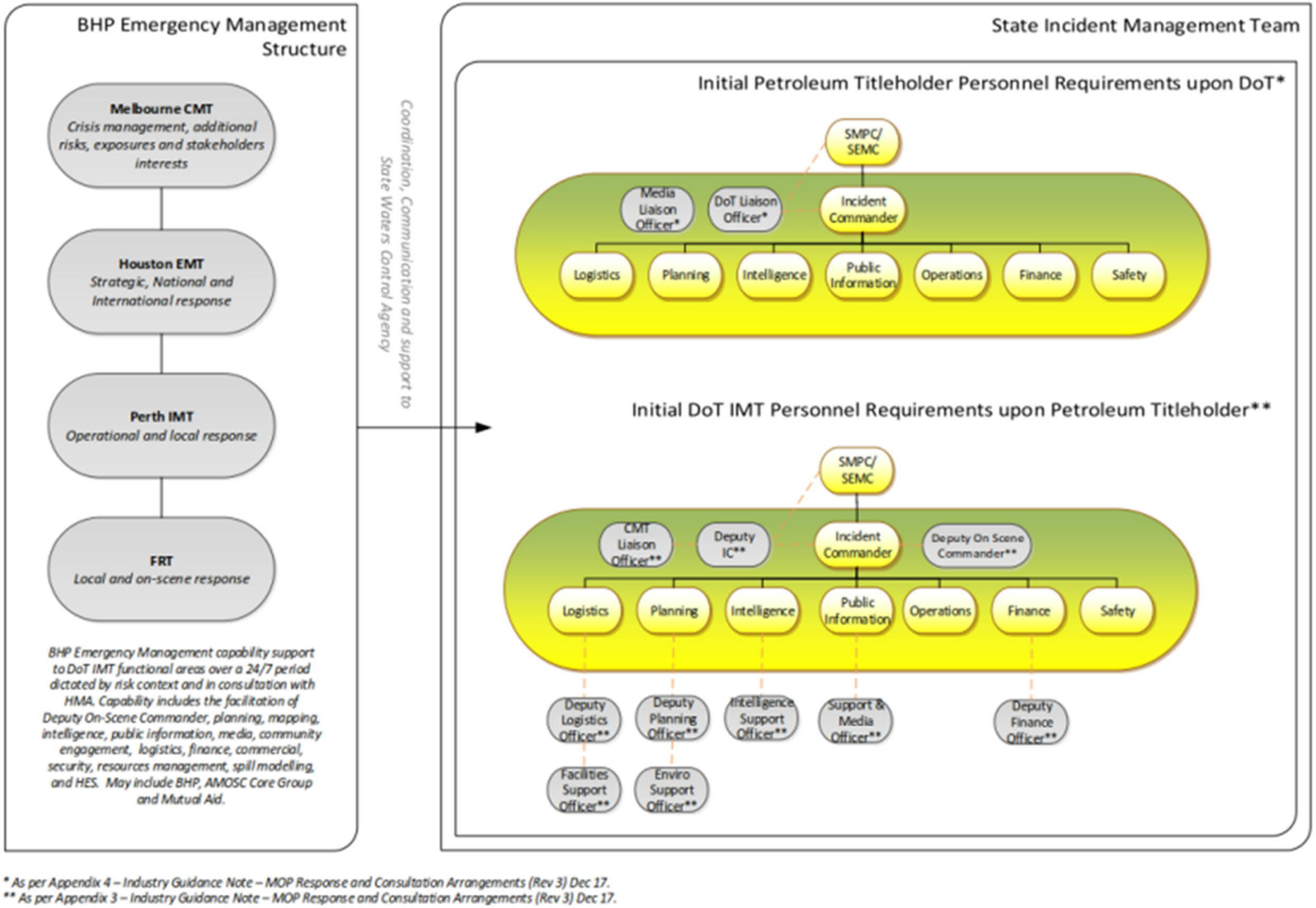


Figure 10-5: Emergency management support to State waters Control Agency – as per DoT IGN requirements

To facilitate the overarching coordination between the two Controlling Agencies and their respective IMT's, a Joint Strategic Coordination Committee (JSCC) will be established (Figure 10-6). The JSCC will be jointly chaired by the SMPC and the BHP's nominated senior representative and will comprise of individuals deemed necessary by the chairs to ensure an effective coordinated response across both jurisdictions.

BHP will continue to provide initial response actions for State waters, until such time that DoT assumes control and subsequently will provide resources in line with the BHP organisation chart and the OPEP.

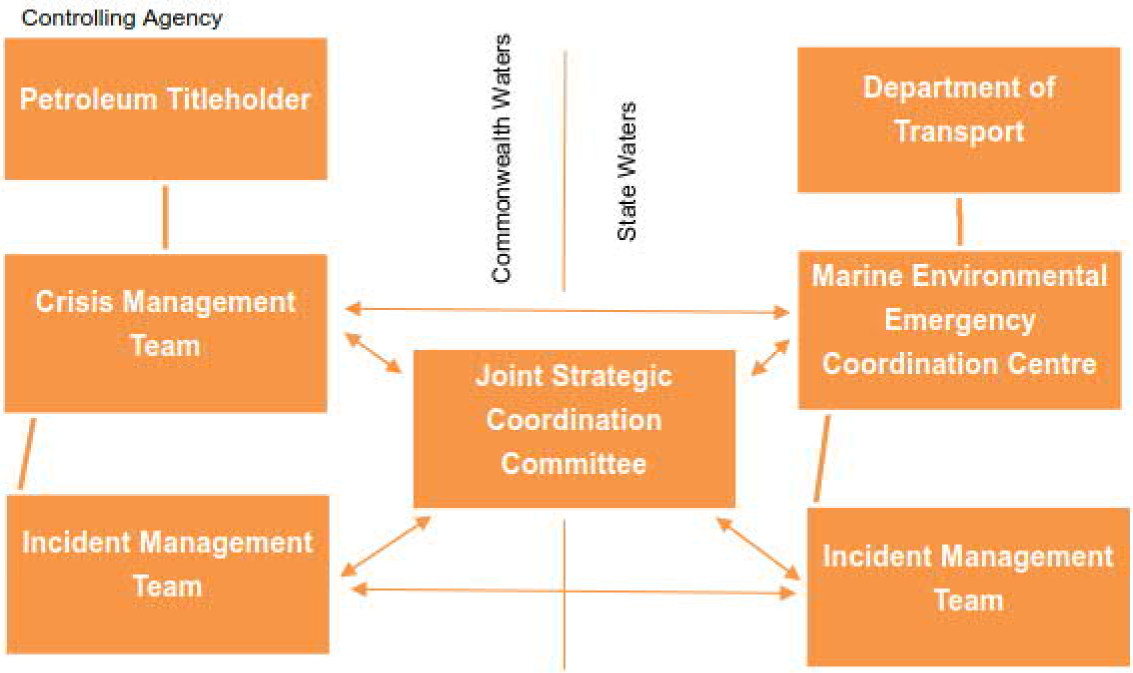


Figure 10-6: Incident management structure for Commonwealth waters Level 2/3 spill incidents entering State waters

Organisational Chart (Level 3 Spill Response]

In the unlikely event of a Level 3 response, BHP will use its existing IMT Control Room in Perth. The arrangements described above for a Level 2 spill response would apply.

In addition to the positions outlined for response to a Level 3 spill, BHP will where appropriate assign additional roles and responsibilities based on the nature and scale of a Level 3 response (Figure 10-7).

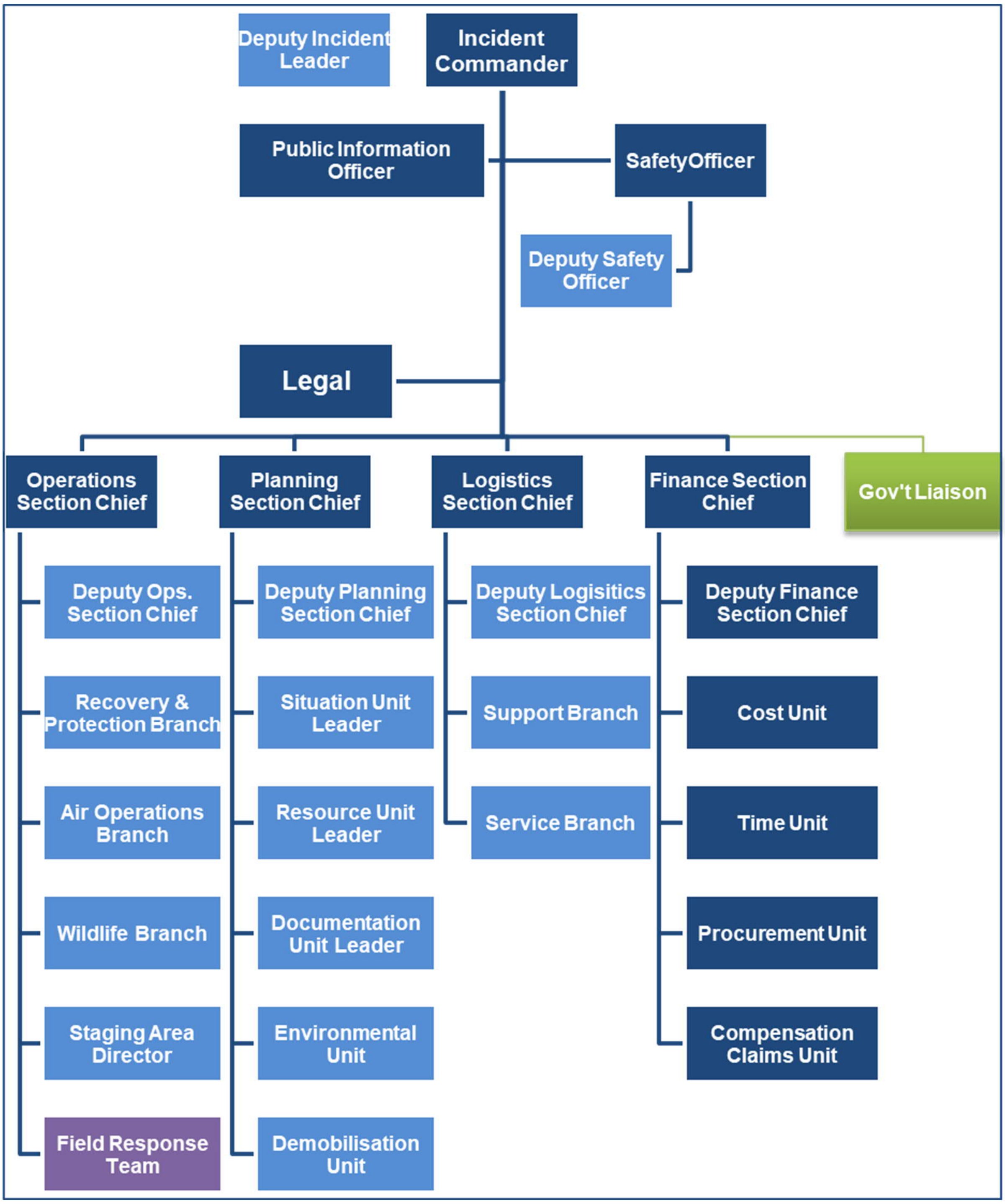


Figure 10-7: Potential APU IMT organisation chart [Level 3 spill response]

Potential Resources Needs

Potential resource requirements for all Levels of response (per 12 hour operational period) are detailed in Table 10-8. BHP's response arrangements can be scaled up or down dependent on the nature and 'level' of the incident.

Table 10-8: Potential resource needs

Function / Position	Level 1	Level 2	Level 3
Incident Commander	1 per incident; Incident Commander may have Deputies as needed.		
Command Staff: **Safety Officer, Public information Officer, Liaison Officer**	1 per incident: Command Staff may have assistants as needed.		
Operations			
Operations Section Chief	1 per operational period		
Deputy Operations Section Chief	NA	2	3
Recovery & Protection Branch Director [dependent on EMBA]	NA	3-4	6
Air Operations Branch Director	NA	2	3
Wildlife Branch Director [dependent on EMBA]	NA	1	1
Staging Area Director	NA	1 per Staging Area	
Planning			
Planning Section Chief	NA	1 per operational period	
Deputy Planning Section Chief	NA	2	3
Resource Unit Leader	NA	1	1
Situation Unit Leader	NA	1	1
Technical Specialist	NA	As needed	
Environmental Unit Leader	NA	1	1
Documentation Unit Leader	NA	1	1
Logistics			
Logistics Section Chief	NA	1 per operational period	
Deputy Logistics Section Chief	NA	1	2
Service Branch Director	NA	As needed	
Support Branch Director	NA	As needed	
Finance/Admin			
Finance/Admin Section Chief	1 per operational period		
Deputy Finance/Admin Section Chief	NA	1	1
Time Unit Leader	NA	1	1
Procurement Unit Leader	NA	1	1
Please note: In a large scale response each function listed above may require a number of people or teams.			

Immediate Response Support

BHP has the capability to implement a response with appropriately trained and competent staff, as follows:

- 8 x personnel on Roster from Thursday to Thursday fulfilling the following roles:
  - Incident Commander
  - Ops section Chief
  - Planning section Chief
  - Logistics Section Chief
  - Deputy Operations Section Chief (Aviation and Marine)
  - Safety officer
  - IT Support
  - Public Information Officer

  Each rostered position is to be within 1 hour of the office and fit for work at all times.

  Each position has additional personnel trained for support. In total the APU IMT has the following trained personnel:
  - Incident Commander x 7
  - Ops section Chief x 6
  - Planning Section Chief x 6
  - Aviation and Marine Unit Leader x 6
  - Logistics Section Chief x 5
  - Finance Section x 6
  - Safety Officer x 3
  - Public Information Officer x 15
  - Human Resources x 2
  - Technical Specialist x 5
  - IT Support Personnel x 12
- The Roster is managed weekly and available personnel are identified early to ensure continuity when other personnel are not available.
- In addition to the above roles identified, BHP has the additional roles:
  - Finance x 6
  - Technical Environmental Specialists x 6
  - Legal Specialists x 2
  - HR specialists x 2
  - IT coverage is provided by Minerals Australia TROC, a 24 hour onsite IT service that will response to support the Australia Production Unit x 2.
- All off rostered personnel would be activated in support of the on call IMT, relief shift patterns would be developed to establish continuity in managing the event.

Additional Personnel

Additional personnel, not on the APU IMT would be resourced due to their specific discipline to provide support to the IMT. Perth office has around 120 personnel that would fulfil this requirement.

- As all events would be managed by the online EMQnet system, additional resources could be sourced remotely i.e. BHP Operations in Trinidad and Tobago, Gulf of Mexico and Houston.
- For long-term protracted events, additional expertise would be sourced from Houston and deployed to the APU to provide support to the IMT for the on ongoing management of the event.
- Other EMTs within Minerals Australia are collated at 125 St Georges Terrace. They have similar resources and structure and are available under existing internal Mutual Aid Arrangements.
- AMOSC Core group are able to provide Technical support as well as personnel. Around 100 personnel are available under the joint agreement.

Off rostered personnel from the Pyrenees and Macedon facilities would also be available to provide personnel support if required.

10.6.5 Emergency Management Team

The role of the EMT is to provide strategic leadership and support. The EMT Leader is notified within 15 minutes of IMT Activation by the Incident Commander or the BHP Emergency and Crisis Centre (ECC). The BHP EMT is based in Houston, USA. The EMT structure is show in Figure 10-8 and the roles and responsibilities are described in Table 10-9.

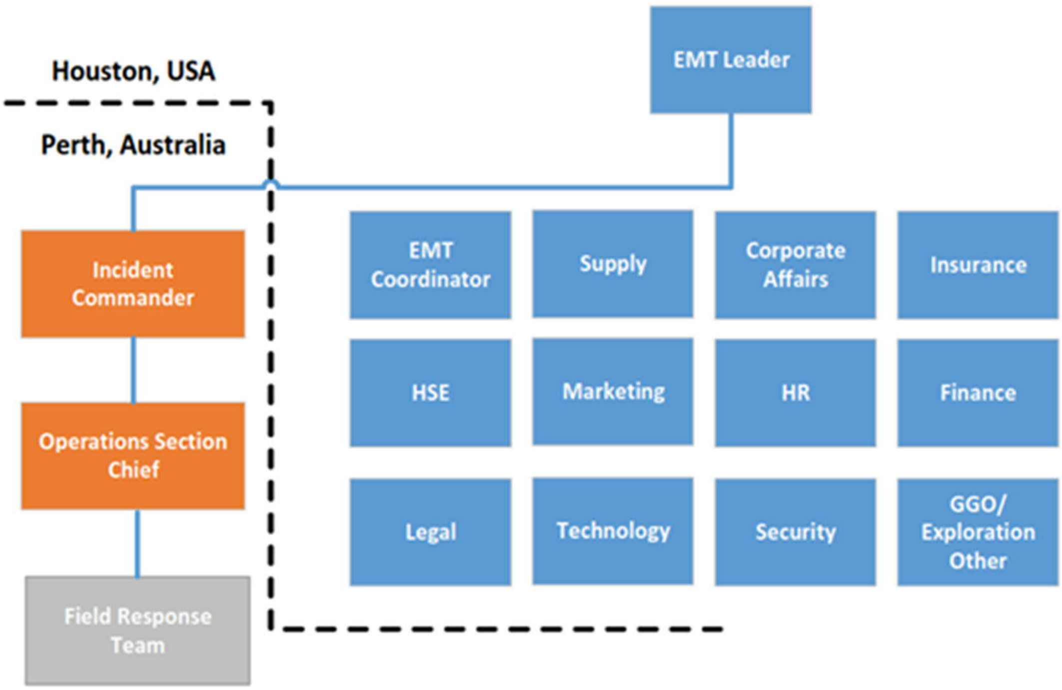


Figure 10-8: EMT structure

Table 10-9: EMT roles and responsibilities

Role	Responsibilities
EMT Leader	Overall responsibility for the management of the response including setting strategic objectives, assigning tasks and providing updates to the Asset President, Petroleum President and Group CEO.
EMT Coordinator	Coordinating all information management needs for the EMT. This includes documentation of incident information and providing administrative support for the EMT.
Legal	Provision of legal advice relating to response activities and public communications, applicable regulatory requirements and any potential liabilities or investigative issues.
Corporate Affairs	Managing Internal and External stakeholder\s as well as media and other communications related to the incident
Human Resources	Management of all personnel issues including family liaison and communication with contractors as appropriate.
Technology	Specialist advice and support relating to all technology systems and implementation of the Disaster recovery plan
HSE	Safety and effective Risk Management of incident response and providing functional oversight and planning expertise for health, safety and environment.
Security	Provision of specialist security advice pertinent to the incident and other affected locations. Security will also liaise with relevant international or local security agencies.
Finance	Tracking financial expenditures for the response, forecasting potential financial impacts and ensuring appropriate systems are in place to make emergency payments.
Marketing	Ensuring the interpretation of the past or current state or condition of one or more commodity markets (or a prediction as the future state or condition of the same), including an opinion as to the nature or effect of events in or affecting such markets.
Supply	Facilitation of the end-to-end procurement process through engagement with third party commercial counterparties by leveraging technical and commercial expertise.
Insurance	Provide support on global insurance exposure, underwriting information and external insurance policies.
GGO/Exploration or Other	The GGO/Exploration function is responsible for supporting the lead contractor during a GGO/Exploration event.

10.6.6 Notifications

The LWI vessel contractor will provide the initial response to an oil spill. Response equipment is located on the vessel. The LWI vessel contractor will follow their SOPEP procedures regarding use of appropriate spill response and amount of spill equipment required.

BHP will be notified immediately of any incident by the LWI vessel contractor.

10.6.7 Oil Spill Response Organisations

In line with BHP Crisis and Emergency Management arrangements, BHP has established formalised third party contracts and agreements with defined performance standards/criteria for the provision of resources, services or equipment in support of emergency response activities. These resources will be activated, dispatched and deactivated prior to and during an emergency.

BHP maintains contracts with a number of Oil Spill Response Agencies (OSRAs). The main relationships are detailed in the sub-sections.

AMOSC

The Australian Marine Oil Spill Centre (AMOSC) is an industry funded oil spill response facility based in Geelong, Victoria. AMOSC resources include:

- AMOSC spill response equipment stored at AMOSC and at other locations;
- Oil company equipment based at various locations; and
- Trained industry response ("Core Group") personnel.

AMOSC form part of BHP's First Strike and primary response strategy to a spill, and will be deployed within 12 hours of notification. Only nominated BHP personnel can request the assistance of AMOSC (see *APU Emergency Contact Directory, AOHSE ER-0002-005*) and this is usually conducted via the Perth IMT. AMOSC can be placed on the levels of advice listed in Table 10-10. Information regarding activation and mobilisation is outlined in the OPEP (Appendix G).

Table 10-10: AMOSC advice levels

AMOSC Advice Level	Status	AMOSC Requirements
Level 1	Forward Notice	• Advise a potential problem. • Provide or update data on oil spill. • Update information on spill and advise 4 hourly.
Level 2	Standby	• AMOSC resources may be required. • Assessment of resources and destination to be made. • Update information on spill and advise 2 hourly.
Level 3	Callout	• AMOSC resources are required. • Detail required resources and destination.

AMOSC maintains a core group of approximately 100 key personnel from oil industry member companies around the country who are trained and regularly exercised in oil spill response operations. Access to the Core Group is via AMOSC.

The cooperative arrangements for response to oil spills by Australian oil and associated industries are brought together under the AMOSPlan. The AMOSPlan will be activated by BHP when the response to an oil spill incident is regarded by BHP as requiring resources beyond those of the company itself.

In the event that the oil spill response requires the call out of AMOSC's own resources, the call out request is made directly to AMOSC by the Perth IMT. Should the response require mutual aid from equipment owned and personnel employed by another company, the request for assistance is made directly company to company via each company's nominated Mutual Aid Contact.

In addition, BHP will also be required to contact AMOSC to activate the Standing Agreement (92032701.WP5) and the Service Contract (for the borrowing company), in the event that BHP require equipment from another company.

Oil Spill Response Limited (OSRL)

BHP is a member of the OSRL group. OSRL is an industry-funded oil spill response organisation with offices in Singapore, Bahrain, Southampton, Aberdeen, and London. OSRL have capacity to mobilise additional equipment and personnel to APU from their Singapore location.

Updates on the availability of OSRL's equipment availability is provided via a weekly Equipment Stockpile Status Report from OSRL's website at:

http://www.oilspillresponse.com/activate-us/equipment-stockpile-status-report

The Equipment Stockpile Status Report provides a quick and timely overview of the availability of OSRL's equipment stockpile globally and is especially useful in assuring OSRL's readiness. It also provides a vital overview of the resources that BHP would be able to access in the event of a spill. Under OSRL's Service Level Agreement (SLA), the first member who initiates mobilisation of OSRL will be entitled to a maximum 50% of the stockpile, while the second member is entitled to a maximum 50% of the remaining stockpile (and so on).

In addition to the Equipment Stockpile Status Report, OSRL provides a response equipment list that provides an overview of the size, type and ancillaries required for the equipment that is available at their bases. To ensure efficient and timely response capability, OSRL also have also pre-packaged some of the equipment into loads ready for dispatch, that are suitable for general spill situations and operating environments.

The equipment list (Appendix B of the OPEP) can also be found at:

http://www.oilspillresponse.com/files/OSRL_Equipment_List.pdf

In addition to providing response equipment, OSRL also supply a selection of ground staff who have the practical skill and experience to assist and support BHP in a spill response and are trained in using the Incident Command System (ICS) structure. Response teams will comprise:

- Team Manager;
- Operations Manager; and
- Senior technicians/ technicians.

OSRL can be called upon to provide immediate technical advice and begin to mobilise personnel if required. OSRL would be called on to lead small specialist teams and/or provide supplementary labour and equipment if ongoing response is required. Any OSRL resources being mobilised from Singapore would be expected to be on the scene in Perth following notification by the IMT in a similar timeframe to resources being mobilised from eastern Australia. Only nominated BHP personnel may request the assistance of OSRL via the IMT Leader.

OSRL also has a Memorandum of Understanding (MoU) with AMOSC, and OSRL may also be activated by AMOSC to provide resources to AMOSC to respond to a situation. Following initial spill notification, OSRL may be mobilised if required within 8 hours.

The Response Group

BHP has a contract in place with The Response Group, located in USA, for the provision of oil spill response personnel and resources for combating an oil spill. They can provide support remotely or deploy personnel to the APU (IMT or FRT).

The Response Group maintain a 24-hour Support contact: +1 (281) 880-5000.

Technical Support

BHP has arrangements in place with SGS Australia to provide 24/7/365 emergency response support in the form of access to emergency response teams. In the first week of a response, SGS would make available 25 personnel from their global emergency response team network at week 2 taking into account staff rotations. Similarly, BHP has arrangements in place with Bennelongia Environmental Consultants who have a staff of up to 10 personnel that could be rotated through specialist avifauna environmental monitoring positions, which could be expanded through access to the Birds Australia network.

BHP has arrangements in place with GHD Pty Ltd to provide environmental monitoring services in support to the emergency response teams. GHD would make available 10-15 personnel, increasing to 20 personnel, with environmental science qualifications and environmental monitoring skills, to rotate through field monitoring positions. To meet any need for additional personnel, GHD would draw from a wider pool of 40-50 environmental staff and GHD subcontractors across Australia.

General Support

BHP has arrangements in place and access to providers to supply personnel as required, for example 40-50 per provider to populate the response teams. BHP has tested these arrangements and considers that personnel for shoreline clean-up operations can be sourced to match and maintain the consequence of a worst-case spill. BHP will aim to mobilise shoreline crews prior to the predicted arrival of hydrocarbons. These crews will focus on pre-cleaning beach areas (e.g. removing debris such as seaweed to areas above the high tide mark) and establishing staging areas to enable a more efficient response when hydrocarbons are arriving ashore.

BHP will use a staged approach to mobilisation of shoreline personnel mobilising shoreline crews at the rate of 200 persons per day up to a level of around 500[4]. This level of personnel will be dependent on the location of the oil and the constraints noted below[5]. At this rate of mobilisation, it is considered that the number of shoreline responders needed to mount an effective response for the removal of bulk oil can be achieved within 2 – 3 weeks of mobilisation, noting that final polishing and treatment may extend beyond this timeframe until the termination criteria for sediment quality monitoring is achieved.

Additional labour resource requirements above the arrangements described for a temporary contract workforce can be drawn from the significant staff resources of BHP’s global petroleum operations, Iron Ore and other divisions that operate in Western Australia and more broadly across Australia. For example, BHP Iron Ore can use direct employees, contractor workforce or utilise current arrangements with Contractors to source additional personnel for shoreline clean-up. It is estimated that this could source an additional 1-2,000 persons to the shoreline response without affecting those mining operations.

During the first strike response phase, BHP will rely on the skilled personnel (i.e. AMOSC Core Group, OSRL) to supervise and lead the unskilled workforce. In addition, personnel from the National Response Team (NRT), Aerial Operation staff from Aerotech 1st response will be mobilised. OSRL may also supply a selection of ground staff who have the practical skills and experience to assist and support BHP during a spill response and are trained in using the Incident Command System (ICS) structure.

Gaps in the trained personnel numbers during the sustained response phase would be filled by providing pre-mob training (1–2 days) to responders to skill up the workforce and reduce the dependency on the current trained personnel.

The gap in shoreline personnel being able to collect the bulk oil coming ashore will have the environmental impact of more oil having the potential to impact wildlife or to remobilise. This impact will be minimised by focusing response efforts in areas where wildlife are most abundant or identified as known high sensitivity. The operational NEBA takes into account seasonal variability, which will be further informed by operational monitoring from SCAT teams. The Operational NEBA will inform the Incident Action Plan and assign clean-up priorities accordingly.

The contract with Hays Personnel enables them to access a work force that have experience and background in the Oil and Gas and HSEQ Industry. Hays have estimated that they have upwards of 15,000 people on their database that currently fit the scope of work (i.e. labour intensive work relating to oil spill response). At an immediate request, Hays Personnel are capable of sourcing 200 people within 48 hours that have appropriate clearance checks for onsite work, in addition to which BHP will undertake on site inductions for arriving personnel. Hays Personnel also estimate that they can source an additional 500 people and have them fully site compliant and ready to mobilise in less than 3 weeks. This unskilled workforce would be used to resource response strategies such as RS5 Shoreline Protection (Section 9.4.5) and RS8 Shoreline Clean-up (Section 9.4.6) and broken into smaller work teams of 10 people that would then be each supervised by trained oil spill responders. Thus, the 500 workers provided by Hays Personnel would require approximately 50 trained oil spill responders acting as supervisors overseeing implementation of the IAP. This requirement will be scaled up or down depending on the size of the incident drawing on the additional resource companies described above. In summary, it is considered that BHP has access to an acceptable level of resources that are flexible and scalable to deal with the range of potential scenarios that may occur during the unlikely event of a hydrocarbon spill.

4 Ramp up capability of 200 persons /day from Day 3 of response

5 Assumes shoreline crews staged out of Coral Bay, Exmouth, Onslow, Karratha

10.6.8 Spill Response Logistics

A Level 3 response will require a large number of equipment and personnel to be deployed and accommodated in multiple locations. Coordination of these aspects of the response will be the responsibility of the Logistics section in the IMT (refer to Section 10.6.4). BHP has a number of existing arrangements for the storage and transport of equipment in the Exmouth area, which will be initially used in a response. These arrangements include agreements with logistics providers for air, marine and land.

The current facilities in Exmouth can be supplemented by regional resources within appropriate timeframes for the response. Regional locations such as Onslow, Karratha and Port Headland are equipped to manage the logistical arrangements for construction, mining and petroleum projects, which are similar in scale to a Level 3 response. BHP maintains a supply base in Dampier, which is immediately available to support response operations. These resources involve the movement of personnel, freight and equipment over large distances.

BHP has internal resources (Material Logistics and Supply Team) and utilises third party logistics providers (i.e. Agility Logistics) for movements of freight from overseas locations by air or sea. The Material Logistics and Supply teams, along with the specialist contractors, are highly experienced in procurement and supply chain management for large scale projects and ongoing offshore operational activities. These skills are directly transferable to a Level 3 response. Many of the Material Logistics and Supply Team are trained in the Logistics Section Chief role and are on the IMT roster.

Road transportation of personnel will be by hire cars (for team leaders, SCAT teams, small teams) and by charter buses for large movements of teams such as shoreline responders. BHP has arrangements in place with providers (i.e. Budget, Avis, Exmouth Bus Charters) that are based in Exmouth that can call on additional resources regionally as well as other regional providers. Regional providers can supplement the Exmouth arrangements within 2-3 days. BHP Minerals has a large Non Process Infrastructure (NPI) team who will support BHP Petroleum with aviation, accommodation and power logistics, making charter flights, mine camps and aerodromes in the Pilbara available for the response. BHP has experience in moving large numbers of personnel over large distances during cyclone de-manning and for the construction phases of the Macedon project and Minerals projects.

Freight logistics by road will utilise existing local contracts (i.e. Exmouth Freight and Logistics) and other local operators supplemented by larger regional providers (i.e. Centurion and Toll). BHP has existing arrangements in place for large scale freight movements by road in the North West and has recent experience in moving large volumes of equipment for the Macedon project as well as our multiple Iron Ore operations, particularly during recent major construction projects.

Exmouth is a permanent home to 2,400 people although during tourist months the figure swells to up to 6,000. It is therefore accustomed to accommodating large influxes of people. Accommodation is likely to be a restraint in the response as the lack of suitable accommodation may restrict the numbers of responder personnel that could be brought into the region. There is a variety of accommodation options in Exmouth ranging from hotel/motel, backpacker, holiday home rental and caravan and camping sites. This can be supplemented by FIFO arrangements with mine camps, accommodation and aerodromes within the iron ore side of the business.

Dampier and Karratha currently have additional accommodation with large accommodation villages (i.e. Gap village) previously used for large construction projects available. These facilities can be used to accommodate responders to address shorelines in the Onslow – Dampier region if required or as a base for long commute by road or air to locations further south.

The modelling indicates that islands may be affected by hydrocarbons in a Level 3 spill. BHP has undertaken an assessment of the requirements that would be needed to support clean-up operations on these islands. A Tactical Response Plan has been developed for the Muiron Islands. Other islands in the worst-case spill EMBA have similar coastal characteristics and can expect similar scale of response in terms of personnel and equipment. Small commercial vessels/utility vessels can be used to access these islands, however, the preferred method would be the use of landing craft for transport of equipment and waste. BHP has assessed that there are a number of suitable vessels that would be able to be contracted in a response that are operating regionally.

10.6.9 State and National Resources

In accordance with the State Hazard Plan – Maritime Environmental Emergency (SHP-MEE), and following consultation with the DoT, additional personnel to assist with labour intensive aspects of a response (if required) will be sourced through the State Combat Committee (Executive Advisory Group). Depending on the level of response required, sources of labour may include the local shire, DBCA and AMSA.

Under the National Plan, a National Response Team (NRT), comprising experienced personnel from operator to senior spill response manager level from Commonwealth/State/NT agencies, industry and other organisations, has been developed.

The services of the NRT will be obtained through the Environment Protection Group (EPG) and AMSA, which has made arrangements with the respective government and industry agencies, for the release of designated personnel for oil spill response activities. These services will be activated when it is assessed that an oil spill incident exceeds the resource availability at the state level.

During a National Plan incident, the BHP Perth IMT or the Marine Pollution Controller appointed by a Control Agency may submit a request to AMSA for personnel from other States/NT to become part of the Incident Management Team or the incident response team.

A request should be made initially through the Environment Protection Duty Officer via the Emergency Response Centre on 1800 641 792 or 02 6230 6811. This request must be followed by written confirmation within three (3) hours of the verbal request.

The following information will be provided when making such a request:

- Roles or skills required (e.g. Planning Officer, Aerial Observer);
- Number of personnel required to fill each role;
- Contact name, address, and time of where personnel are to initially report; and
- Brief overview of the work to be undertaken.

Suitable personnel will then be selected by AMSA from the National Response Team or the National Response Support Team (NRST), unless special circumstances exist.

10.6.10 Industry Resources

BHP is a Full Member of AMOSC and as such has access to Industry Mutual Aid Arrangement equipment and National Plan equipment held as part of the contingency plans of the Australian Oil Industry and the Australian Government. AMOSC require confirmation from mobilisation authorities to access equipment listed under the National Plan.

All National Plan, AMOSC and those industry equipment resources that are registered with AMOSC, which are potentially available for response to an incident, are listed in the Marine Oil Spill Equipment System (MOSES) database. The MOSES database is a computer database that lists the type, quantity, location, status and availability of pollution control equipment. It is also used to manage audits, maintenance and repair of AMSA-owned equipment (Appendix B of the OPEP).

Normal requests for assistance are directed to AMOSC in Geelong to coordinate, but equipment may also be accessed through the MOSES database, or AMSA – Marine Environmental Protection Services (MEPS).

10.6.11 Government Agency Notification

BHP response teams are hierarchical in nature, and response teams and resources are progressively activated depending on the severity of an incident. Government Agencies and Industry Organisations may also be mobilised (refer to First Strike Plan in the OPEP). The Crosby-3H1 LWI Activities Stakeholder Database will be used to maintain contact with identified stakeholders.

10.6.12 Exmouth Working Group

BHP, in conjunction with Santos and Woodside, has established an Exmouth Working Group to mutually assist in oil spill preparedness and response in the Exmouth region. All three operators have similar assets in the region and, therefore, similar risk profiles.

10.6.13 Industry Joint Venture Programmes

BHP undertake Joint Venture Programmes with other operators and organisations including, but not limited to, Santos, Woodside, Vermillion, DoT and AMOSC. These programmes aim to develop operational guidelines, operational tests, training processes and plans to inform and prepare oil spill response strategies. The programmes also provide guidance and training around First Strike incident plans, key operational considerations, understanding of shoreline sensitivities and lists of resources required to implement response.

10.6.14 Review and Testing of the OPEP

Control and Distribution of the OPEP

The *Crosby-3H1 Light Well Intervention OPEP (PYHSE-ER-0006)* (Appendix G) shall be controlled as described by the BHP *Australian Production Unit (APU) Document Control Procedure (AOIM-0001*). This procedure describes the process of approval, issue and withdrawal of APU controlled documents. The OPEP shall be issued as per the distribution list. The APU Document Controller is responsible for the distribution of the OPEP.

Review of the OPEP

Due to the short duration of the light well intervention activity, a review of the OPEP is not anticipated to be required.

The APU HSE Manager is responsible for assessing any changes and deciding if the changes require a resubmission of the OPEP under Section 17 of the Environment Regulations.

Response Testing

The OPEP references response strategies common to the arrangements within the Pyrenees Operations OPEP. Key responsibilities for personnel are provided in Section 10.6.4. Testing of the response arrangements described in the OPEP will align with the BHP *APU Incident Management Team Desktop Exercises Procedure (AOHSE-ER-0020)*. In a typical year across the APU, there are six desktop exercises, of which at least two are oil spill related.

BHP will conduct a desk-based emergency response exercise that will include an oil spill scenario related to the Crosby-3H1 well intervention activities at least 30 days before commencing the activity. Observations during this exercise will be noted and findings from the exercise will be recorded and tracked to closure to ensure continual improvement.

Schedule of Response Testing

BHP maintains a schedule of testing of response arrangements of the various OPEPs. The schedule will be revised if any of the conditions identified in Regulation 14(8C) change. The objectives of the response exercises are to test BHP oil spill response arrangements for Australian offshore operations, which includes the Pyrenees Facility Operations and activities covered under the Crosby-3H1 LWI EP.

BHP undertakes testing of response arrangements in accordance with the *Petroleum Health Safety and Environment - Crisis and Emergency Management Standard (PET-HSE00-HX-STD-00001)*. This describes the performance requirements to conduct emergency response training and exercises, including the review of role requirements and applicable plans. The mechanism for examining the effectiveness of each test against the objectives is determined by: Exercise Facilitator(s), Crisis and Emergency Management Subject Matter Experts, and HSE Manager during the planning and execution of each exercise. Actions from exercises are tracked and closed out via the BHP 1SAP system.

Response Personnel Training [Management]

The APU HSE Manager is responsible for the overall management of the IMT including:

- Training and competency;
- Ensuring the IMT is adequately resourced; and
- Maintaining the associated training documentation for Emergency Response.

The IMT is mainly resourced by personnel from the BHP Australian Production Unit (APU), except for the Legal team where additional external specialists make up part of the team. An individual is assigned to join the APU IMT roster by their line manager and the APU HSE Manager. Where possible the IMT role is aligned to the individuals' current role responsibilities (refer to Table 10-11). For example, the Operations Section Chief is drawn from the Engineering and Operations teams. This ensures that a person assigned to an IMT role brings a depth of technical knowledge to the APU IMT.

Table 10-11: IMT competencies

IMT Position	Selected from	CEM Induction	ICS100	ICS 200
Incident Commander	Functional Managers	Y	Y	Y
Operations Section Chief	Engineers and Operations Specialists	Y	Y	Y
Planning Section Chief	Engineers / HSE	Y	Y	Y
Logistics Section Chief	M&L Specialists	Y	Y	Y
Human Resources Coordinator	HR Specialists	Y	Y	N
Environment Unit Leader	Technical Assistants	Y	Y	Y
Public Information Officer	External Affairs Specialists	Y	Y	N
Legal	Legal Specialists and Internal Counsel	Y	Y	N
Safety Officer	HSE Specialists	Y	Y	Y

Once nominated for an IMT role, the candidate must complete the following Training and Assessment before engagement in an IMT role:

- An online BHP Crisis and Emergency Management (CEM) induction program;
- ICS 100/200; and
- IMT Role Specific Training Session.

Once in the role IMT members are required to participate in regular desktop exercises and major exercises as described above. The ad hoc mobilisation (EMQnet) drills are also arranged to test a range of IMT responses, including oil spill response, as per the exercise schedule in BHP *APU Incident Management Team Desktop Exercises Procedure AOHSE-ER-0020*.

The APU IMT is mobilised to the IMT Room located in the BHP offices 125 St Georges Terrace, Perth, Western Australia and is capable of responding to an incident within 1 hour of activation. Test call-out notifications are conducted each Thursday. In addition, a weekly unscheduled test notification is made to check response times to the call out message. IMT members will be identified to undertake further training to further develop in-house capabilities and knowledge around oil spill response. Alternative providers for the identified courses may also be used if they meet the required outcomes.

In order to implement and maintain core group competencies, BHP will align with current AMOSC practice of a skills maintenance program, which requires that members complete skills maintenance activity before the end of the 36 month timeframe (as outlined in the AMOSC Core Group Program and Policies). As part of the weekly IMT handovers, set desktop exercise's and additional oil spill response training, BHP maintain a continual improvement cycle of core group competences and training in relation to oil spill response readiness.

Audits

Audits of External Organisations

A formal audit of AMOSC is done by representatives of member companies annually. At the conclusion of an audit, improvement opportunities and corrective actions are formally noted and corrective actions assigned. In some instances changes may be required to the OPEP, but changes will only be made in accordance with the OPGGS (Environment) Regulations.

Audits of Internal Actions

Following an emergency spill incident there may be a requirement for legal and/ or other regulatory or formal HSEC incident investigations to be conducted in accordance with the BHP HSEC Management System.

In addition to this, it is essential that the IMT response actions are reviewed as soon as practicable after an incident. The aim of the incident review is to identify any particular lessons that should be shared across the Company, and that can be used to improve the plans or response actions in the future.

Post-spill debriefs address:

- Spill causes, if known;
- Spill response;
- Speed;
- Operation;
- Effectiveness;
- Equipment suitability;
- Health and safety issues, as appropriate; and
- Integration of plan and procedures with other response organisations, consultants, and or agencies.

10.6.15 Incident Reporting Requirements

BHP employees and contractors are required to report all environmental incidents and non-conformance with commitments made in the EP. A computerised database called 1SAP is used for the recording and reporting of these incidents. Detailed investigations are completed for all actual and high potential environmental incidents. The classification, reporting, investigation and actioning of environmental incidents are undertaken in accordance with BHP HSEC Management Standards. Incident corrective actions are monitored using 1SAP and closed out in a timely manner. In addition to the internal notification and reporting requirements outlined above, the reporting requirements for environmental incidents are outlined in previous Section 10.5.

10.6.16 OPEP Consultation

The BHP APU HSE Manager shall arrange for copies of the OPEP requirements to be forwarded to the following key Response Agencies:

- Australian Maritime Oil Spill Centre (AMOSC); and
- WA DoT Oil Spill Response Coordination (OSRC) Unit.

10.6.17 Pollution Insurance

BHP and all subsidiary companies, including BHP Petroleum Australia maintain liability insurance for sudden and accidental pollution up to a limit of US $800 million per occurrence.

10.6.18 Cyclone Response

Tropical cyclones have the potential to cause damage to equipment, risk to the safety and health of personnel and potential to cause spills of hazardous materials into the environment from damaged equipment and vessels.

As the timing of the Crosby-3H1 well intervention activities may change, it is possible the campaign could overlap with the cyclone season (November to April, with most cyclones occurring between January and March). If well intervention is conducted in cyclone season, the LWI vessel contractor must have a Cyclone Contingency Plan (CCP) in place outlining the processes and procedures that would be implemented during a cyclone event, which will be reviewed and accepted by BHP.

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Appendix A

BHP Charter

BHP

Our Charter

We are BHP,
a leading global resources company.

Our Purpose

To bring people and resources together to build a better world.

Our Strategy

Our strategy is to have the best capabilities, best commodities and best assets, to create long-term value and high returns.

Our Values

Sustainability
Putting health and safety first, being environmentally responsible and supporting our communities.

Integrity
Doing what is right and doing what we say we will do.

Respect
Embracing openness, trust, teamwork, diversity and relationships that are mutually beneficial.

Performance
Achieving superior business results by stretching our capabilities.

Simplicity
Focusing our efforts on the things that matter most.

Accountability
Defining and accepting responsibility and delivering on our commitments.

We are successful when:

Our people start each day with a sense of purpose and end the day with a sense of accomplishment.

Our teams are inclusive and diverse.

Our communities, customers and suppliers value their relationships with us.

Our asset portfolio is world-class and sustainably developed.

Our operational discipline and financial strength enables our future growth.

Our shareholders receive a superior return on their investment.

Andrew S Mackenzie

Andrew Mackenzie
Chief Executive Officer

May 2019

Appendix B

RELEVANT LEGISLATION, REGULATIONS AND OTHER REQUIREMENTS

Commonwealth Legislation and Regulations

Legislation or Regulation	Description
Air Navigation Act 1920	The Act relates to the management of air navigation.
Australian Maritime Safety Authority Act 1990	The Australian Maritime Safety Authority (AMSA) is a Commonwealth agency responsible for regulation of maritime safety, search and rescue, and ship sourced pollution prevention functions under the Navigation Act 1912 (Cth), protection of the sea legislation, including the Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (Cth) and subordinate legislation made pursuant to these Acts.
Biosecurity Act 2015	This Act is about managing diseases and pests that may cause harm to human, animal or plant health or the environment. The proposed amendments also strengthen Australia's ability to manage ballast water in ships. They will provide additional protection for coastal environments from the risk of marine pest incursions by fostering new ballast water treatment technologies and phasing out ballast water exchange.
Biosecurity Regulation 2016	The Biosecurity Regulation prescribes a number of measures and obligations that are common between the Biosecurity Act. Pre-arrival reporting, cost recovery and the isolation and export power provisions all support business as usual activities that were available under the Quarantine Act and therefore represent no substantive change.
Environment Protection & Biodiversity Conservation Act 1999 (EPBC Act)	Commonwealth Department of Sustainability, Environment, Water, Population & Communities administers Act that provides legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places—defined in the EPBC Act as matters of national environmental significance (NES). These include nationally threatened species and ecological communities, migratory species and Commonwealth marine areas. The Act regulates assessment and approval of proposed actions likely to have a significant impact on a matter of NES. The approval decision is made by a delegate of the Australian Government Environment Minister.
Environment Protection and Biodiversity Conservation Regulations 2000	Regulations provide for a wide range of detail essential for the operation of the Act, including regulations relating to management of Commonwealth reserves, information requirements for assessment processes, enforcement, granting of various permits, publication requirements and criteria that need to be met in relation to a wide variety of decision making processes provided for under the Act.
Environment Protection and Biodiversity Conservation Act 1999 - Proclamation - Ningaloo Marine Park (Commonwealth Waters)	Declaration of Ningaloo Marine Park in Commonwealth Waters.
Environment Protection (Sea Dumping) Act 1981 Environment Protection (Sea Dumping) Regulations 1983	The Act regulates the dumping at sea of controlled material (including certain wastes and other matter), the incineration at sea of controlled material, loading for the purpose of dumping or incineration, export for the purpose of dumping or incineration, and the placement of artificial reefs. Permits are required for any sea dumping activities. Operational discharges from vessels are not defined as 'dumping' under the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 and therefore not regulated under the Act.
Hazardous Waste (Regulation of Exports and Imports) Act 1989	Relates to controls over import and export of hazardous waste material. Permits are required to import waste into Australia.
Industrial Chemicals (Notification and Assessment Act) 1989	The Act establishes the National Industrial Chemicals Notification and Assessment Scheme (NICNAS) to regulate the supply of chemicals into Australia, and importers or manufacturers of chemicals or chemical products

Legislation or Regulation	Description
	must comply. The Act involves assessing and registering industrial chemicals in a national scheme and applies to solvents, adhesives, plastics, laboratory chemicals and paints, as well as chemicals used in cleaning products. Chemicals are defined by exclusion: a substance is an industrial chemical if it is not an agricultural or veterinary product, medicine or medicinal product, food additive, contaminant or natural toxicant.
Maritime Transport and Offshore Facilities Security Act 2003	Department of Infrastructure & Transport (Maritime Security for Offshore Oil & Gas) regulate offshore security plans and Maritime Security Identification Cards (MSIC's).
Maritime Transport and Offshore Facilities Security Regulations 2003	Department of Infrastructure & Transport (Maritime Security for Offshore Oil & Gas) regulate offshore security plans and MSICs.
National Environment Protection Council Act 1994	This Act provides for the establishment of a National Environment Protection Council (NEPC), and empowers the setting of National Environmental Protection Measures (NEPM). Under the NEPC Act, the Commonwealth has agreed to apply any adopted NEPM to its activities as part of the fulfilment of its obligations under the Intergovernmental Agreement on the Environment 1992 and enables application of State law to ensure uniformity in national pollution standards and environmental protection. NEPMs can only be made to address the following 7 environmental issues: 1.ambient air quality; 2.ambient marine, estuarine and fresh water quality; 3.noise standards; 4.site contamination assessment guidelines; 5.hazardous waste impacts; 6. re-use and recycling of used material; and 7.motor vehicle noise and emissions.
National Environment Protection (National Pollutant Inventory) Measure 1998	The National Pollutant Inventory (NPI) is a database established to provide information on substances being emitted to the air, land and water, and transported in waste. The inventory tracks the magnitude of emissions and the amounts transported in waste of 93 substances. While the NPI NEPM is a federal initiative, each state has legislation giving effect to the program.
National Greenhouse and Energy Reporting Act 2007	This Act provides for the reporting and dissemination of information related to greenhouse gas emissions, greenhouse gas projects, energy production and energy consumption, and for other purposes.
Navigation Act 2012	This Act establishes framework for controls on navigation, marine safety and shipping for ships in Australian waters or territories primarily proceeding on international or inter-state voyages.
Navigation (Orders) Regulations 1980	Details the penalty where Marine Orders are prescribed as "Penal Provisions".
Marine Orders	Marine Orders (MO) are subordinate rules made pursuant to the Navigation Act 1912 and Protection of the Sea (Prevention of Pollution from Ships) Act 1983 affecting the maritime industry. They are a means of implementing Australia's international maritime obligations by giving effect to international conventions in Australian law.
Marine Order 32 - Cargo Handling Equipment	MO32 relates to loading and unloading of cargo, and the safe transfer of persons, from ships, off-shore industry vessels and off-shore industry mobile units
Marine Order 41 Carriage of Dangerous Goods	MO41 gives effect to Part A Chapter VII of SOLAS, in particular the International Maritime Dangerous Goods Code (IMGDC) which deals with the carriage of dangerous goods in packaged form, together with prescribing other matters related to carriage of dangerous goods in ships, notice of intention to ship dangerous goods, and provisions related to the loading, stowing, carriage or unloading in ships of cargo.
Marine Order 58 – International Safety Management Code	MO58 specifies the requirements of the International Safety Management (ISM) Code and gives effect to Chapter IX of SOLAS. The purpose of the ISM Code is to provide an international standard for the safe management and operation of ships and for pollution prevention.
Marine Order 59 –Offshore Industry Supply Vessels	MO59 specifies a number of performance-based requirements for safe navigation and a safe system of operations for off-shore industry vessel operations, including arrangements for safe operations during emergencies. The Order specifies guidelines considered to satisfy these performance-based

Legislation or Regulation	Description
	requirements. The Order also allows alternative practices to be considered and approved as equivalent to those practices in the specified guidelines (NWEA Guidelines). MO59 applies to vessels not registered in Australia, if vessel is engaged in operations associated with or incidental to petroleum exploration or production activity.
Marine Order 91 - Marine Pollution Prevention - Oil	MO91 gives effect to Annex I of the International Convention for the Prevention of Pollution from Ships 1973, as amended by the Protocol of 1978 (MARPOL 73/78).
Marine Order 93 - Marine Pollution Prevention - Noxious Liquid Substances	MO93 gives effect to Annex II of the International Convention for the Prevention of Pollution from Ships 1973, as amended by the Protocol of 1978 (MARPOL 73/78). Details the discharge criteria and measures for the control of pollution by noxious liquid substances carried in bulk. It subdivides substances into and contains detailed operational standards and procedures. Some 250 substances are appended to the London Convention. The discharge of their residues is allowed only to reception facilities until certain concentrations and conditions (which vary with the category of substances) are compiled with. In any case, no discharge of residues containing noxious substances is permitted within 12 miles of the nearest land.
Marine Order 94 - Marine Pollution Prevention – Package Harmful Substances	MO94 gives effect to Annex III of the International Convention for the Prevention of Pollution from Ships 1973, as amended by the Protocol of 1978 (MARPOL 73/78) in relation to packaged harmful substances.
Marine Order 95 - Marine Pollution Prevention - Garbage	MO95 gives effect to Regulation 8 of Annex V (dealing with port State control on operational requirements) and prescribes matters in relation to Regulation 9 of Annex V (dealing with placards, garbage management plans and garbage record-keeping) to the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78).
Marine Order 96 Marine Pollution Prevention - Sewage	MO96 sets out MARPOL requirements in relation to survey and certification requirements; how sewage should be treated or held aboard ship; and the circumstances in which discharge into the sea may be allowed.
Marine Order 97 - Marine Pollution Prevention - Air Pollution	MO96 sets out MARPOL requirements in relation to air pollution.
Marine Order 98 Marine Pollution - Anti-fouling Systems	MO98 gives affect Articles 3, 4 and 10 of the Anti-Fouling System Convention and Annex 4 to that Convention which provides for controls on anti-fouling systems, and the survey, inspection and certification of ships in relation to those systems. MO98 also prescribes various matters, such as survey and certification requirements and forms to be used to report incidents, for the purposes of the Protection of the Sea (Harmful Anti-fouling Systems) Act 2006.
Notices to Mariners	Issues Nautical Charts. Manages marking of Safety Zones after NOPSEMA gazetting under OPGGSA Section 612 and Marine Cautionary Zones.
Offshore Petroleum and Greenhouse Gas Storage Act 2006	Legislation concerning Australian offshore petroleum exploration & production in Commonwealth Waters. National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) is an independent safety and environmental management Authority funded by levies on industry participants and regulates matters with powers conferred directly from OPGGSA and via Regulations concerned with: • Occupational Health & Safety law at Facilities and offshore operations under Schedule 3 • Environmental management • Structural integrity of Wells under Resource management regulations. NOPSEMA may also declare a 500 metre petroleum safety zone around wells associated with drilling operations.
Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009	Regulations administered by NOPSEMA to ensure offshore petroleum activity is carried out in a manner consistent with the principles of ecologically sustainable development and in accordance with an accepted environment plan, in particular:

Legislation or Regulation	Description
	• Assessment of environment plans (EP), including associated oil pollution emergency plans (OPEPs) [previously oil spill contingency plans (OSCPs)]; and • Investigation of accidents, occurrences and circumstances with regard to deficiencies in environmental management.
Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2009	Regulations administered by NOPSEMA particularly requiring that an accepted Safety Case is in force for a facility. A facility can include a Mobile Offshore Drilling Unit, and aspects of the Safety Case may interrelate with environmental considerations, such as the Facility Description and matters related to technical integrity of the facility.
Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011	NOPSEMA acceptance of well operations management plan (WOMP) & administration of regulations associated with well integrity.
Offshore Petroleum and Greenhouse Gas Storage (Regulatory Levies) Act 2003	Act to impose levies relating to the regulation of offshore petroleum activities, including well levies and environment plan levy.
Offshore Petroleum and Greenhouse Gas Storage (Regulatory Levies) Regulations 2004	Regulations prescribing the amount and method of calculation for imposition of levies relating to the regulation of offshore petroleum activities, including well levies and environment plan levy.
Ozone Protection and Synthetic Greenhouse Gas Management Act 1989	This Act gives effect to Australia's obligations under the Vienna Convention and the Montreal Protocol by introducing, a system of controls on the manufacture, import and export of substances that deplete ozone in the atmosphere and synthetic greenhouse gases.
Ozone Protection and Synthetic Greenhouse Gas Management Regulations 1995	Regulation contain controls relating to: import/export/manufacture licensing; manufacture and disposal of scheduled substances; refrigeration and air-conditioning; methyl bromide; and fire protection; import and export of any products and equipment containing hydrofluorocarbons, perfluorocarbons and SF6; and a requirement for importers and manufacturers to pay a levy incorporating a carbon charge component based on the equivalent carbon price.
Protection of the Sea (Harmful Anti-fouling Systems) Act 2006	Gives effect to the Control of Harmful Anti-Fouling Systems on Ships (HAF) Convention which makes it an offence for any ship bearing harmful chemical compounds on their hulls or external parts or surfaces to enter an Australian port, shipyard or offshore terminal, unless the ship bears a coating to prevent such compounds leaching into the water. A similar offence applies to Australian ships entering a port, shipyard or offshore terminal elsewhere in the world.
Protection of the Sea (Powers of Intervention) Act 1981	Act authorises AMSA to take measures for the purpose of protecting the sea from pollution by oil and other noxious substances discharged from ships and implements the International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties and the Protocol relating to Intervention on the High Seas in Cases of Pollution by Substances other than Oil. Act enables AMSA to take measures on the high seas to prevent, mitigate or eliminate the danger apparent upon a maritime casualty where there is grave and imminent danger to the coastline of Australia, or to the related interests of Australia from pollution or threat of pollution of the sea by oil which may reasonably be expected to result in major harmful consequences. Similar powers apply in relation to a ship which is in internal waters, is in the Australian coastal sea, or any Australian ship on the high seas where oil or a noxious substance is escaping, and gives AMSA power to take such measures as it considers necessary to achieve a number of objectives detailed in the Act.
Protection of the Sea (Prevention of Pollution from Ships) Act 1983	Act administered by the Australian Maritime Safety Authority (AMSA), deals with the protection of the marine environment from ship-sourced pollution. The Act implements the International Convention for the Prevention of Pollution from Ships 1973 and the subsequent 1978 Protocol to the Convention (collectively MARPOL 73/78) and setting operational and construction

Legislation or Regulation	Description
	standards for ships to prevent pollution and regulating normal operational discharges from ships. MARPOL 73/78 annexes regulate the discharge of oil (Annex I), noxious liquid substances (Annex II), the disposal from ships of sewage (Annex IV) and garbage (Annex V) and prohibit the disposal of harmful substances carried by sea in packaged forms (Annex III).
Protection of the Sea (Prevention of Pollution from Ships) (Orders) Regulations 1994	Sets penalty levels for non-compliance.
Protection of the Sea (Shipping Levy Collection) Act 1981	Levy is a charge against ships and is based on the "potential polluter pays" principle. The levy applies to vessels which are more than 24 metres in length and have onboard more than 10 tonnes of oil in bulk as fuel or cargo.
Underwater Cultural Heritage Act 2018	The Act replaces the *Historic Shipwrecks Act 1976* with a modernised framework for protecting and managing Australia underwater culture heritage. The Act protects shipwrecks that are at least 75 years old, whether their location is known or unknown, and associated relics. It also enables the Minister to protect shipwrecks that have been sunk for less than 75 years if they are of historic significance, such as ships wrecked during World War II. All relics associated with historic shipwrecks are protected both while associated with the shipwreck and after their removal, provided that they went down with the ship. The Act also enables the Minister to declare protected zones around historic shipwrecks. A permit is required to carry out prescribed activities, such as trawling, diving or mooring or using ships in a protected zone. The Act prohibits conduct that may interfere with protected shipwrecks and their associated relics.

Western Australian Legislation and Regulations

Legislation or Regulation	Description
Aboriginal Heritage Act 1972	Enacted to ensure that all Aboriginal cultural heritage within Western Australia could be properly protected and preserved. The Act provides recognition, protection and preservation of Aboriginal sites in Western Australia. It is an offence under s.17 of the Act to excavate, destroy, damage, conceal, or in any way alter an Aboriginal site.
Conservation and Land Management Act 1984	Department of Environment and Conservation (DEC) is responsible for the day to day management of marine parks vested with Marine Parks and Reserves Authority (MPRA) and provide administrative support to the MPRA. MPRA is responsible for the preparation of management plans for all lands and waters which are vested in it. Marine nature reserves, marine parks and marine management areas are the three reserve categories vested in the MPRA. Offshore operations must comply with specific marine park conditions when navigating or conducting activities in or near areas designated as marine sanctuaries for conservation, recreational, ecological, historical, research, educational, or aesthetic qualities, such as Ningaloo Marine Park (state waters) (Class A reserve) and Muiron Islands Marine Management Area.
Conservation and Land Management Regulations 2002	Details further requirements for protection of flora and fauna including restrictions on approaches to fauna, fishing restrictions and operation of vessels in marine protected areas. Also includes prohibition of pollution in marine protected areas.
Dangerous Goods Safety Act 2004	Act relating to the safe storage, handling and transport of dangerous goods and for related purposes.
Dangerous Goods Safety (Explosives) Regulations 2007	Relevant to storage and handling of explosives on marine support vessels.
Dangerous Goods Safety (Goods in Ports) Regulations 2007	'Goods in Ports' Regulations give legal status to the provisions of Australian Standard AS 3846 The handling and transport of dangerous cargoes in port areas. Requires classification of Dangerous Goods loads based on the International Maritime Dangerous Goods Code (IMDG) rather than ADG Code. Additional requirements are for safety management and emergency plans.
Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007	Regulations adopt NOHSC Standard for the Storage and Handling of Workplace Dangerous Goods. Western Australia has retained a licensing system for dangerous goods. In relation to dangerous goods, 'handling' includes manufacture, process, pack, use, sell, supply, carry and disposal of dangerous goods. References to the Australian Dangerous Goods Code (the ADG Code) in the regulations relate to the 7th edition of the ADG Code.
Emergency Management Act 2005	WestPlan-MTE details the emergency management arrangements relating to the prevention of, preparation for, response to and recovery from Marine Transport Emergencies that occur in WA waters.
Emergency Management Regulations 2006	DoT Marine Safety is the prescribed Hazard Management Agency for response under the Emergency Management Regulations 2006 for all emergencies in which there is an —actual or impending event involving a ship that is capable of causing loss of life, injury to a person or damage to the health of a person, property or the environment.
Environmental Protection Act 1986	Act contains measures for preventing or minimising pollution, which includes a general prohibition against pollution. Applicable areas include discharge of operational waste (sewage, galley waste) and oily water from vessels, gaseous emissions from diesel engines and ballast water exchange and discharge.
Environmental Protection Regulations 1987	Prescribes further matters to give effect to the Act including control of pollution and licence fees.
Environmental Protection (Unauthorised Discharges) Regulations 2004	Prescribes further details of materials that are prohibited from discharge into the environment.

Legislation or Regulation	Description
Fish Resources Management Act 1994	Act establishes framework for management of fishery resources. Commercial fishing is licensed or under a Fisheries Management Plan. Fisheries in WA waters are subject to the Act and include a wide range of aquatic organisms, other than protected species. Threatened aquatic species may be protected under State and Commonwealth biodiversity conservation laws. Department of Fisheries manages commercial and recreational fishing in Western Australia within four regions – the West Coast, Gascoyne, South Coast and North Coast. The Act also has power to declare Fish Habitat Protection Areas (FHPA).
Marine and Harbours Act 1981	Act to provide for the advancement of efficient and safe shipping and effective boating and port administration through the provision of certain facilities and services.
Marine and Harbours (Fuelling) Regulations 1985	Refuelling businesses in ports to be licensed.
Maritime Archaeology Act 1973	Maritime Archaeology Act of 1973 protects maritime archaeological sites in state waters, such as bays, harbours and rivers. Other than shipwrecks, it includes single relics, such as an anchor, and land sites associated with exploration, early settlements, whaling and pearling camps and shipwreck survivor camps.
Pollution of Waters by Oil and Noxious Substances Act 1987	Act relating to the protection of the sea and certain waters from pollution by oil and other noxious substances discharged from ships and places on land.
Pollution of Waters By Oil and Noxious Substances Regulations 1993	
Port Authorities Act 1999	Local Pilotage Directions apply to vessels navigating within declared ports such as the Dampier Port Authority (DPA) port limits however DPA complies with the Port Authorities Act 1999 (WA) and Port Authorities Regulations 2001 (WA) Part 3. The Regulations take precedent over Port Directions in the event of any conflict.
Port Authorities Regulations 2001	Pilotage services within the Port are licensed by DPA in the form of a pilotage provider's licence issued under the terms of the Port Authorities Regulations 2001.
Port of Dampier Marine Notice (002/2005)	Addresses sewage and putrescible waste discharge requirements whilst vessel in Port of Dampier.
Shipping and Pilotage Act 1967	Act relating to shipping and pilotage in and about the ports, fishing boat harbours and mooring control areas of the State.
Navigable Waters Regulations 1958	Prescribes further matters on navigational safety in WA waters, use of jetties, obstruction and wrecks, berthing and mooring of vessels.
Western Australian Marine (Sea Dumping) Act 1981	An Act to provide for the protection of the environment by regulating the dumping into the sea, and the incineration at sea, of wastes and other matter and the dumping into the sea of certain other objects.
Western Australian Marine (Sea Dumping) Regulations 1982	Primarily concerns fees and prescribed information for reports of dumping.
Western Australian Marine Act 1982	Before any commercial vessel can operate in the State of Western Australia, the vessel is required to have onboard a valid Certificate of Survey. Certificate of Survey is only issued when the vessel satisfactorily complies with the Western Australian Marine Act in respect to its hull, machinery and equipment and is crewed according to the WA Marine Act 1982.
WA Marine (Surveys and Certificates of Survey) Regulations 1983	Marine Safety is responsible for approving plans, inspecting, approving construction and carrying out periodical surveys of all commercial vessels under WA jurisdiction, be they passenger carrying, trading, fishing, or offshore industry vessels.
W.A. Marine (Certificates of Competency and Safety Manning) Regulations 1983	Marine Safety is responsible for administering national and internationally agreed competency standards; and for the examination of candidates for

Legislation or Regulation	Description
	commercial Certificates of Competency as master, mate or engineer in WA vessels.
Prevention of Collisions at Sea Regulations 1983	Regulations largely comprise the Rules set out in the International Regulations for Preventing Collisions at Sea 1972 (COLREGs) applicable in state and internal waters.
Wildlife Conservation Act 1950 Wildlife Conservation Regulations 1970	An Act to provide for the conservation and protection of wildlife.
Wildlife Conservation (Specially Protected Fauna) Notice 2006	Declaration of specially protected fauna in WA, including fauna that is rare of is likely to become extinct. List includes over 199 species, itemising scientific and common name.

Industry Standards, Codes of Practice and Guidelines

Australian Petroleum Production and Exploration Association (APPEA) Code of Practice 2008
Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000
Australian Ballast Water Management Requirements, Version 7, 2017
Australian National Guidelines for Whale and Dolphin Watching 2005
EPBC Act Policy Statement 2.1 - Interactions between Offshore Seismic Activities and Whales (May 2007)
Guidelines on Minimising Acoustic Disturbance to Marine Fauna 1997 – WA Department of Mines and Petroleum
National Biofouling Management Guidance for the Petroleum Production and Exploration Industry 2009
National Light Pollution Guidelines for Wildlife, January 2020
National Marine Safety Committee principal technical standard, the National Standard for commercial vessels. National Standard for Commercial Vessels (NSCV)
National Strategy for Ecologically Sustainable Development 1992
Australia's Oceans Policy - Western Australia South-West, Western-Central and North-West Marine Plans
National Maritime Emergency Response Arrangement (NMERA)

Appendix C

CONDITIONS FOR OPERATIONS ISSUED TO THE PYRENEES DEVELOPMENT - HIGHLIGHTED CONDITIONS ARE RELEVANT TO THIS ENVIRONMENT PLAN

Reference	Approval Conditions under *EPBC Act* (see EPBC 2005/2034) (Environment Minister, 2006)	Reference	Consolidated Approval Notice (September 2015)	EP Section Reference
1c)	Operations	1c)	Operations	
1(c)i	Trading tanker vetting procedures.	1(c)i	Trading tanker vetting procedures.	N/A to this EP.
1c)ii	Ballast water management for international vessels arriving in Australia.		Not referenced.	N/A
1(c)iii	Produced formation water (PFW) and naturally occurring radioactive materials (NORMs) monitoring and management.	1c)ii	Produced formation water (PFW) and naturally occurring radioactive materials (NORMs) monitoring and management	N/A to this EP.
1(c)iv	Interaction procedures for supply vessels and aircraft that are consistent with Part 8 of the EPBC Regulations 2000.	1(c)iii	Interaction procedures for supply vessels and aircraft that are consistent with Part 8 of the EPBC Regulations 2000.	N/A to this EP.
1(c) v	Monitoring of noise effects of operations on cetaceans.	1(c)iv	Monitoring of noise effects of operations on cetaceans.	Noise emissions associated with the operations of the Pyrenees Development is covered in the Pyrenees Facility Operations EP (PYHSE-E-0001) Rev 14 - the current accepted EP by NOPSEMA.
1(c) vi	Cetacean and whale shark sighting reporting.	1(c) v	Cetacean and whale shark sighting reporting.	Cetacean and whale shark sighting reporting is covered in Sections 7.5, 8.8 and 10.5.
2	Approved Oil Spill Contingency Plan (OSCP), including: • Types of dispersants, protective booms, clean up gear, and related equipment to be used in the event of a spill and their storage arrangements; • A demonstrated capacity to deploy oil spill response equipment within 12 hours; • Training of staff in oil spill response measures; • Identification of sensitive areas, in particular, Ningaloo Marine Park, and specific response measures for these areas;	2	Approved OSCP, including: • Types of dispersant, protective booms, clean up gear, and related equipment to be used in the event of a spill and their storage arrangements; • A demonstrated capacity to deploy oil spill response equipment within 12 hours; • Training of staff in oil spill response measures; • Identification of sensitive areas, in particular, Ningaloo Marine Park, and specific response measures for these areas; and • The reporting of oil spill incidents. The approved Plan must be implemented.	Pyrenees Facility Operations EP (PYHSE-E-0001) Rev 14 is the current accepted EP by NOPSEMA. The Pyrenees Facility Operations OPEP (PYHSE-ER-0001-0005) forms part of the Pyrenees Facility Operation EP. For hydrocarbon spill response in relation to the Crosby-3H1 Light Well Intervention activities refer to the Crosby-3H1 Light Well Intervention Oil Pollution Emergency Response Plan (OPEP) (PYHSE-ER-0006).

Reference	Approval Conditions under *EPBC Act* (see EPBC 2005/2034) (Environment Minister, 2006)	Reference	Consolidated Approval Notice (September 2015)	EP Section Reference
	• Details of insurance arrangements that have been made in respect of the costs associated with repairing any environmental damage arising from potential oil spills; and • The reporting of oil spill incidents to the DoEE. The approved plan must be implemented.			
3	Prepare a Decommissioning Plan for Ministerial approval at least 12 months before start of decommissioning. The approved Decommissioning Plan must be implemented.	3	Prepare a Decommissioning Plan for Ministerial approval at least 12 months before start of decommissioning. The approved Decommissioning Plan must be implemented	Acknowledged, however decommissioning is not part of the scope of this EP. A separate approval process will be implemented for decommissioning activities associated with the Pyrenees Development.
4	Within 18 months of the commencement of offshore construction, BHP must ensure that an independent approved audit of compliance with the conditions of approval is conducted. The audit criteria must be agreed by the Minister and the audit report must address the criteria to the satisfaction of the Minister.	4	Within 18 months of the commencement of offshore construction, BHP must ensure that an independent approved audit of compliance with the conditions of approval is conducted. The audit criteria must be agreed by the Minister and the audit report must address the criteria to the satisfaction of the Minister.	Completed, as such, N/A to this EP
5	On 1 July of each year of the Development, the General Manager, BHP Petroleum must provide a certificate stating that BHP has complied with the conditions of this Approval.	5	Condition 5 revoked	N/A
6	Any subsea tie-ins not included in an approved Plan pursuant to condition 1, 2 and 3, must submit a revised version of any such Plan for the Minister's approval. The revised Plan submitted, must be implemented instead of the Plan originally approved.	6	Any subsea tie-ins not included in an approved EP pursuant to condition 1, 2 and 3, must revise the EP or submit a new EP to address the activities associated with, and potential environmental impacts of, the subsea tie-in. Activities associated with subsea tie-ins may not be commenced until each EP or revised EP has been approved by the Minister. The revised EP that has been approved by the Minister must be implemented.	Subsea tie-in installations will be subject to a separate EP approval. Operational activities and the potential environmental impacts of, subsea tie-ins would be revised in the Pyrenees Facility Operations EP (PYHSE-E-0001) and submitted for approval.
7	Any activity otherwise than in accordance with the Plan referred to in conditions 1,2 and 3, must submit a revised version of any such	7	BHP may choose to revise an Management Plan approved by the Minister under condition 1, 2, 3 or 6 without submitting it for approval under section 143A of the EPBC	Acknowledged.

Reference	Approval Conditions under *EPBC Act* (see EPBC 2005/2034) (Environment Minister, 2006)	Reference	Consolidated Approval Notice (September 2015)	EP Section Reference
	Plan for the Minister's approval. The revised Plan submitted, must be implemented instead of the Plan originally approved.		Act, if the taking of the action in accordance with the revised EP would not likely to have new or increased impact. If BHP makes this choice they must: i. Notify the Department in writing that the approved Plan has been revised and provide the Department with an electronic copy of the revised EP; ii. Implement the revised Plan from the date that the EP is submitted to the Department.; and iii. For the life of the approval, maintain a record of the reasons BHP considers that taking the action in accordance with the revised Plan would not likely to have a new or increased impact.	
		7A	BHP may revoke their choice under condition 7 at any time by notice to the Department. If BHP revokes the choice to implement a revised Plan, without approval under section 143A of the Act, the Plan approved by the Minister must be implemented.	Acknowledged.
		7B	If the Minister gives a notice to BHP that the Minister is satisfied that the taking of the action in accordance with the revised Plan would be likely to have a new or increased impact then: i. Condition 7 does not apply, or ceases to apply, in relation to the revised Plan; and ii. BHP must implement the plan approved by the Minister. To avoid any doubt, this condition does not affect any operation of condition 7 and 7A in the period before that day of this notice is given. At the time of giving this notice the Minister may also notify that for a specified period of time that condition 7 does not apply for one or more specified Plan required under the approval.	Acknowledged.
		7C	Condition 7, 7A, and 7B are not intended to limit the operation of section 143A of the Act which allows BHP to submit a revised Plan to the minister for approval.	Acknowledged.

Reference	Approval Conditions under *EPBC Act* (see EPBC 2005/2034) (Environment Minister, 2006)	Reference	Consolidated Approval Notice (September 2015)	EP Section Reference
8	It the Minster believes that it is necessary or desirable for the better protection of the environment to do so, the Minister may request BHP to make specified revisions to an approved Plan pursuant to conditions 1,2 and 3, and to submit a revised Plan for the Minister's approval. BHP must comply with any such request. If the Minister approves a revised Plan pursuant to this condition, the revised Plan must be implemented instead of the Plan originally approved.	8	Condition 8 revoked.	N/A
9	Within five years of the date of this approval, BHP must provide to the satisfaction of the Minister evidence that the proposal has been substantially commenced. If the Minister is not satisfied that there has been substantial commencement of the Development, the Development must not thereafter be commenced.	9	Within five years of the date of this approval, BHP must provide to the satisfaction of the Minister evidence that the proposal has been substantially commenced. If the Minister is not satisfied that there has been substantial commencement of the Development, the Development must not thereafter be commenced. Note: Relates to date or approval decision 26 April 2006.	Completed.
		10	An Plan required by condition 1, 2, 3 or 6 is automatically deemed to have been submitted to, and approved by, the Minister if the measures (as specified in the relevant condition) are included in an EP relating to the taking of the action that: a) Was submitted to NOPSEMA after 27 February 2014; b) Either i. Is in force under the OPGGS (Environment) Regulations; or ii. Has ended in accordance with regulation 25A of the OPGGS (Environment) Regulations The Plan approved by the Minister no longer needs to be implemented.	N/A to the Crosby-3H1 LWI EP. Pyrenees Facility Operations EP (PYHSE-E-0001) Rev 14 is the current accepted EP by NOPSEMA.
		10A	Where a Plan required by condition 1, 2 or 6 has been approved by the Minister and the measures (as specified in the relevant condition) are included in an Plan that: c) Was submitted to NOPSEMA after 27 February 2014; d) Either	N/A to the Crosby-3H1 LWI EP. The Pyrenees Facility Operations EP (PYHSE-E-0001) Rev 14 is the current accepted EP by NOPSEMA.

Reference	Approval Conditions under *EPBC Act* (see EPBC 2005/2034) (Environment Minister, 2006)	Reference	Consolidated Approval Notice (September 2015)	EP Section Reference
			iii. is in force under the OPGGS (Environment) Regulations; or iv. has ended in accordance with regulation 25A of the OPGGS (Environment) Regulations The Plan approved by the Minister no longer needs to be implemented.	
		10B	Where an Plan, which includes measure specified in the conditions referred to in condition 10 and 10A above, is in force under the OPGGS (Environment) Regulations that relates to the taking of the action, BHP must comply with those measures as specified in that Plan.	N/A to the Crosby-3H1 LWI EP The Pyrenees Facility Operations EP (PYHSE-E-0001) Rev 14 is the current accepted EP by NOPSEMA.

Appendix D

EPBC ACT PROTECTED MATTERS SEARCH REPORT: OPERATIONAL AREA

Australian Government
Department of the Environment and Energy

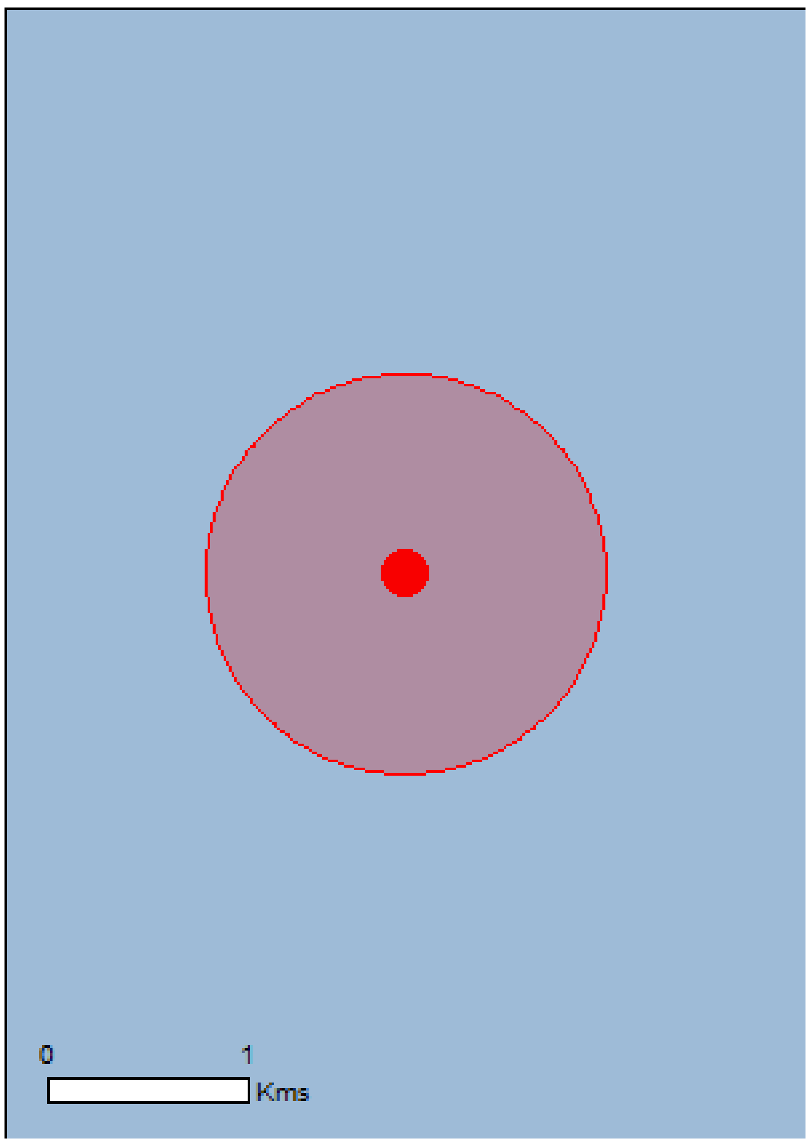
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 05/02/20 17:17:37



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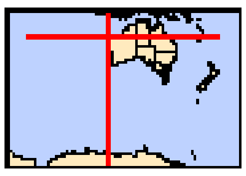

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	20
Listed Migratory Species:	35

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	47
Whales and Other Cetaceans:	24
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	None
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	1

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
North-west

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Sharks		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Listed Migratory Species

[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat may occur within area
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat may occur within area
Fish		
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area

Name	Status	Type of Presence
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat may occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Extra Information

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Canyons linking the Cuvier Abyssal Plain and the	North-west

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-21.54528 114.09528

Acknowledgements

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-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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EPBC ACT PROTECTED MATTERS SEARCH REPORT: WIDER EMBA

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

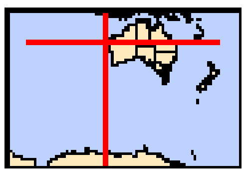
This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 20/05/20 13:08:46

Coordinates
Buffer: 1.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	2
National Heritage Places:	5
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	78
Listed Migratory Species:	79

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	5
Commonwealth Heritage Places:	4
Listed Marine Species:	152
Whales and Other Cetaceans:	40
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	15

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	32
Regional Forest Agreements:	None
Invasive Species:	24
Nationally Important Wetlands:	5
Key Ecological Features (Marine)	13

Details

Matters of National Environmental Significance

World Heritage Properties [Resource Information]

Name	State	Status
Shark Bay, Western Australia	WA	Declared property
The Ningaloo Coast	WA	Declared property

National Heritage Properties [Resource Information]

Name	State	Status
Natural		
Shark Bay, Western Australia	WA	Listed place
The Ningaloo Coast	WA	Listed place
Historic		
Batavia Shipwreck Site and Survivor Camps Area 1629 - Houtman Abrolhos	WA	Listed place
Dirk Hartog Landing Site 1616 - Cape Inscription Area	WA	Listed place
HMAS Sydney II and HSK Kormoran Shipwreck Sites	EXT	Listed place

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea
Extended Continental Shelf

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
North-west
South-west

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community may occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops		
Australian Lesser Noddy [26000]	Vulnerable	Breeding known to occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species

Name	Status	Type of Presence
		habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Malurus leucopterus edouardi White-winged Fairy-wren (Barrow Island), Barrow Island Black-and-white Fairy-wren [26194]	Vulnerable	Species or species habitat likely to occur within area
Malurus leucopterus leucopterus White-winged Fairy-wren (Dirk Hartog Island), Dirk Hartog Black-and-White Fairy-wren [26004]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta cauta Shy Albatross [82345]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Turnix varius scintillans Painted Button-quail (Houtman Abrolhos) [82451]	Vulnerable	Species or species habitat likely to occur within area
Fish		
Milyeringa veritas Blind Gudgeon [66676]	Vulnerable	Species or species habitat known to occur within area
Ophisternon candidum Blind Cave Eel [66678]	Vulnerable	Species or species habitat known to occur within area
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Bettongia lesueur Barrow and Boodie Islands subspecies Boodie, Burrowing Bettong (Barrow and Boodie Islands) [88021]	Vulnerable	Species or species habitat known to occur

Name	Status	Type of Presence
		within area
Bettongia lesueur lesueur Burrowing Bettong (Shark Bay), Boodie [66659]	Vulnerable	Species or species habitat known to occur within area
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat known to occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Isoodon auratus barrowensis Golden Bandicoot (Barrow Island) [66666]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes conspicillatus conspicillatus Spectacled Hare-wallaby (Barrow Island) [66661]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes hirsutus Central Australian subspecies Mala, Rufous Hare-Wallaby (Central Australia) [88019]	Endangered	Translocated population known to occur within area
Lagorchestes hirsutus bernieri Rufous Hare-wallaby (Bernier Island) [66662]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes hirsutus dorreae Rufous Hare-wallaby (Dorre Island) [66663]	Vulnerable	Species or species habitat known to occur within area
Lagostrophus fasciatus fasciatus Banded Hare-wallaby, Merrnine, Marnine, Munning [66664]	Vulnerable	Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Breeding known to occur within area
Osphranter robustus isabellinus Barrow Island Wallaroo, Barrow Island Euro [89262]	Vulnerable	Species or species habitat likely to occur within area
Perameles bougainville bougainville Western Barred Bandicoot (Shark Bay) [66631]	Endangered	Species or species habitat known to occur within area
Petrogale lateralis lateralis Black-flanked Rock-wallaby, Moororong, Black-footed Rock Wallaby [66647]	Endangered	Species or species habitat known to occur within area
Pseudomys fieldi Shark Bay Mouse, Djoongari, Alice Springs Mouse [113]	Vulnerable	Species or species habitat likely to occur within area
Rhinonicteris aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area
Other		

Name	Status	Type of Presence
Idiosoma nigrum		
Shield-backed Trapdoor Spider, Black Rugose Trapdoor Spider [66798]	Vulnerable	Species or species habitat known to occur within area
Kumonga exleyi		
Cape Range Remipede [86875]	Vulnerable	Species or species habitat known to occur within area
Plants		
Caladenia barbarella		
Small Dragon Orchid, Common Dragon Orchid [68686]	Endangered	Species or species habitat may occur within area
Caladenia hoffmanii		
Hoffman's Spider-orchid [56719]	Endangered	Species or species habitat likely to occur within area
Eucalyptus argutifolia		
Yanchep Mallee, Wabling Hill Mallee [24263]	Vulnerable	Species or species habitat may occur within area
Eucalyptus beardiana		
Beard's Mallee [18933]	Vulnerable	Species or species habitat may occur within area
Pityrodia augustensis		
Mt Augustus Foxglove [4962]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
Aipysurus apraefrontalis		
Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Ctenotus lancelini		
Lancelin Island Skink [1482]	Vulnerable	Species or species habitat known to occur within area
Ctenotus zastictus		
Hamelin Ctenotus [25570]	Vulnerable	Species or species habitat likely to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Egernia stokesii badia		
Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink [64483]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Sharks		
Carcharias taurus (west coast population)		
Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Name	Status	Type of Presence
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna pacifica Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Hydroprogne caspia Caspian Tern [808]		Breeding known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Onychoprion anaethetus Bridled Tern [82845]		Breeding known to occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Vulnerable*	Species or species habitat likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat likely to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known

Name	Threatened	Type of Presence
		to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Dugong dugon Dugong [28]		Breeding known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea		Species or species

Name	Threatened	Type of Presence
populations) [78900]		habitat known to occur within area
Migratory Terrestrial Species		
Hirundo rustica		
Barn Swallow [662]		Species or species habitat known to occur within area
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres		
Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris alba		
Sanderling [875]		Species or species habitat known to occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis		
Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris		
Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii		
Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum		
Oriental Pratincole [840]		Species or species habitat may occur within area
Limosa lapponica		
Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa		
Black-tailed Godwit [845]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis squatarola Grey Plover [865]		Species or species habitat known to occur within area
Thalasseus bergii Crested Tern [83000]		Breeding known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Species or species habitat known to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Defence - EXMOUTH VLF TRANSMITTER STATION
Defence - LANCELIN TRAINING AREA
Defence - LEARMONTH - AIR WEAPONS RANGE
Defence - LEARMONTH RADAR SITE - VLAMING HEAD EXMOUTH

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
Lancelin Defence Training Area	WA	Listed place
Learmonth Air Weapons Range Facility	WA	Listed place
Ningaloo Marine Area - Commonwealth Waters	WA	Listed place
Historic		
HMAS Sydney II and HSK Kormoran Shipwreck Sites	EXT	Listed place

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Breeding known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris alba Sanderling [875]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur

Name	Threatened	Type of Presence
		within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Species or species habitat known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Larus novaehollandiae Silver Gull [810]		Breeding known to occur within area
Larus pacificus Pacific Gull [811]		Breeding known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Pelagodroma marina White-faced Storm-Petrel [1016]		Breeding known to occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Phalacrocorax fuscescens Black-faced Cormorant [59660]		Breeding likely to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pluvialis squatarola Grey Plover [865]		Species or species habitat known to occur within area
Pterodroma macroptera Great-winged Petrel [1035]		Foraging, feeding or related behaviour known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Puffinus assimilis Little Shearwater [59363]		Breeding known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus huttoni Hutton's Shearwater [1025]		Foraging, feeding or related behaviour known to occur within area
Puffinus pacificus Wedge-tailed Shearwater [1027]		Breeding known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna anaethetus Bridled Tern [814]		Breeding known to occur within area
Sterna bengalensis Lesser Crested Tern [815]		Breeding known to occur within area
Sterna bergii Crested Tern [816]		Breeding known to occur within area
Sterna caspia Caspian Tern [59467]		Breeding known to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sterna fuscata Sooty Tern [794]		Breeding known to occur within area
Sterna nereis Fairy Tern [796]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Vulnerable*	Species or species habitat likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Species or species habitat known to occur within area
Fish		
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Hippocampus subelongatus West Australian Seahorse [66722]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Mitotichthys meraculus Western Crested Pipefish [66259]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Dugong dugon Dugong [28]		Breeding known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Breeding known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus pooleorum Shark Bay Seasnake [66061]		Species or species habitat may occur within area
Aipysurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis czeblukovi Fine-spined Seasnake [59233]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis mcdowelli null [25926]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Hyperoodon planifrons Southern Bottlenose Whale [71]		Species or species habitat may occur within area
Indopacetus pacificus Longman's Beaked Whale [72]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species

Name	Status	Type of Presence
		habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon ginkgodens Gingko-toothed Beaked Whale, Gingko-toothed Whale, Gingko Beaked Whale [59564]		Species or species habitat may occur within area
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area

Name	Status	Type of Presence
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Abrolhos	Habitat Protection Zone (IUCN IV)
Abrolhos	Multiple Use Zone (IUCN VI)
Abrolhos	National Park Zone (IUCN II)
Abrolhos	Special Purpose Zone (IUCN VI)
Argo-Rowley Terrace	Multiple Use Zone (IUCN VI)
Carnarvon Canyon	Habitat Protection Zone (IUCN IV)
Gascoyne	Habitat Protection Zone (IUCN IV)
Gascoyne	Multiple Use Zone (IUCN VI)
Gascoyne	National Park Zone (IUCN II)
Jurien	National Park Zone (IUCN II)
Jurien	Special Purpose Zone (IUCN VI)
Montebello	Multiple Use Zone (IUCN VI)
Ningaloo	National Park Zone (IUCN II)
Ningaloo	Recreational Use Zone (IUCN IV)
Shark Bay	Multiple Use Zone (IUCN VI)

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Airlie Island	WA
Barrow Island	WA
Bernier And Dorre Islands	WA
Bessieres Island	WA
Boodie, Double Middle Islands	WA
Bundegi Coastal Park	WA
Cape Range	WA
Dirk Hartog Island	WA
Jurabi Coastal Park	WA
Koks Island	WA
Lancelin And Edwards Islands	WA
Locker Island	WA
Montebello Islands	WA
Muiron Islands	WA
Nilgen	WA
Part Murchison house	WA
Round Island	WA
Serrurier Island	WA
Tamala Pastoral Lease (Part)	WA
Unnamed WA26400	WA
Unnamed WA37338	WA
Unnamed WA37383	WA
Unnamed WA37500	WA
Unnamed WA40322	WA
Unnamed WA40828	WA
Unnamed WA41080	WA
Unnamed WA44665	WA
Unnamed WA44688	WA
Unnamed WA48858	WA

Name	State
Wanagarren	WA
Wedge Island	WA
Zuytdorp	WA

Invasive Species

[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area

Name	Status	Type of Presence
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Cylindropuntia spp. Prickly Pears [85131]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Bundera Sinkhole	WA
Cape Range Subterranean Waterways	WA
Lake MacLeod	WA
Learmonth Air Weapons Range - Saline Coastal Flats	WA
Shark Bay East	WA

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Ancient coastline at 125 m depth contour	North-west
Canyons linking the Cuvier Abyssal Plain and the	North-west
Commonwealth waters adjacent to Ningaloo Reef	North-west
Continental Slope Demersal Fish Communities	North-west
Exmouth Plateau	North-west
Glomar Shoals	North-west
Wallaby Saddle	North-west
Ancient coastline at 90-120m depth	South-west
Commonwealth marine environment surrounding	South-west
Commonwealth marine environment within and	South-west
Perth Canyon and adjacent shelf break, and other	South-west
Western demersal slope and associated fish	South-west
Western rock lobster	South-west

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-16.8839556876048 116.646808460642,-17.6746653133535 116.987142496229,-18.4559893597211 117.459287378909,-18.87203531198 117.608507388505,-19.0916733151713 117.43421922114,-19.9326095223116 116.770586222376,-20.2467255305588 116.026226828405,-20.4948872051803 115.545792300874,-20.6929535391744 115.441952622216,-20.8100230203461 115.377707174946,-20.9095863876017 115.440179017048,-21.1017965504704 115.407827387624,-21.1847387951592 115.372210668787,-21.3434488278011 115.2244267425,-21.5303359475459 115.038941997675,-21.7193400003407 114.766030000084,-21.841503503284 114.456863697602,-21.8472142099678 114.279831798499,-21.8316043372703 114.12445258312,-21.9243087461517 114.017139303636,-22.192474001474 113.913989668489,-22.3276273866945 113.858786173243,-22.6098314620523 113.724703546032,-22.7050099022851 113.805010354444,-22.8239829523513 113.864496879927,-23.0696623011742 113.881807458747,-23.1791175076668 113.815182551034,-23.4027868424388 113.824700394608,-23.4908268995417 113.808044167904,-23.6526302483872 113.653379202188,-23.7858859840509 113.571693689013,-23.9500628740024 113.505852619603,-24.1856295136911 113.470160704853,-24.4592675285735 113.441607172333,-24.5175643238344 113.483941749512,-24.6853199102856 113.237670910284,-24.7578898853099 113.186509123897,-25.2987740285985 113.091491827786,-25.4179147914344 113.054173660886,-25.4889299996198 112.979160000334,-25.6081506177567 112.960460328681,-25.817543186269 113.031844159081,-25.9888643786881 113.14605828736,-26.0626276704306 113.193647507027,-26.1839801809406 113.234098344463,-26.2924836034355 113.332861839402,-26.4138361148448 113.337144868741,-26.6065724557542 113.574139184876,-26.7307505767777 113.673808858292,-27.2783835276776 114.042863259632,-28.4542338415185 113.80521459228,-28.8834886070135 114.038401770625,-29.2412974277341 113.9611043312,-30.5749169565523 114.578704122697,-30.7761118907511 115.210524262385,-31.1235131973761 115.396122220164,-31.7448001804839 113.222905017153,-32.3729480878839 112.690920510873,-31.0281551724232 108.476376380066,-29.646861432609 107.836760236096,-27.1192039733846 108.150575401334,-24.3004953491809 106.930414930005,-21.2067335971777 106.241165910079,-21.1569710677605 106.230079479784,-20.7321430972261 107.002246314316,-19.5624299809588 108.878065009293,-18.0767172183249 109.734296126765,-17.5092248615381 110.358134325539,-15.7949956548256 112.712895257111,-16.5332024413395 114.648652175558,-16.3431156254857 116.220067261595,-16.3370158819773 116.270492797305,-16.8839556876048 116.646808460642

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- -Office of Environment and Heritage, New South Wales
- -Department of Environment and Primary Industries, Victoria
- -Department of Primary Industries, Parks, Water and Environment, Tasmania
- -Department of Environment, Water and Natural Resources, South Australia
- -Department of Land and Resource Management, Northern Territory
- -Department of Environmental and Heritage Protection, Queensland
- -Department of Parks and Wildlife, Western Australia
- -Environment and Planning Directorate, ACT
- -Birdlife Australia
- -Australian Bird and Bat Banding Scheme
- -Australian National Wildlife Collection
- -Natural history museums of Australia
- -Museum Victoria
- -Australian Museum
- -South Australian Museum
- -Queensland Museum
- -Online Zoological Collections of Australian Museums
- -Queensland Herbarium
- -National Herbarium of NSW
- -Royal Botanic Gardens and National Herbarium of Victoria
- -Tasmanian Herbarium
- -State Herbarium of South Australia
- -Northern Territory Herbarium
- -Western Australian Herbarium
- -Australian National Herbarium, Canberra
- -University of New England
- -Ocean Biogeographic Information System
- -Australian Government, Department of Defence
- Forestry Corporation, NSW
- -Geoscience Australia
- -CSIRO
- -Australian Tropical Herbarium, Cairns
- -eBird Australia
- -Australian Government – Australian Antarctic Data Centre
- -Museum and Art Gallery of the Northern Territory
- -Australian Government National Environmental Science Program
- -Australian Institute of Marine Science
- -Reef Life Survey Australia
- -American Museum of Natural History
- -Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
- -Tasmanian Museum and Art Gallery, Hobart, Tasmania
- -Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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EPBC ACT PROTECTED MATTERS SEARCH REPORT: MDO EMBA

Australian Government
Department of the Environment and Energy

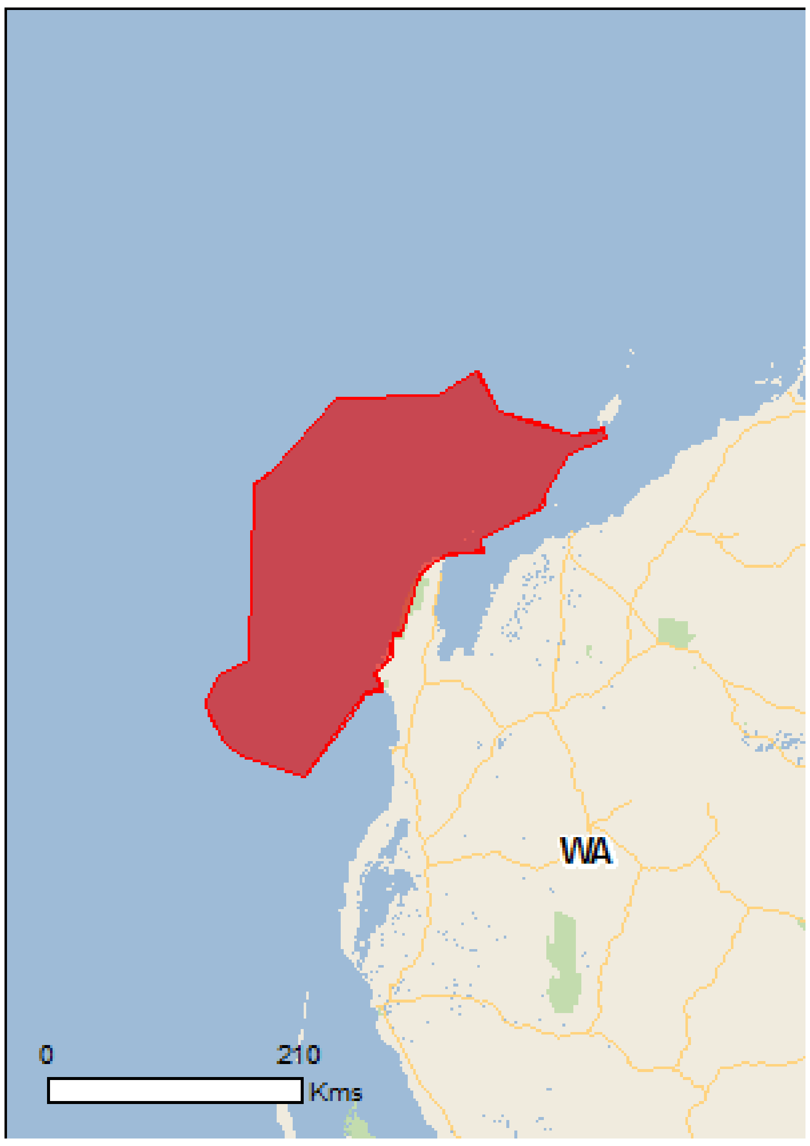
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

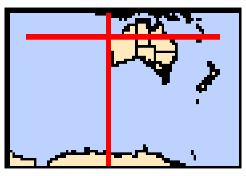
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 26/03/20 18:14:34



Coordinates
Buffer: 1.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	1
National Heritage Places:	1
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	35
Listed Migratory Species:	52

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	4
Commonwealth Heritage Places:	2
Listed Marine Species:	87
Whales and Other Cetaceans:	29
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	4

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	6
Regional Forest Agreements:	None
Invasive Species:	11
Nationally Important Wetlands:	3
Key Ecological Features (Marine)	5

Details

Matters of National Environmental Significance

World Heritage Properties [Resource Information]

Name	State	Status
The Ningaloo Coast	WA	Declared property

National Heritage Properties [Resource Information]

Name	State	Status
Natural		
The Ningaloo Coast	WA	Listed place

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
North-west

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica baueri		
Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica menzbieri		
Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pezoporus occidentalis		
Night Parrot [59350]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding known to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Fish		
Milyeringa veritas Blind Gudgeon [66676]	Vulnerable	Species or species habitat known to occur within area
Ophisternon candidum Blind Cave Eel [66678]	Vulnerable	Species or species habitat known to occur within area
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Bettongia lesueur Barrow and Boodie Islands subspecies Boodie, Burrowing Bettong (Barrow and Boodie Islands) [88021]	Vulnerable	Species or species habitat known to occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Isoodon auratus barrowensis Golden Bandicoot (Barrow Island) [66666]	Vulnerable	Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Petrogale lateralis lateralis Black-flanked Rock-wallaby, Moororong, Black-footed Rock Wallaby [66647]	Endangered	Species or species habitat known to occur within area
Rhinonicteris aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area
Other		
Kumonga exleyi Cape Range Remipede [86875]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Sharks		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Listed Migratory Species

[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Ardenna pacifica Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Hydroprogne caspia Caspian Tern [808]		Breeding known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat likely to occur within area
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat likely to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Dugong dugon Dugong [28]		Breeding known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific		Species or species

Name	Threatened	Type of Presence
Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		habitat known to occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcinus orca		
Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus		
Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata		
Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa chinensis		
Indo-Pacific Humpback Dolphin [50]		Species or species habitat known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations)		
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Hirundo rustica		
Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Thalasseus bergii Crested Tern [83000]		Breeding known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Defence - EXMOUTH VLF TRANSMITTER STATION
Defence - LEARMONTH - AIR WEAPONS RANGE
Defence - LEARMONTH RADAR SITE - VLAMING HEAD EXMOUTH

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
Learmonth Air Weapons Range Facility	WA	Listed place
Ningaloo Marine Area - Commonwealth Waters	WA	Listed place

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Larus novaehollandiae Silver Gull [810]		Breeding known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely

Name	Threatened	Type of Presence
		to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Puffinus pacificus Wedge-tailed Shearwater [1027]		Breeding known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna bengalensis Lesser Crested Tern [815]		Breeding known to occur within area
Sterna bergii Crested Tern [816]		Breeding known to occur within area
Sterna caspia Caspian Tern [59467]		Breeding known to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sterna fuscata Sooty Tern [794]		Breeding known to occur within area
Sterna nereis Fairy Tern [796]		Breeding known to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Fish		
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Breeding known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Hydrophis czeblukovi Fine-spined Seasnake [59233]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species

Name	Status	Type of Presence
		habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks	[Resource Information]
Name	Label
Gascoyne	Habitat Protection Zone (IUCN IV)
Gascoyne	Multiple Use Zone (IUCN VI)
Ningaloo	National Park Zone (IUCN II)
Ningaloo	Recreational Use Zone (IUCN IV)

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Bessieres Island	WA
Boodie, Double Middle Islands	WA
Cape Range	WA
Jurabi Coastal Park	WA
Muiron Islands	WA
Unnamed WA44665	WA

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Vulpes vulpes		
Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris		
Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus		
Asian House Gecko [1708]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Bundera Sinkhole	WA
Cape Range Subterranean Waterways	WA
Learmonth Air Weapons Range - Saline Coastal Flats	WA

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Ancient coastline at 125 m depth contour	North-west
Canyons linking the Cuvier Abyssal Plain and the	North-west
Commonwealth waters adjacent to Ningaloo Reef	North-west
Continental Slope Demersal Fish Communities	North-west
Exmouth Plateau	North-west

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-22.9026883631774 113.444743389796,-23.3111039986506 113.124122575297,-23.1598698682997 112.652340006086,-23.0783215655877 112.533858927448,-22.8841532512715 112.412425488745,-22.7999126751298 112.401624865695,-22.6215168156485 112.491726388362,-22.5172391887375 112.714351042766,-21.3095431348078 112.749085621105,-21.2113712903527 112.894054407685,-20.7096627287519 113.372112853525,-20.6888577801624 114.119992235353,-20.5231004378349 114.394476697542,-20.8062342188341 114.572724920719,-20.9656311617487 115.131307125623,-20.9228008638687 115.338320233692,-20.9770525751162 115.352596999052,-21.0869836731579 115.084193798405,-21.3752868669953 114.904047958946,-21.4331341766009 114.894603732976,-21.4693134510549 114.863770607927,-21.6812393189394 114.423639758168,-21.7633307240337 114.434347332863,-21.7722537020467 114.359394310899,-21.778341605081 114.187343805173,-21.8425613856994 114.075436630396,-21.9014584352585 113.999619806909,-21.9824790823437 113.949651125899,-22.1026418635311 113.910390018684,-22.1538002747628 113.897302983546,-22.2977576657836 113.85685214611,-22.3322598503118 113.824729422925,-22.334473095357 113.777337634125,-22.4817952278675 113.765124266072,-22.5751825090655 113.676143581961,-22.6047602111148 113.643543266609,-22.6843825383235 113.687886962513,-22.7143637463897 113.692169991852,-22.7363484364312 113.583026089283,-22.9026883631774 113.444743389796

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix E

ABORIGINAL HERITAGE INQUIRY SYSTEM SEARCH REPORTS FOR ABORIGINAL HERITAGE PLACES WITHIN THE EMBA

Aboriginal Heritage Inquiry System

List of Registered Aboriginal Sites

Search Criteria

107 Registered Aboriginal Sites in Shapefile - EMBA_CrudeLeak_578bpd

Disclaimer

The *Aboriginal Heritage Act 1972* preserves all Aboriginal sites in Western Australia whether or not they are registered. Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist.

The information provided is made available in good faith and is predominately based on the information provided to the Department of Planning, Lands and Heritage by third parties. The information is provided solely on the basis that readers will be responsible for making their own assessment as to the accuracy of the information. If you find any errors or omissions in our records, including our maps, it would be appreciated if you email the details to the Department at AboriginalHeritage@dplh.wa.gov.au and we will make every effort to rectify it as soon as possible.

South West Settlement ILUA Disclaimer

Your heritage enquiry is on land **within or adjacent to** the following Indigenous Land Use Agreement(s): Yued Indigenous Land Use Agreement.

On 8 June 2015, six identical Indigenous Land Use Agreements (ILUAs) were executed across the South West by the Western Australian Government and, respectively, the Yued, Whadjuk People, Gnaala Karla Booja, Ballardong People, South West Boojarah #2 and Wagyl Kaip & Southern Noongar groups, and the South West Aboriginal Land and Sea Council (SWALSC).

The ILUAs bind the parties (including 'the State', which encompasses all State Government Departments and certain State Government agencies) to enter into a Noongar Standard Heritage Agreement (NSHA) when conducting Aboriginal Heritage Surveys in the ILUA areas, unless they have an existing heritage agreement. It is also intended that other State agencies and instrumentalities enter into the NSHA when conducting Aboriginal Heritage Surveys in the ILUA areas. It is recommended a NSHA is entered into, and an 'Activity Notice' issued under the NSHA, if there is a risk that an activity will 'impact' (i.e. by excavating, damaging, destroying or altering in any way) an Aboriginal heritage site. The Aboriginal Heritage Due Diligence Guidelines, which are referenced by the NSHA, provide guidance on how to assess the potential risk to Aboriginal heritage.

Likewise, from 8 June 2015 the Department of Mines, Industry Regulation and Safety (DMIRS) in granting Mineral, Petroleum and related Access Authority tenures within the South West Settlement ILUA areas, will place a condition on these tenures requiring a heritage agreement or a NSHA before any rights can be exercised.

If you are a State Government Department, Agency or Instrumentality, or have a heritage condition placed on your mineral or petroleum title by DMIRS, you should seek advice as to the requirement to use the NSHA for your proposed activity. The full ILUA documents, maps of the ILUA areas and the NSHA template can be found at https://www.wa.gov.au/organisation/department-of-the-premier-and-cabinet/south-west-native-title-settlement.

Further advice can also be sought from the Department of Planning, Lands and Heritage at AboriginalHeritage@dplh.wa.gov.au.

Copyright

Coordinate Accuracy

Coordinates (Easting/Northing metres) are based on the GDA 94 Datum. Accuracy is shown as a code in brackets following the coordinates.

Terminology (NB that some terminology has varied over the life of the legislation)

Place ID/Site ID: This a unique ID assigned by the Department of Planning, Lands and Heritage to the place.
Status:

- **Registered Site**: The place has been assessed as meeting Section 5 of the *Aboriginal Heritage Act 1972.*
- **Other Heritage Place which includes:**
  - **Stored Data / Not a Site:** The place has been assessed as not meeting Section 5 of the *Aboriginal Heritage Act 1972.*
  - **Lodged:** Information has been received in relation to the place, but an assessment has not been completed at this *stage* to determine if it meets Section 5 of the *Aboriginal Heritage Act 1972.*

Access and Restrictions:

- **File Restricted = No:** Availability of information that the Department of Planning, Lands and Heritage holds in relation to the place is not restricted in any way.
- **File Restricted = Yes:** Some of the information that the Department of Planning, Lands and Heritage holds in relation to the place is restricted if it is considered culturally sensitive. This information will only be made available if the Department of Planning, Lands and Heritage receives written approval from the informants who provided the information. To request access please contact AboriginalHeritage@dplh.wa.gov.au.
- **Boundary Restricted = No:** Place location is shown as accurately as the information lodged with the Registrar allows.
- **Boundary Restricted = Yes:** To preserve confidentiality the exact location and extent of the place is not displayed on the map. However, the shaded region (generally with an area of at least $4km^2$) provides a general indication of where the place is located. If you are a landowner and wish to find out more about the exact location of the place, please contact the Department of Planning, Lands and Heritage.
- **Restrictions:**
  - **No Restrictions:** *Anyone* can view the information.
  - **Male Access Only:** Only *males* can view restricted information.
  - **Female Access Only:** *Only* females can view restricted information.

Legacy ID: This is the former unique number that the former Department of Aboriginal Sites assigned to the place. This has been replaced by the Place ID / Site ID.

Basemap Copyright

Satellite, Hybrid, Road basemap sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, HERE, DeLorme, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community.

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Aboriginal Heritage Inquiry System

List of Registered Aboriginal Sites

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
159	CORAL BAY 02	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	785242mE 7438548mN Zone 49 [Reliable]	P07594
508	POINT MURAT 03	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	209042mE 7584688mN Zone 50 [Reliable]	P07503
509	POINT MURAT 04	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	208690mE 7584604mN Zone 50 [Reliable]	P07504
563	POINT MURAT 01	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	208716mE 7585665mN Zone 50 [Reliable]	P07501
564	POINT MURAT 02	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	209079mE 7585539mN Zone 50 [Reliable]	P07502
600	UPPER BULBARLI WELL 2	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	782842mE 7398748mN Zone 49 [Reliable]	P07442
628	CAMP THIRTEEN BURIAL	No	No	No Gender Restrictions	Registered Site	Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	800392mE 7559449mN Zone 49 [Reliable]	P07434
873	MONTEBELLO IS: NOALA CAVE.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Rockshelter, BP Dating: 27,220 +/- 640	*Registered Knowledge Holder names available from DAA	348188mE 7741053mN Zone 50 [Reliable]	P07287
926	MONTEBELLO IS: HAYNES CAVE.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Rockshelter, Arch Deposit	*Registered Knowledge Holder names available from DAA	348289mE 7741005mN Zone 50 [Reliable]	P07286
6017	YARDIE CREEK CARAVAN BURIAL	No	No	No Gender Restrictions	Registered Site	Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	191538mE 7576555mN Zone 50 [Unreliable]	P07115
6060	CAPE CUVIER	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	743392mE 7318648mN Zone 49 [Reliable]	P07053
6311	POINT MURAT.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Skeletal Material / Burial, Camp, Other: ?	*Registered Knowledge Holder names available from DAA	208538mE 7584405mN Zone 50 [Reliable]	P06628

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
6498	DIRK HARTOG ISLAND	No	No	No Gender Restrictions	Registered Site	Man-Made Structure	*Registered Knowledge Holder names available from DAA	695143mE 7175147mN Zone 49 [Unreliable]	P06448
6596	POINT ANDERSON.	Yes	Yes	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Camp, Hunting Place, Shell, Water Source	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	P06341
6606	CRAYFISH BAY 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Water Source	*Registered Knowledge Holder names available from DAA	729642mE 7083846mN Zone 49 [Unreliable]	P06351
6607	CRAYFISH BAY 2	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Quarry	*Registered Knowledge Holder names available from DAA	729642mE 7084646mN Zone 49 [Unreliable]	P06352
6608	ZUYTDORP POINT	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	729442mE 7078146mN Zone 49 [Unreliable]	P06353
6616	CORAL BAY ACCESS 2	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	784342mE 7438148mN Zone 49 [Unreliable]	P06361
6723	MULANDA 2	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	784742mE 7441148mN Zone 49 [Unreliable]	P06257
6724	MULANDA 3	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	784842mE 7441248mN Zone 49 [Unreliable]	P06258
6725	MULANDA 4	No	No	No Gender Restrictions	Registered Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	785541mE 7441198mN Zone 49 [Unreliable]	P06259
6754	OSPREY BAY 6	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	792942mE 7538749mN Zone 49 [Reliable]	P06165
6755	OSPREY BAY INTERDUNAL 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	792342mE 7537149mN Zone 49 [Unreliable]	P06166
6756	OSPREY BAY INTERDUNAL 2	No	No	No Gender Restrictions	Registered Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	792642mE 7537149mN Zone 49 [Reliable]	P06167

Aboriginal Heritage Inquiry System

List of Registered Aboriginal Sites

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
6757	BLOODWOOD CREEK MIDDEN 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	794942mE 7544549mN Zone 49 [Reliable]	P06168
6758	BLOODWOOD CREEK MIDDEN 2	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	794942mE 7545049mN Zone 49 [Reliable]	P06169
6759	BLOODWOOD CREEK MIDDEN 3	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	795142mE 7544949mN Zone 49 [Reliable]	P06170
6760	BLOODWOOD CREEK SHORELINE	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	794942mE 7545249mN Zone 49 [Reliable]	P06171
6761	LOW POINT MIDDEN	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	802992mE 7566299mN Zone 49 [Reliable]	P06172
6762	MILYERING MIDDEN	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	801342mE 7561449mN Zone 49 [Reliable]	P06173
6763	YARDIE ROCKSHELTERS NORTH.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Rockshelter	*Registered Knowledge Holder names available from DAA	791542mE 7530249mN Zone 49 [Unreliable]	P06174
6764	CAMP 17 SOUTH MIDDENS	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	799042mE 7555649mN Zone 49 [Unreliable]	P06175
6765	CAMP 17 NORTH MIDDENS	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	799042mE 7555849mN Zone 49 [Unreliable]	P06176
6769	MULANDA 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	784550mE 7441050mN Zone 49 [Reliable]	P06180
6782	28 MILE CREEK NORTH 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	795242mE 7545949mN Zone 49 [Unreliable]	P06140
6784	MANDU MANDU CREEK SOUTH	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	796642mE 7548649mN Zone 49 [Unreliable]	P06142

Aboriginal Heritage Inquiry System

List of Registered Aboriginal Sites

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
6785	MANDU MANDU CREEK NORTH	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	796642mE 7548649mN Zone 49 [Unreliable]	P06143
6787	MANDU MANDU ROCKSHELTERS.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Rockshelter, Arch Deposit, Other: ?	*Registered Knowledge Holder names available from DAA	797242mE 7547449mN Zone 49 [Reliable]	P06145
6790	YARDIE CREEK SOUTH 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	788942mE 7527749mN Zone 49 [Reliable]	P06148
6791	YARDIE CREEK SOUTH 2	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	790342mE 7528149mN Zone 49 [Reliable]	P06149
6792	MULANDA BLUFF MIDDEN.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, BP Dating: 7,140	*Registered Knowledge Holder names available from DAA	786642mE 7439948mN Zone 49 [Reliable]	P06150
6793	ROAD ALIGNMENT 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	794942mE 7541649mN Zone 49 [Unreliable]	P06151
6794	ROAD ALIGNMENT 2	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	794942mE 7541449mN Zone 49 [Unreliable]	P06152
6795	ROAD ALIGNMENT 3	No	No	No Gender Restrictions	Registered Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	794842mE 7541249mN Zone 49 [Reliable]	P06153
6797	YARDIE WELL ROCKSHELTER.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Rockshelter, Arch Deposit, BP Dating: 10, 490+/-180BP, Other: ?	*Registered Knowledge Holder names available from DAA	791542mE 7530449mN Zone 49 [Reliable]	P06155
6798	YARDIE INTERDUNAL SWALE	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	789942mE 7528849mN Zone 49 [Reliable]	P06156
6799	YARDIE BEACH MIDDEN	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	789842mE 7529049mN Zone 49 [Reliable]	P06157
6800	OYSTER STACKS MIDDEN	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	797042mE 7549849mN Zone 49 [Reliable]	P06158

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
6801	NORTH T-BONE BAY	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	801666mE 7562059mN Zone 49 [Reliable]	P06159
6802	OSPREY BAY 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	792742mE 7538149mN Zone 49 [Reliable]	P06160
6803	OSPREY BAY 2	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	792742mE 7538049mN Zone 49 [Reliable]	P06161
6804	OSPREY BAY 3	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	792542mE 7537849mN Zone 49 [Reliable]	P06162
6805	OSPREY BAY 4	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	792342mE 7537049mN Zone 49 [Reliable]	P06163
6806	OSPREY BAY 5	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	792742mE 7538149mN Zone 49 [Reliable]	P06164
6827	CORAL BAY SKELETON	No	No	No Gender Restrictions	Registered Site	Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	785143mE 7445149mN Zone 49 [Unreliable]	P06132
7070	MIDDEN HILL	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	791042mE 6990045mN Zone 49 [Unreliable]	P05842
7071	ZUYTDORP WRECK SITE-MIDDEN1	No	No	No Gender Restrictions	Registered Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	790842mE 6989945mN Zone 49 [Unreliable]	P05843
7072	ZUYTDORP WRECK SITE-MIDDEN2	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, BP Dating: 4000+/-78BP	*Registered Knowledge Holder names available from DAA	790842mE 6990245mN Zone 49 [Unreliable]	P05844
7073	ROAD MIDDEN	No	No	No Gender Restrictions	Registered Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	791642mE 6989645mN Zone 49 [Unreliable]	P05845
7074	SOUTH GULLY SITES	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	791642mE 6989845mN Zone 49 [Unreliable]	P05846

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
7077	ZUYTDORP MIDDEN SOUTH 1	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	204638mE 6980652mN Zone 50 [Unreliable]	P05849
7078	ZUYTDORP MIDDEN SOUTH 2	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	204638mE 6978652mN Zone 50 [Unreliable]	P05850
7119	CLIFF TOP SITE	No	No	No Gender Restrictions	Registered Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	791142mE 6989945mN Zone 49 [Unreliable]	P05839
7120	A FRAME SITE	No	No	No Gender Restrictions	Registered Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	791042mE 6989745mN Zone 49 [Unreliable]	P05840
7121	CAMP HILL, ZUYTDORP WRECK	No	No	No Gender Restrictions	Registered Site	Midden / Scatter	*Registered Knowledge Holder names available from DAA	791042mE 6989545mN Zone 49 [Unreliable]	P05841
7123	BERNIER ISLAND	No	No	No Gender Restrictions	Registered Site	Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	716459mE 7249035mN Zone 49 [Unreliable]	P05789
7124	DORRE ISLAND	No	No	No Gender Restrictions	Registered Site	Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	711750mE 7220260mN Zone 49 [Unreliable]	P05790
7126	MESA CAMP	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	798442mE 7554749mN Zone 49 [Unreliable]	P05792
7138	QUOBBA DUNES.	Yes	Yes	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Skeletal Material / Burial, Camp	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	P05804
7203	BAUBOODJOO POINT (Bruboodjoo Midden Site)	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Camp, Hunting Place	*Registered Knowledge Holder names available from DAA	789242mE 7456149mN Zone 49 [Reliable]	P05707
7205	TWIN HILL FISHING PLACE.	No	No	No Gender Restrictions	Registered Site	Hunting Place	*Registered Knowledge Holder names available from DAA	787042mE 7467649mN Zone 49 [Unreliable]	P05709
7206	WEALJUGOO MIDDEN.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Camp, Hunting Place	*Registered Knowledge Holder names available from DAA	776584mE 7504740mN Zone 49 [Reliable]	P05710

Aboriginal Heritage Inquiry System

List of Registered Aboriginal Sites

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
7209	BULBARLI POINT COMPLEX.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Camp, Water Source	*Registered Knowledge Holder names available from DAA	778042mE 7393048mN Zone 49 [Reliable]	P05713
7211	MAUD LANDING.	No	No	No Gender Restrictions	Registered Site	Skeletal Material / Burial, Camp, Meeting Place, Water Source	*Registered Knowledge Holder names available from DAA	784292mE 7441048mN Zone 49 [Unreliable]	P05715
7254	SANDY BAY NORTH	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	793442mE 7539949mN Zone 49 [Reliable]	P05652
7265	LAKE SIDE VIEW	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	800942mE 7560549mN Zone 49 [Reliable]	P05664
7298	YARDIE CREEK ROCKSHELTERS	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	790635mE 7529704mN Zone 49 [Reliable]	P05644
7299	YARDIE CREEK	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	789642mE 7528649mN Zone 49 [Unreliable]	P05645
7300	MANDU MANDU CK ROCKSHELTERS	Yes	Yes	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	P05646
7301	CAMP 17 CREEK EAST	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	800342mE 7555749mN Zone 49 [Reliable]	P05647
7303	TULKI WELL MIDDEN	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	798642mE 7554249mN Zone 49 [Reliable]	P05649
7304	PILGRAMUNNA BAY MIDDEN	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	794642mE 7543349mN Zone 49 [Reliable]	P05650
7305	MANGROVE BAY.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Skeletal Material / Burial, Hunting Place	*Registered Knowledge Holder names available from DAA	804142mE 7568149mN Zone 49 [Reliable]	P05651
8300	CORAL BAY	No	No	No Gender Restrictions	Registered Site	Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	784442mE 7430398mN Zone 49 [Unreliable]	P04352

Aboriginal Heritage Inquiry System

List of Registered Aboriginal Sites

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
8301	NINGALOO STATION	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	775891mE 7493649mN Zone 49 [Unreliable]	P04353
8302	WARROORA	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	786642mE 7420648mN Zone 49 [Unreliable]	P04354
8927	TEN MILE WELL BURIAL	No	No	No Gender Restrictions	Registered Site	Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	783642mE 7480649mN Zone 49 [Reliable]	P03570
10381	VLAMING HEAD	Yes	Yes	No Gender Restrictions	Registered Site	Ceremonial, Mythological	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	P01799
10728	WHALE WELL	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	769442mE 7033596mN Zone 49 [Reliable]	P01462
10999	CRAYFISH BAY.	No	No	No Gender Restrictions	Registered Site	Historical, Man-Made Structure, Other: STOCKADES	*Registered Knowledge Holder names available from DAA	729642mE 7084646mN Zone 49 [Unreliable]	P01151
11001	CULCURDU	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Man-Made Structure, Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	770642mE 7033646mN Zone 49 [Unreliable]	P01153
11400	YARDIE CREEK STATION	No	No	No Gender Restrictions	Registered Site	Engraving	*Registered Knowledge Holder names available from DAA	191638mE 7576655mN Zone 50 [Unreliable]	P00750
11401	5 Mile Well (Cape Range)	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Engraving, Painting, Quarry, Arch Deposit	*Registered Knowledge Holder names available from DAA	198638mE 7583655mN Zone 50 [Unreliable]	P00751
11458	NINGALOO (near)	No	No	No Gender Restrictions	Registered Site	Painting	*Registered Knowledge Holder names available from DAA	781642mE 7511649mN Zone 49 [Unreliable]	P00701
11460	WARROORA STATION	No	No	No Gender Restrictions	Registered Site	Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	784642mE 7401648mN Zone 49 [Unreliable]	P00703
11461	BULBARLI WELL.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Skeletal Material / Burial, Camp, Hunting Place	*Registered Knowledge Holder names available from DAA	781542mE 7395648mN Zone 49 [Unreliable]	P00704

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
11552	FALSE ENTRANCE.	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Camp	*Registered Knowledge Holder names available from DAA	730642mE 7079646mN Zone 49 [Unreliable]	P00634
11885	PADJARI MANU CAVE (Formerly Bunbury Cave)	Yes	Yes	No Gender Restrictions	Registered Site	Artefacts / Scatter, Ceremonial, Engraving, Painting, Arch Deposit, Water Source	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	P00267
15322	POINT MURAT/WHITE OPAL	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	209012mE 7585213mN Zone 50 [Reliable]	P07916
16594	Cardabia Station	No	No	No Gender Restrictions	Registered Site	Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	790319mE 7453138mN Zone 49 [Reliable]	
16596	Coral Bay to Yardie Creek 3	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	776901mE 7494189mN Zone 49 [Reliable]	
16597	Baler Bluff	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Midden / Scatter, Shell	*Registered Knowledge Holder names available from DAA	788977mE 7464149mN Zone 49 [Reliable]	
17193	Ningaloo Station	No	No	No Gender Restrictions	Registered Site	Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	775891mE 7489149mN Zone 49 [Unreliable]	
17447	PAP HILL OCHRE	No	No	No Gender Restrictions	Registered Site	Ceremonial, Grinding Patches / Grooves, Rockshelter, Ochre	*Registered Knowledge Holder names available from DAA	198327mE 7581741mN Zone 50 [Reliable]	
17448	CHUGORI ROCKHOLE	No	No	No Gender Restrictions	Registered Site	Ceremonial, Grinding Patches / Grooves, Man-Made Structure, Mythological, Water Source	*Registered Knowledge Holder names available from DAA	193492mE 7579323mN Zone 50 [Reliable]	
20051	Kwelena Mambakort - Wedge Island	Yes	Yes	No Gender Restrictions	Registered Site	Artefacts / Scatter, Ceremonial, Grinding Patches / Grooves, Historical, Midden / Scatter, Rockshelter, Arch Deposit, Camp, Hunting Place, Meeting Place, Shell, Water Source	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	
20052	Wedge Island Coast Sandune Quinilup Springs/ Yonga Kep Wari	No	No	No Gender Restrictions	Registered Site	Artefacts / Scatter, Grinding Patches / Grooves, Historical, Midden / Scatter, Camp, Hunting Place, Meeting Place, Named Place, Water Source	*Registered Knowledge Holder names available from DAA	326413mE 6593758mN Zone 50 [Unreliable]	

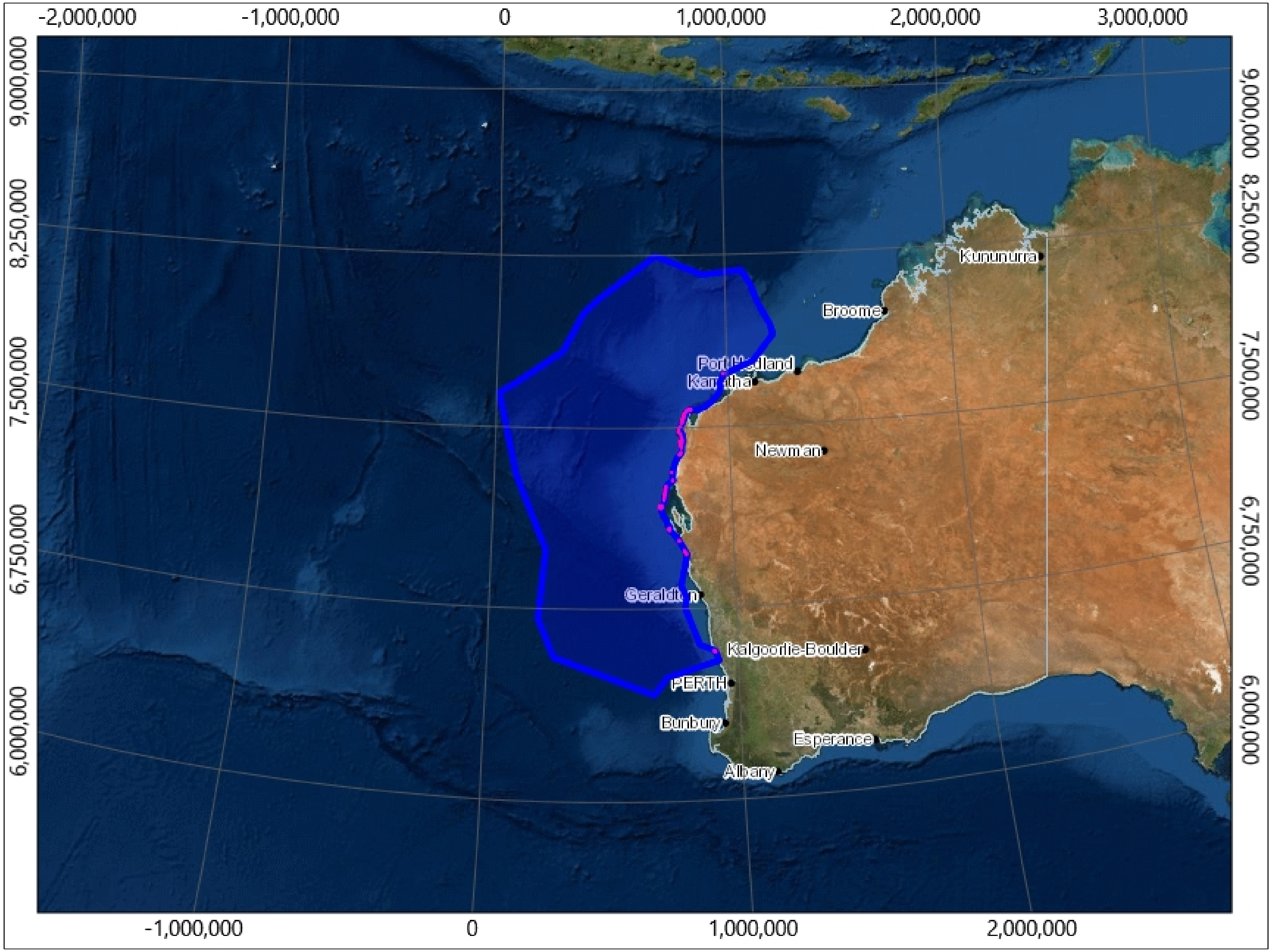
Aboriginal Heritage Inquiry System

Department of Planning, Lands and Heritage

GOVERNMENT OF WESTERN AUSTRALIA

Map of Registered Aboriginal Sites

For further important information on using this information please see the Department of Planning, Lands and Heritage's Disclaimer statement at https://www.dplh.wa.gov.au/about-this-website



Legend

- Registered Aboriginal Site
- Search Area
- Town
- Road
- River
- Local Government Authority

884.15 kilometres

Map Scale 1 : 26,790,000

MGA Zone 49 (GDA94)

Aboriginal Heritage Inquiry System

List of Other Heritage Places

Search Criteria

68 Other Heritage Places in Shapefile - EMBA_CrudeLeak_578bpd

Disclaimer

The Aboriginal Heritage Act 1972 preserves all Aboriginal sites in Western Australia whether or not they are registered. Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist.

The information provided is made available in good faith and is predominately based on the information provided to the Department of Planning, Lands and Heritage by third parties. The information is provided solely on the basis that readers will be responsible for making their own assessment as to the accuracy of the information. If you find any errors or omissions in our records, including our maps, it would be appreciated if you email the details to the Department at AboriginalHeritage@dplh.wa.gov.au and we will make every effort to rectify it as soon as possible.

South West Settlement ILUA Disclaimer

Your heritage enquiry is on land within or adjacent to the following Indigenous Land Use Agreement(s): Yued Indigenous Land Use Agreement.

On 8 June 2015, six identical Indigenous Land Use Agreements (ILUAs) were executed across the South West by the Western Australian Government and, respectively, the Yued, Whadjuk People, Gnaala Karla Booja, Ballardong People, South West Boojarah #2 and Wagyl Kaip & Southern Noongar groups, and the South West Aboriginal Land and Sea Council (SWALSC).

The ILUAs bind the parties (including 'the State', which encompasses all State Government Departments and certain State Government agencies) to enter into a Noongar Standard Heritage Agreement (NSHA) when conducting Aboriginal Heritage Surveys in the ILUA areas, unless they have an existing heritage agreement. It is also intended that other State agencies and instrumentalities enter into the NSHA when conducting Aboriginal Heritage Surveys in the ILUA areas. It is recommended a NSHA is entered into, and an 'Activity Notice' issued under the NSHA, if there is a risk that an activity will 'impact' (i.e. by excavating, damaging, destroying or altering in any way) an Aboriginal heritage site. The Aboriginal Heritage Due Diligence Guidelines, which are referenced by the NSHA, provide guidance on how to assess the potential risk to Aboriginal heritage.

Likewise, from 8 June 2015 the Department of Mines, Industry Regulation and Safety (DMIRS) in granting Mineral, Petroleum and related Access Authority tenures within the South West Settlement ILUA areas, will place a condition on these tenures requiring a heritage agreement or a NSHA before any rights can be exercised.

If you are a State Government Department, Agency or Instrumentality, or have a heritage condition placed on your mineral or petroleum title by DMIRS, you should seek advice as to the requirement to use the NSHA for your proposed activity. The full ILUA documents, maps of the ILUA areas and the NSHA template can be found at https://www.wa.gov.au/organisation/department-of-the-premier-and-cabinet/south-west-native-title-settlement.

Further advice can also be sought from the Department of Planning, Lands and Heritage at AboriginalHeritage@dplh.wa.gov.au.

Copyright

Coordinate Accuracy

Coordinates (Easting/Northing metres) are based on the GDA 94 Datum. Accuracy is shown as a code in brackets following the coordinates.

Terminology (NB that some terminology has varied over the life of the legislation)

Place ID/Site ID: This a unique ID assigned by the Department of Planning, Lands and Heritage to the place.

Status:

- Registered Site: The place has been assessed as meeting Section 5 of the Aboriginal Heritage Act 1972.
- Other Heritage Place which includes:
  - Stored Data / Not a Site: The place has been assessed as not meeting Section 5 of the Aboriginal Heritage Act 1972.
  - Lodged: Information has been received in relation to the place, but an assessment has not been completed at this stage to determine if it meets Section 5 of the Aboriginal Heritage Act 1972.

Access and Restrictions:

- File Restricted = No: Availability of information that the Department of Planning, Lands and Heritage holds in relation to the place is not restricted in any way.
- File Restricted = Yes: Some of the information that the Department of Planning, Lands and Heritage holds in relation to the place is restricted if it is considered culturally sensitive. This information will only be made available if the Department of Planning, Lands and Heritage receives written approval from the informants who provided the information. To request access please contact AboriginalHeritage@dplh.wa.gov.au.
- Boundary Restricted = No: Place location is shown as accurately as the information lodged with the Registrar allows.
- Boundary Restricted = Yes: To preserve confidentiality the exact location and extent of the place is not displayed on the map. However, the shaded region (generally with an area of at least 4km²) provides a general indication of where the place is located. If you are a landowner and wish to find out more about the exact location of the place, please contact the Department of Planning, Lands and Heritage.
- Restrictions:
  - No Restrictions: Anyone can view the information.
  - Male Access Only: Only males can view restricted information.
  - Female Access Only: Only females can view restricted information.

Legacy ID: This is the former unique number that the former Department of Aboriginal Sites assigned to the place. This has been replaced by the Place ID / Site ID.

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ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
158	CORAL BAY 01	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	785042mE 7438048mN Zone 49 [Reliable]	P07593
599	NORWEGIAN BAY 2	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Midden / Scatter, Skeletal Material / Burial, Other: 11462 is also a duplicate of this site.	*Registered Knowledge Holder names available from DAA	773421mE 7500769mN Zone 49 [Reliable]	P07441
884	BARROW ISLAND 02	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	331673mE 7691987mN Zone 50 [Reliable]	P07292
885	BARROW ISLAND 03	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	326224mE 7689495mN Zone 50 [Reliable]	P07293
886	BARROW ISLAND 04	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	325227mE 7694610mN Zone 50 [Reliable]	P07294
887	BARROW ISLAND 05	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	337603mE 7713680mN Zone 50 [Reliable]	P07295
888	BARROW ISLAND 06 A-F	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	337202mE 7710824mN Zone 50 [Unreliable]	P07296
890	BARROW ISLAND 08	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	326487mE 7695727mN Zone 50 [Reliable]	P07298
891	BARROW ISLAND 09	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	326270mE 7691185mN Zone 50 [Reliable]	P07299
892	BARROW ISLAND 10	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	331892mE 7691082mN Zone 50 [Reliable]	P07300
893	BARROW ISLAND 11	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	326145mE 7695108mN Zone 50 [Reliable]	P07301
894	BARROW ISLAND 12	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	326347mE 7699332mN Zone 50 [Reliable]	P07302

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
3193	LEDGE POINT WELL.	No	No	No Gender Restrictions	Lodged	Water Source	*Registered Knowledge Holder names available from DAA	344297mE 6559168mN Zone 50 [Reliable]	S00600
3237	LEDGE POINT.	No	No	No Gender Restrictions	Stored Data / Not a Site	Camp, Water Source	*Registered Knowledge Holder names available from DAA	345136mE 6565151mN Zone 50 [Unreliable]	S00542
4403	NABAROO.	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Camp	*Registered Knowledge Holder names available from DAA	344639mE 6558650mN Zone 50 [Unreliable]	S00049
6119	PAP HILL 1.	No	No	No Gender Restrictions	Lodged	Rockshelter	*Registered Knowledge Holder names available from DAA	198238mE 7581955mN Zone 50 [Reliable]	P07008
6120	PAP HILL 2.	No	No	No Gender Restrictions	Lodged	Grinding Patches / Grooves, Rockshelter, BP Dating: 35,230 BP	*Registered Knowledge Holder names available from DAA	198138mE 7581855mN Zone 50 [Reliable]	P07009
6615	CORAL BAY ACCESS 1	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	785542mE 7437748mN Zone 49 [Reliable]	P06360
6783	28 MILE CREEK NORTH 2	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	796642mE 7545649mN Zone 49 [Unreliable]	P06141
6786	LAKESIDE COASTAL PLAIN	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	801642mE 7560649mN Zone 49 [Unreliable]	P06144
6789	TURQUOISE BAY NORTH	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	798642mE 7554649mN Zone 49 [Unreliable]	P06147
6796	ROAD ALIGNMENT 4	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	792442mE 7533369mN Zone 49 [Reliable]	P06154
6831	GNARALOO STATION	No	No	No Gender Restrictions	Lodged	Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	763342mE 7374948mN Zone 49 [Reliable]	P06136
7204	CHABJUWARDOO BAY.	No	No	No Gender Restrictions	Lodged	Hunting Place	*Registered Knowledge Holder names available from DAA	789442mE 7460849mN Zone 49 [Reliable]	P05708

Aboriginal Heritage Inquiry System

List of Other Heritage Places

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
7207	NORWEGIAN BAY MIDDEN	No	No	No Gender Restrictions	Lodged	Midden / Scatter	*Registered Knowledge Holder names available from DAA	775641mE 7498949mN Zone 49 [Reliable]	P05711
7208	MILYERING ROCKS.	No	No	No Gender Restrictions	Lodged	Hunting Place	*Registered Knowledge Holder names available from DAA	800842mE 7560649mN Zone 49 [Reliable]	P05712
7210	UPPER BULBARLI WELL.	No	No	No Gender Restrictions	Lodged	Hunting Place	*Registered Knowledge Holder names available from DAA	782342mE 7396848mN Zone 49 [Reliable]	P05714
7212	GREYLING CLIFFS.	No	No	No Gender Restrictions	Lodged	Hunting Place	*Registered Knowledge Holder names available from DAA	788642mE 7447048mN Zone 49 [Unreliable]	P05716
7302	CAMP 17 CREEK ROCKSHELTERS	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	800042mE 7555249mN Zone 49 [Unreliable]	P05648
8946	YARDIE CREEK	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	790842mE 7527849mN Zone 49 [Reliable]	P03537
8951	BARROW ISLAND	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	335137mE 7705156mN Zone 50 [Unreliable]	P03542
10074	TAMALA STONE MOUND	No	No	No Gender Restrictions	Lodged	Man-Made Structure	*Registered Knowledge Holder names available from DAA	774642mE 7020646mN Zone 49 [Unreliable]	P02138
10099	POINT MAUD, CORAL BAY	No	No	No Gender Restrictions	Lodged	Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	783342mE 7440448mN Zone 49 [Unreliable]	P02064
10100	GNARALOO BAY	No	No	No Gender Restrictions	Lodged	Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	755143mE 7365149mN Zone 49 [Unreliable]	P02065
10215	WOMERANGEE RAIN SHED	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Camp	*Registered Knowledge Holder names available from DAA	775642mE 7022646mN Zone 49 [Unreliable]	P01966
10216	WOMERANGEE CLIFFS	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Camp, Hunting Place	*Registered Knowledge Holder names available from DAA	774492mE 7021446mN Zone 49 [Unreliable]	P01967

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
10595	CORAL BAY BURIAL	No	No	No Gender Restrictions	Lodged	Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	783942mE 7429848mN Zone 49 [Unreliable]	P01594
11000	CARRANG-TAMALA BOUNDARY	No	No	No Gender Restrictions	Lodged	Midden / Scatter	*Registered Knowledge Holder names available from DAA	743642mE 7063646mN Zone 49 [Unreliable]	P01152
11044	RED BLUFF	No	No	No Gender Restrictions	Lodged	Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	744642mE 7300648mN Zone 49 [Unreliable]	P01144
11403	THEVENARD ISLAND	No	No	No Gender Restrictions	Lodged	Midden / Scatter	*Registered Knowledge Holder names available from DAA	292638mE 7625655mN Zone 50 [Unreliable]	P00753
11692	WARROORA WELL	No	No	No Gender Restrictions	Lodged	Midden / Scatter	*Registered Knowledge Holder names available from DAA	785642mE 7399648mN Zone 49 [Unreliable]	P00451
11801	COASTAL MIDDEN, 5 MILE	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Midden / Scatter	*Registered Knowledge Holder names available from DAA	195638mE 7582655mN Zone 50 [Unreliable]	P00345
16595	Jarvis Well Camp	No	No	No Gender Restrictions	Stored Data / Not a Site	Artefacts / Scatter, Historical	*Registered Knowledge Holder names available from DAA	776491mE 7498549mN Zone 49 [Reliable]	
20053	Wedge Island Camping Ground Shell Middens	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Historical, Midden / Scatter, Camp	*Registered Knowledge Holder names available from DAA	326883mE 6592327mN Zone 50 [Unreliable]	
21439	Cardabia Station Waterhole	No	No	No Gender Restrictions	Lodged	Water Source	*Registered Knowledge Holder names available from DAA	787283mE 7443156mN Zone 49 [Unreliable]	
21468	Sandy Point Rockshelter	No	No	No Gender Restrictions	Lodged	Man-Made Structure, Rockshelter, Arch Deposit, Shell	*Registered Knowledge Holder names available from DAA	786694mE 7521436mN Zone 49 [Reliable]	
22943	Flacourt Bay 01	No	No	No Gender Restrictions	Lodged	Rockshelter	*Registered Knowledge Holder names available from DAA	331540mE 7705613mN Zone 50 [Reliable]	
24398	Quobba Skeletal Remains	No	No	No Gender Restrictions	Lodged	Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	746575mE 7286075mN Zone 49 [Reliable]	

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
25076	Norwegian Bay Burial 01/2008	No	No	No Gender Restrictions	Lodged	Skeletal Material / Burial	*Registered Knowledge Holder names available from DAA	774175mE 7499790mN Zone 49 [Reliable]	
26119	Dirk Hartog Island: Preseverant Camp-Fireplace	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter, Shell	*Registered Knowledge Holder names available from DAA	693965mE 7175048mN Zone 49 [Reliable]	
26191	Chillion Kornt, Wetj Boya	Yes	Yes	No Gender Restrictions	Lodged	Artefacts / Scatter, Fish Trap, Midden / Scatter, Rockshelter	*Registered Knowledge Holder names available from DAA	Not available when location is restricted	
29549	Boodie Soak	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	333058mE 7702494mN Zone 50 [Reliable]	
31762	Site 1	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	332664mE 7694168mN Zone 50 [Reliable]	
31763	Site 2	No	No	No Gender Restrictions	Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	332528mE 7694213mN Zone 50 [Reliable]	
36199	Boodie Cave	No	No		Lodged	Artefacts / Scatter, Rockshelter	*Registered Knowledge Holder names available from DAA	329709mE 7703887mN Zone 50 [Reliable]	
36234	South End structures, Barrow Island.	No	No		Lodged	Historical, Man-Made Structure	*Registered Knowledge Holder names available from DAA	326057mE 7689365mN Zone 50 [Unreliable]	
36261	G-13-S0001	No	No		Lodged	Quarry	*Registered Knowledge Holder names available from DAA	329032mE 7702259mN Zone 50 [Reliable]	
36262	H-24-S0001	No	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	330962mE 7691480mN Zone 50 [Reliable]	
36263	H-24-S0002	No	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	330959mE 7691251mN Zone 50 [Reliable]	
36264	I-23-S0001	No	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	331260mE 7692010mN Zone 50 [Reliable]	

ID	Name	File Restricted	Boundary Restricted	Restrictions	Status	Type	Knowledge Holders	Coordinate	Legacy ID
36265	I-23-S0002	No	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	331643mE 7692090mN Zone 50 [Reliable]	
36266	I-24-S0003	No	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	331552mE 7691950mN Zone 50 [Reliable]	
36267	J-23-S0001	No	No		Lodged	Grinding Patches / Grooves	*Registered Knowledge Holder names available from DAA	332215mE 7692570mN Zone 50 [Reliable]	
36268	J-23-S0002	No	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	332208mE 7692431mN Zone 50 [Reliable]	
36269	J-23-S0003	No	No		Lodged	Modified Tree	*Registered Knowledge Holder names available from DAA	332193mE 7692286mN Zone 50 [Reliable]	
36270	M-03-S0001	No	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	335996mE 7712066mN Zone 50 [Reliable]	
36271	N-02-S0001	No	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	336855mE 7713004mN Zone 50 [Reliable]	
36272	O-02-S0002	No	No		Lodged	Artefacts / Scatter	*Registered Knowledge Holder names available from DAA	337100mE 7713272mN Zone 50 [Reliable]	

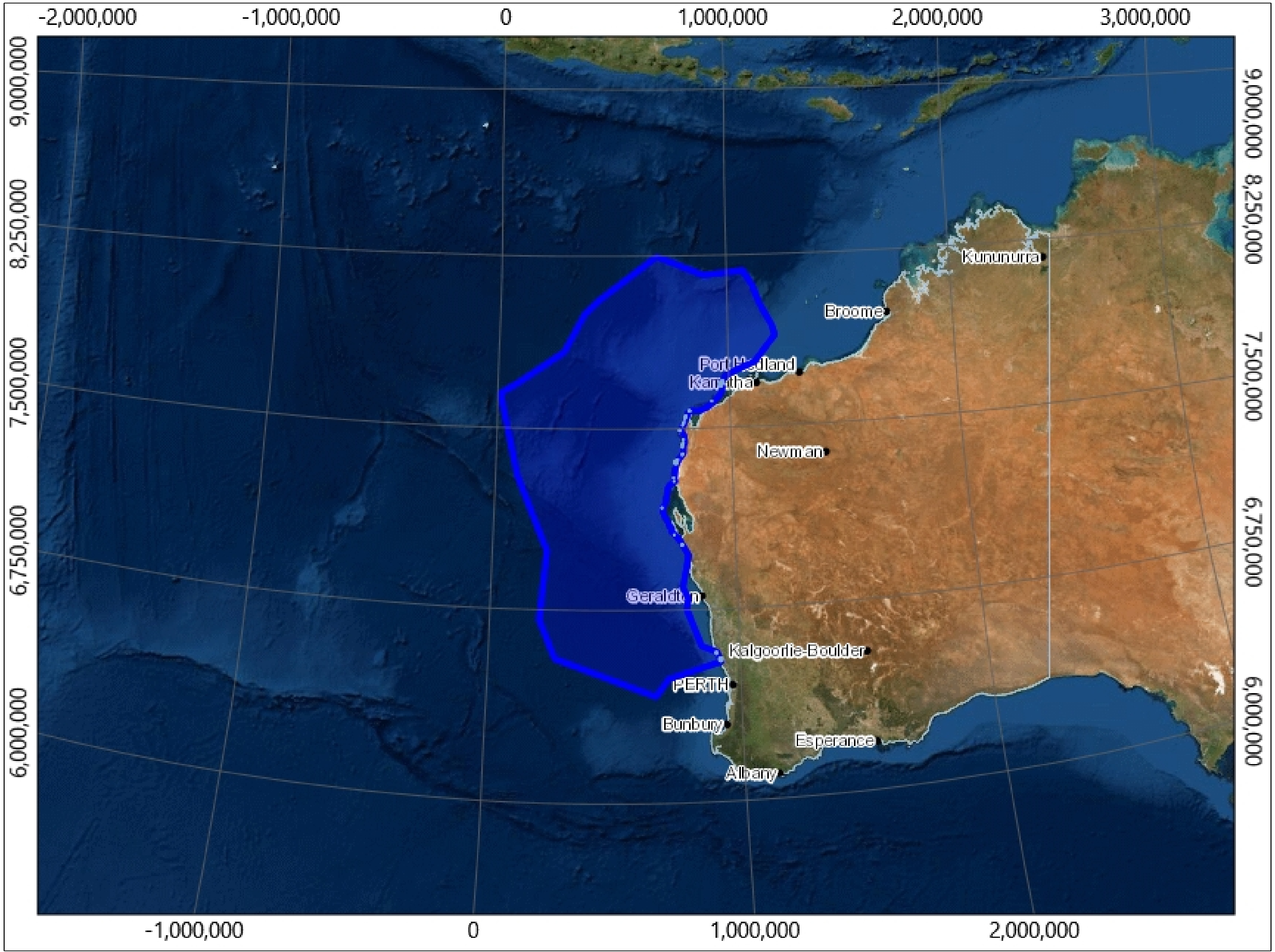
Department of Planning, Lands and Heritage

GOVERNMENT OF WESTERN AUSTRALIA

Aboriginal Heritage Inquiry System

Map of Other Heritage Places

For further important information on using this information please see the Department of Planning, Lands and Heritage's Disclaimer statement at https://www.dplh.wa.gov.au/about-this-website



Legend

- Other Heritage Place
- Search Area
- Town
- Road
- River
- Local Government Authority

884.15 kilometres

Map Scale 1 : 26,790,000

MGA Zone 49 (GDA94)

Appendix F

STAKEHOLDER CONSULTATION

Consultation (Cover Email, 14 February 2020)

BHP

BHP Consultation with Relevant Stakeholder – 14 February 2020

Dear Stakeholder,

BHP is planning to undertake vessel-based well intervention activities on the Crosby-3H1 well located in Production Licence WA-42-L in Commonwealth waters, commencing in Quarter three or four 2020 (calendar year) pending approvals, vessel availability and weather constraints. The intervention activities will be short in duration (6 to 8 days to complete depending on weather).

A Fact Sheet is attached which provides information on the proposed activity, including a summary of potential key risks and associated management measures.

Activity Overview

Activity purpose:	To support ongoing production from the Pyrenees Operations	
Activity:	Well intervention activities (vessel-based) on the Crosby-3H1 well	
Activity location:	27 km north of the North West Cape peninsula, Exmouth, Western Australia	
Well location:	Crosby-3H1 well	21° 32' 43.063" S, 114° 05' 42.504" E
Approximate water depth:	~ 200 m	
Estimate start date:	Any time in Quarter three or Quarter four 2020 (Calendar Year). Earliest expected start is July/August 2020.	
Approximate duration:	6 to 8 days depending on weather conditions	
Vessel:	Subsea installation vessel • Dynamic positioning • No anchoring required • No support vessels required	
Exclusion zone:	Petroleum safety zone of 500 m will be in place around the subsea installation vessel	

Your Feedback

Your feedback on the proposed activity and our response will be included in an Environment Plan for assessment by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA), as is required under the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009. Please be aware that recent amendments to the Environment Regulations require NOPSEMA to publish the Environment Plan for this activity in full following acceptance.

As a relevant stakeholder you are invited to provide comments. Please advise BHP if you do not wish for your comments to be published in the Environment Plan, or wish to provide your comments anonymously. In which case, we will ensure it is included in the sensitive information part of the Environment Plan. The feedback and information we receive will form part of the Environment Plan assessment, however it will not be released publicly and will remain confidential to NOPSEMA throughout.

Please provide your views by close of business **13 March 2020** to allow us sufficient time to inform our planning for the proposed activity. Comments can be made by email, letter or by phone.

Regards,

BHP

Consultation (Fact Sheet, February 2020)

Petroleum

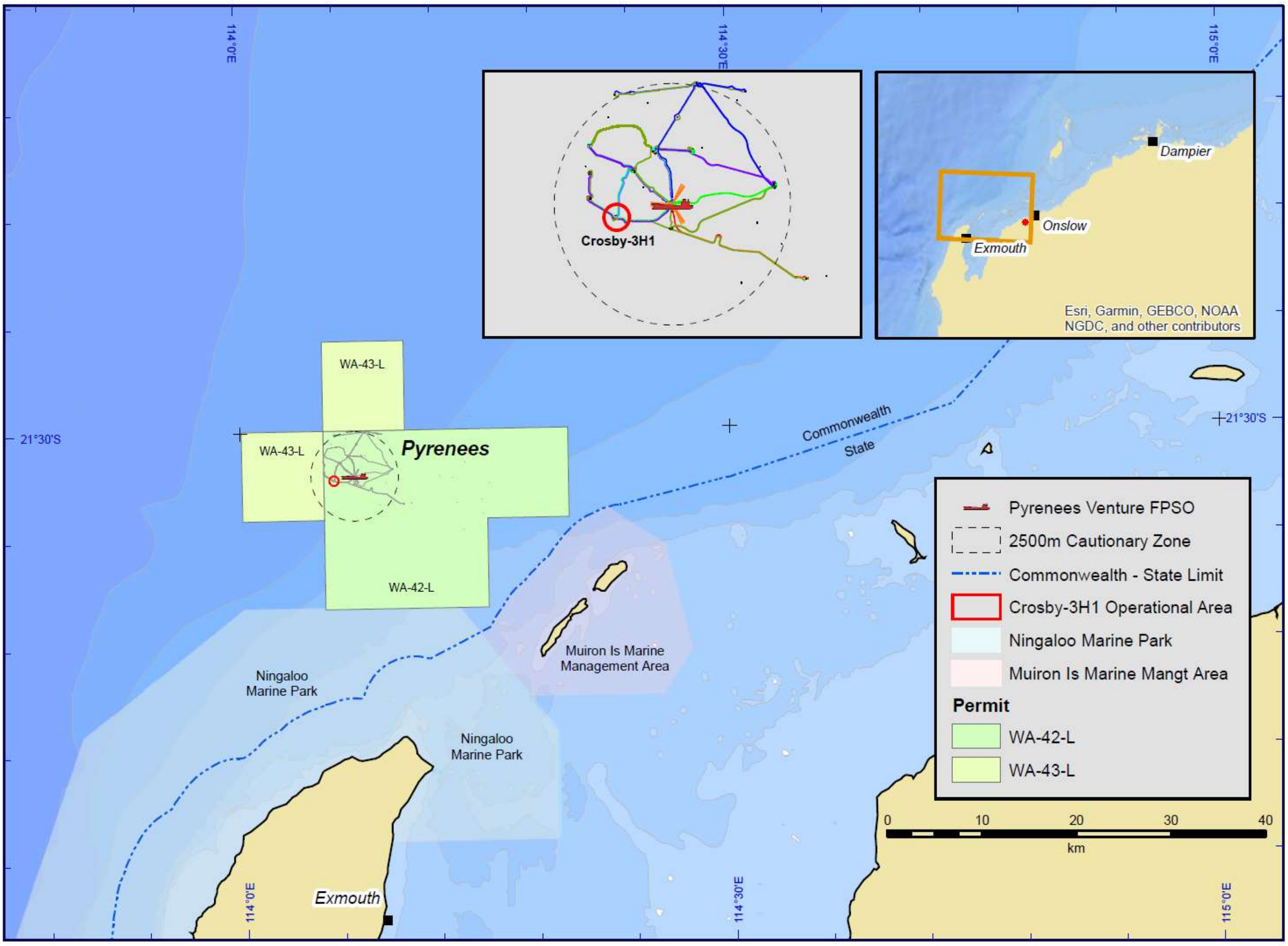
Invitation for Feedback: Stakeholder Information Fact Sheet

CROSBY-3H1 LIGHT WELL INTERVENTION ENVIRONMENT PLAN

Northern Carnarvon Basin, North West Australia

BHP is planning to undertake well intervention activities on the Crosby-3H1 well within Petroleum Licence WA-42-L in Commonwealth waters to support ongoing production from the Pyrenees Operations. These activities will be short in duration (6 to 8 days to complete depending on weather) and are expected to commence during Quarter three or four 2020 (calendar year) and take 6 to 8 days to complete. The earliest expected timing to commence the activities is July/August 2020 subject to approvals, vessel availability and weather constraints. BHP is preparing an Environment Plan for submission to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009.

BHP is the designated operator on behalf of the WA-42-L titleholders, BHP and Santos Limited.



This Stakeholder Fact Sheet relates to the submission of a new Environment Plan for the well intervention activities planned for the Crosby-3H1 well. The well forms part of the Pyrenees Development producing crude oil from six separate oil fields in production permits WA-42-L and WA-43-L. Production fluids from the Pyrenees fields are produced to the *Pyrenees Venture* Floating Production Storage and Offloading facility (FPSO), a double-hulled stand-alone facility.

Location of Activity and Operational Area

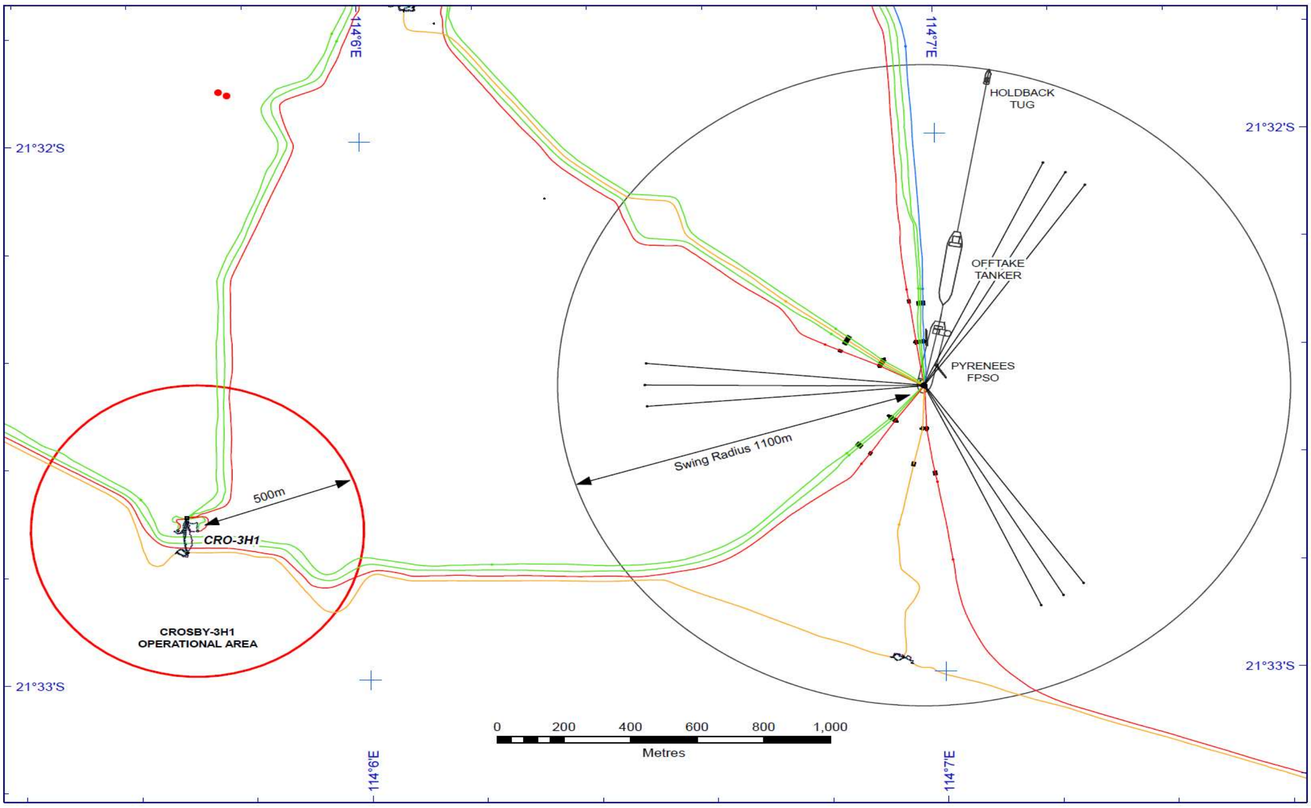
The Operational Area defines the spatial boundary within which the well intervention activities will take place. The Operational Area is a 500-m radius around the Crosby-3H1 well located in Production Licence WA-42-L. The closest landfall is the tip of the North West Cape, Exmouth, approximately 27 km to the south of the Operational Area.

The Operational Area lies approximately 15 km from the northern boundary of the Ningaloo Marine Park boundary (Commonwealth Waters).

Value/ Sensitivity	Approx. Distance from Operational Area
Ningaloo Coast - World Heritage / National Heritage Area	13 km
Ningaloo Marine Park (Cmth)	13 km
Gascoyne Marine Park (Cmth)	17 km
Ningaloo Marine Park (State)	20 km
Muiron Islands Management Area	22 km

Description of Activity

Crosby-3H1 Well Intervention	
Earliest expected commencement date	Quarter three or Quarter four 2020 (calendar year) pending approvals, vessel availability and weather constraints. Earliest expected start is July/August 2020.
Crosby 3H1 well location	21° 32' 43.063" S, 114° 05' 42.504" E
Approximate estimated duration	6 to 8 days depending on weather conditions
Water depth	~ 200 m
Project vessel (subsea intervention vessel)	Subsea intervention vessel (dynamic positioning)
Operational area	500-m radius around the well



The well intervention activities will be carried out from a subsea intervention vessel mobilised to the Operational Area and positioned over the wellhead. These activities will involve the deployment of a subsea intervention device (SID) from the vessel on to the Crosby-3H1 Xmas Tree, the establishment of service and safety systems, hook up to the well and commencement of intervention activities. On completion, the SID will be retrieved to the vessel and the well made ready for return to production. In accordance with BHP Well Integrity Standard, a minimum of two well barriers to the reservoir will be in place at all times.

Summary of potential risks and associated management measures

Potential Risks	Management and / or Mitigations Measures
Planned Activities	
Emissions: Light	○ Lighting is minimised to that required for safety and navigational purposes.
Emissions: Underwater noise	○ Measures will be in place for interacting with protected marine fauna as per the EPBC Regulations (Part 8).
Physical presence: Interactions with other marine users	○ BHP's existing infrastructure is marked on nautical charts with gazetted exclusion and cautionary zones. ○ Consultation with relevant stakeholders (e.g. adjacent petroleum titleholders, commercial fishers and their representative organisations, and government departments and agencies) to inform decision making for the proposed activity and the development of the Environment Plan. ○ Advice to relevant stakeholders prior to commencement of the activities.
Planned discharges to the marine environment	○ Chemical use will be managed in accordance with BHP and contractor chemical selection and approval procedures. ○ All routine marine discharges will be managed according to legislative and regulatory requirements and BHP's Environment Performance Standards where applicable.
Waste generation	○ Waste generated on the vessel will be managed in accordance with legislative requirements and a Waste Management Plan. ○ Wastes will be managed and disposed of in a safe and environmental responsible manner that prevents accident loss to the marine environment. ○ Wastes transported onshore will be sent to appropriate recycling or disposal facilities by a licences waste contractor.
Unplanned Risks	
Invasive marine species	○ BHP contracted vessels comply with Australian biosecurity requirements and guidance, and Australian ballast water requirements. ○ Vessel will be assessed and managed in line with BHP procedures to prevent the introduction of invasive marine species.
Marine fauna interaction	○ Measures will be in place for interacting with protected marine fauna as per the EPBC Regulations (Part 8).
Vessel collision	○ Marine notifications will be made to relevant stakeholders, describing the location of the activity and the 500 m petroleum safety zone to prevent the risk of vessel collisions.
Unplanned releases including hydrocarbons	○ All personnel undertaking activities will undergo relevant inductions and training. ○ Procedures for lifts, equipment maintenance, inspections and bunding. ○ All offshore activities will be managed in accordance with BHP lifting and transfer ○ Recovery of hazardous solid wastes lost overboard where safe and practicable to do so. ○ Oil Pollution Emergency Plan. ○ Appropriate vessel spill response plan, equipment and materials will be in place and maintained.

Protecting Our People and the Environment

Safety of our people and the communities in which we operate always comes first. Identifying, controlling and mitigating safety risks is managed through an overarching, consistent approach guided by BHP's Risk Management governance framework, with supporting processes and performance requirements. All activities (routine and non-routine) will be performed in accordance with the industry leading standards established in BHP's Charter, HSEC Framework and Controls, Engineering Standards and Procedures, Environment Plan and the NOPSEMA-approved Well Operations Management Plan (WOMP) and NOPSEMA-approved Vessel Safety Case.

Offshore petroleum activities are regulated through a robust and comprehensive environmental protection regime administered by NOPSEMA under the Commonwealth *Offshore Petroleum and Greenhouse Gas Storage Act 2006*. BHP undertakes risk assessments for all environmental aspects of a petroleum activity and stringently adheres to the regulatory regime.

The objective of the Environment Plan is to ensure that potential adverse impacts on the environment associated with activities, during both routine and non-routine operations, are identified, and will be continuously reduced to as low as reasonably practicable (ALARP) and an acceptable level. BHP is committed to understanding the impacts of our activities on stakeholders with an interest in the Pyrenees field and seeks feedback as part of the development of the EPs (and subsequent revisions).

Responding to Emergencies

BHP's incident response plans are approved by the regulator NOPSEMA. The Commonwealth Oil Pollution Emergency Plan (OPEP) is required by law under the Environmental Regulations and forms an appendix to the full EP. The documents outline responsibilities, specific procedures and identify resources available in the unlikely event of an incident.

BHP maintains a constant vigilance and readiness to prevent and/or respond to hydrocarbon loss of containment incidents.

The readiness and competency of BHP to respond to incidents is maintained and tested by conducting a series of drills.

Should you have any questions, concerns or grievances regarding these activities or any other BHP Petroleum activities, please call BHP on **1800 421 077** or send an email to **bhppetexternalaffairs@bhp.com**

BHP believes in putting health and safety first, being environmentally responsible and supporting our communities

Any person providing feedback is asked to advise if information provided is to remain confidential and is not to be published within the Environment Plan.

Fisheries Focused Fact Sheet (14 February 2020)

Petroleum

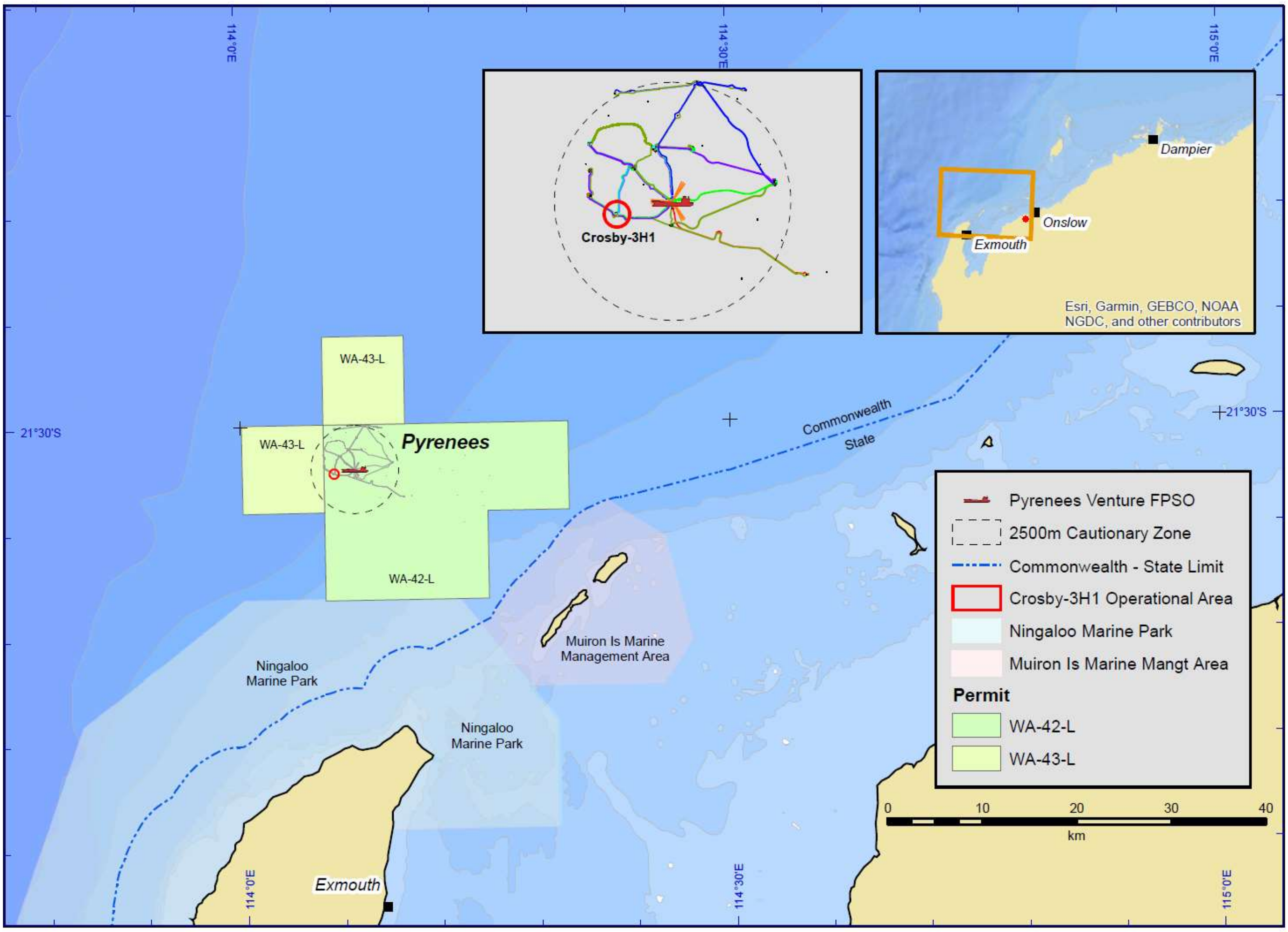
Invitation for Feedback: Stakeholder Information Fact Sheet

CROSBY-3H1 LIGHT WELL INTERVENTION ENVIRONMENT PLAN

Northern Carnarvon Basin, North West Australia

BHP is planning to undertake well intervention activities on the Crosby-3H1 well within Petroleum Licence WA-42-L in Commonwealth waters to support ongoing production from the Pyrenees Operations. These activities will be short in duration (6 to 8 days to complete depending on weather) and are expected to commence during Quarter three or four 2020 (calendar year). The earliest expected timing to commence the activities is July/August 2020 subject to approvals, vessel availability and weather constraints. BHP is preparing an Environment Plan for submission to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009.

BHP is the designated operator on behalf of the WA-42-L titleholders, BHP and Santos Limited.



This Stakeholder Fact Sheet relates to the submission of a new Environment Plan for the well intervention activities planned for the Crosby-3H1 well. The well forms part of the Pyrenees Development producing crude oil from six separate oil fields in production permits WA-42-L and WA-43-L. Production fluids from the Pyrenees fields are produced to the *Pyrenees Venture* Floating Production Storage and Offloading facility (FPSO), a double-hulled stand-alone facility.

Location of Activity and Operational Area

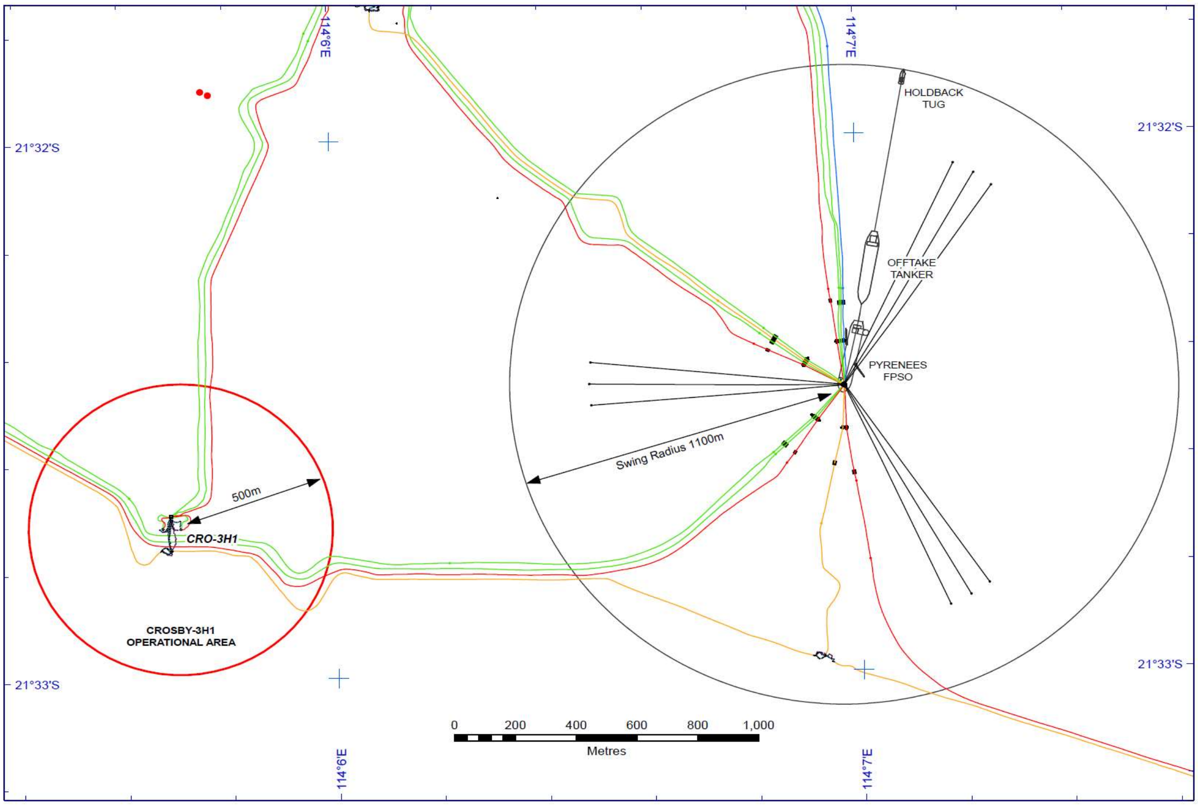
The Operational Area defines the spatial boundary within which the well intervention activities will take place. The Operational Area is a 500-m radius around the Crosby-3H1 well located in Production Licence WA-42-L. The closest landfall is the tip of the North West Cape, Exmouth, approximately 27 km to the south of the Operational Area.

The Operational Area lies approximately 15 km from the northern boundary of the Ningaloo Marine Park boundary (Commonwealth Waters).

Value/ Sensitivity	Approx. Distance from Operational Area
Ningaloo Coast - World Heritage / National Heritage Area	13 km
Ningaloo Marine Park (Cmth)	13 km
Gascoyne Marine Park (Cmth)	17 km
Ningaloo Marine Park (State)	20 km
Muiron Islands Management Area	22 km

Description of Activity

Crosby-3H1 Well Intervention	
Earliest expected commencement date	Quarter three or Quarter four 2020 (calendar year) pending approvals, vessel availability and weather constraints. Earliest expected start is July/August 2020.
Crosby 3H1 well location	21° 32' 43.063" S, 114° 05' 42.504" E
Approximate estimated duration	6 to 8 days depending on weather conditions
Water depth	~ 200 m
Project vessel (subsea intervention vessel)	Subsea intervention vessel (dynamic positioning)
Operational area	500 m radius around the well



The well intervention activities will be carried out from a subsea intervention vessel mobilised to the Operational Area and positioned over the wellhead. These activities will involve the deployment of a subsea intervention device (SID) from the vessel on to the Crosby-3H1 Xmas Tree, the establishment of service and safety systems, hook up to the well and commencement of intervention activities. On completion, the SID will be retrieved to the vessel and the well made ready for return to production. In accordance with BHP Well Integrity Standard, a minimum of two well barriers to the reservoir will be in place at all times.

What Fisheries May be Affected

Commercial fisheries have been identified as being relevant on the basis of fishing licence overlap with the proposed operational (activity) area, as well as consideration of government fishing effort data from recent years, fishing methods and water depth. Individual licence holders and representative fishing associations/organisations have been contacted as part of this consultation and relevant stakeholders include:

- State Fisheries:
    - Pilbara Demersal Scale Fisheries (Trap/Trawl/Line)
- Commonwealth Fisheries – None activity in the immediate vicinity
- Australian Fisheries Management Authority (AFMA)
- Commonwealth Fisheries Association (CFA)
- Department of Primary Industry and Resources (DPIRD)
- Pearl Producers Association (PPA)
- Recfish West
- Western Australian Fishing Industry Council (WAFIC)

Summary of potential risks to fishing sector

Potential Risks	Risk Description	Management and / or Mitigations Measures
Planned Activities		
Physical presence	○ The physical presence of the subsea installation vessel during the activities is not considered to affect other marine users from access to the area given the gazetted exclusion and cautionary zones for BHP's existing infrastructure.	○ BHP's existing infrastructure is marked on nautical charts with gazetted exclusion and cautionary zones. ○ BHP will notify relevant fishery stakeholders and Government maritime safety agencies of start and end dates for the activity, and vessel location details and any exclusion zones prior to commencement of the activity.
Emissions: Underwater noise	○ Underwater noise will be generated by the subsea installation vessel. The low acoustic source levels are not predicted to impact fish feeding, spawning or hearing.	○ Acoustic impacts to marine fauna from the vessel are considered not significant, with no lasting effects predicted. Acoustic source levels are in a similar range to other commercial vessels in the region.
Planned discharges to the marine environment	○ Discharges from the operation of the vessel include sewage, grey water, cooling water, desalination brine, deck drainage, ballast and bilge water. ○ Discharges from the operation of the subsea installation vessel will result in localised and short-term reduction in water quality. Discharges will be rapidly diluted and dispersed.	○ Chemical use will be managed in accordance with BHP and contractor chemical selection and approval procedures. ○ All routine marine discharges will be managed according to legislative and regulatory requirements and BHP's Environment Performance Standards where applicable.
Unplanned Risks		
Invasive marine species	○ Introduction or translocation and establishment of invasive marine species via vessel ballast water or biofouling (e.g. hull, submersible equipment).	○ BHP contracted vessels comply with Australian biosecurity requirements and guidance, and Australian ballast water requirements. ○ Vessel will be assessed and managed in line with BHP procedures to prevent the introduction of invasive marine species.

Potential Risks	Risk Description	Management and / or Mitigations Measures
Unplanned releases including hydrocarbons	○ Loss of solid hazardous and non-hazardous waste overboard (i.e. dropped objects or wind-blown rubbish, or improper storage). ○ Release of hydrocarbons to the marine environment from a vessel collision resulting in a fuel tank rupture. ○ Release of hydrocarbons from loss of well integrity.	○ All personnel undertaking activities will undergo relevant inductions and training. ○ Procedures for lifts, equipment maintenance, inspections and bunding. ○ All offshore activities will be managed in accordance with BHP and Contractor lifting and transfer procedures. ○ Well barrier management. ○ Recovery of hazardous solid wastes lost overboard where safe and practicable to do so. ○ Oil Pollution Emergency Plan. ○ Appropriate vessel spill response plan, equipment and materials will be in place and maintained.

Protecting Our People and the Environment

Safety of our people and the communities in which we operate always comes first. Identifying, controlling and mitigating safety risks is managed through an overarching, consistent approach guided by BHP's Risk Management governance framework, with supporting processes and performance requirements. All activities (routine and non-routine) will be performed in accordance with the industry leading standards established in BHP's Charter, HSEC Framework and Controls, Engineering Standards and Procedures, Environment Plan and the NOPSEMA-approved Well Operations Management Plan (WOMP) and NOPSEMA-approved Vessel Safety Case.

Offshore petroleum activities are regulated through a robust and comprehensive environmental protection regime administered by NOPSEMA under the Commonwealth *Offshore Petroleum and Greenhouse Gas Storage Act 2006*. BHP undertakes risk assessments for all environmental aspects of a petroleum activity and stringently adheres to the regulatory regime.

The objective of the Pyrenees Facility Operations EP is to ensure that potential adverse impacts on the environment associated with activities, during both routine and non-routine operations, are identified, and will be continuously reduced to ALARP and an acceptable level. BHP is committed to understanding the impacts of our operations on stakeholders with an interest in the Pyrenees field and seeks feedback as part of the development of the EPs (and subsequent revisions).

Responding to Emergencies

BHP's incident response plans are approved by the regulator NOPSEMA. The Commonwealth Oil Pollution Emergency Plan (OPEP) is required by law under the Environmental Regulations and forms an appendix to the full EP. The documents outline responsibilities, specific procedures and identify resources available in the unlikely event of an incident.

BHP maintains a constant vigilance and readiness to prevent and/or respond to hydrocarbon loss of containment incidents.

The readiness and competency of BHP to respond to incidents is maintained and tested by conducting a series of drills.

Should you have any questions, concerns or grievances regarding these activities or any other BHP Petroleum activities, please call BHP WA Community Hotline on **1800 421 077** or send an email to **bhppetexternalaffairs@bhp.com**

BHP believes in putting health and safety first, being environmentally responsible and supporting our communities

Any person providing feedback is asked to advise if information provided is to remain confidential and is not to be published within the Environment Plan.

Exmouth Community Reference Group Meeting

12 March 2020

Disclaimer

Reliance on Third Party Information

The views expressed here contain information that has been derived from publicly available sources that have not been independently verified. No representation or warranty is made as to the accuracy, completeness or reliability of the information. This presentation should not be relied upon as a recommendation or forecast by BHP.

Forward Looking Statements

This presentation may include forward-looking statements within the meaning of the U.S. Securities Litigation Reform Act of 1995 regarding future events and the future financial performance of BHP. These forward-looking statements are not guarantees or predictions of future performance, and involve known and unknown risks, uncertainties and other factors, many of which are beyond our control, and which may cause actual results to differ materially from those expressed in the statements contained in this presentation. BHP's filings with the US Securities and Exchange Commission (the 'SEC') (including in Annual Reports on Form 20-F) which are available on the SEC's website at www.sec.gov.

No Offer of Securities

Nothing in this presentation should be construed as either an offer to sell or a solicitation of an offer to buy or sell BHP securities in any jurisdiction.

Stakeholder feedback

Please note, the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 requires Operators to perform consultation relating to environment plans and oil spill contingency plans. The latest revision of the Regulations includes a requirement for correspondence from stakeholders relating to these plans to be passed on to NOPSEMA and therefore should not be considered to be confidential between the author and BHP. It is recommended that confidential matters not relating to the environment should be in separate communications.

Subject:	Exmouth Community Reference Group Meeting		
Location:	Mantarays Ningaloo Beach Resort		
Day and Date:	Thursday, 12 March 2020		
Meeting Open:	5:30 pm	**Meeting Close:**	7.30 pm
Meeting chaired by:	BHP		

Attendees:

Representatives from:

BHP

Santos

Woodside

Cape Conservation Group

Gun Marine Services

Exmouth Chamber of Commerce and Industry

Exmouth District High School;

Gascoyne Development Commission

Exmouth Bus Charter

Ningaloo Turtle Rehabilitation Centre

Ray White Exmouth

Recfishwest

The Shire of Exmouth

Agenda

1. Operational Update
2. Environmental Update
3. Community Update

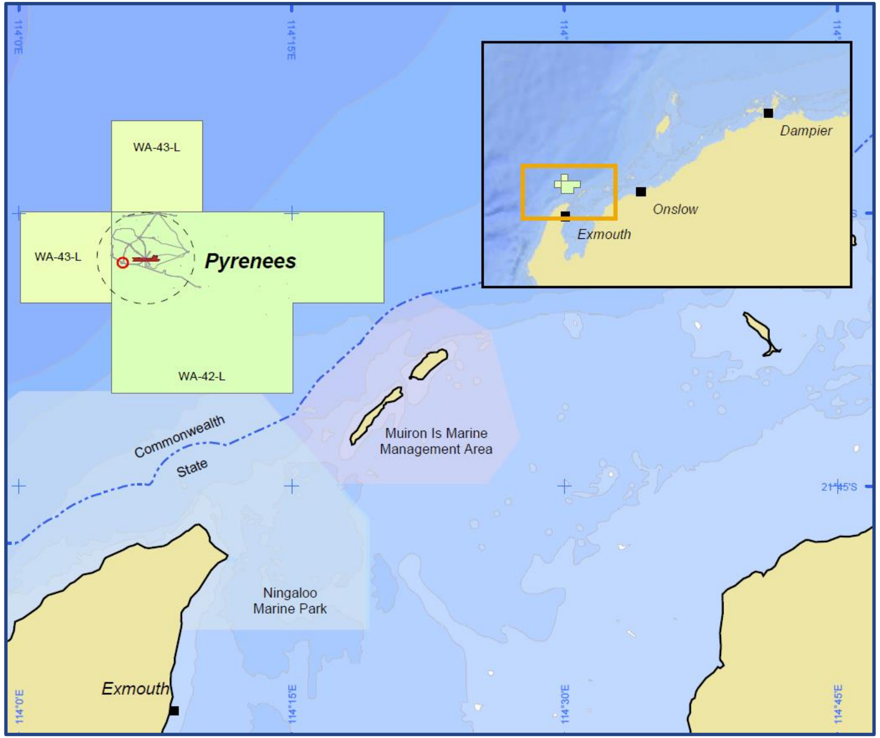
BHP

Environmental Update

Crosby-3H1 Light Well Intervention Environment Plan

Environment Plan

- Crosby-3H1 well located in permit area WA-42-L. Drilled in November 2015.
- Reduce excessive water production through isolation of lower lateral.
- Vessel-based activity, short in duration (6-10 days).
- New Environment Plan being drafted.
- Oil spill modelling and stakeholder engagement underway.
- Expect submission of the Environment Plan to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for assessment at the end of March.



Have you got a concern?

Enquiries, concerns and / or complaints can be directed to the BHP Corporate Affairs team:

P: 1800 421 077 (updated number)

E: wacommunity@bhp.com (updated email address)

BHP

Consultation Cover Email (May 2020)

BHP

BHP Consultation with Relevant Stakeholders – May 2020

Dear Stakeholder,

This email is to communicate changes to our proposed activities on the Crosby-3H1 well that was presented in our Fact Sheet issued to you in early February 2020.

Based on the current environment and to allow for potential schedule changes, the proposed activity may now occur at any time of year with the earliest expected start in September 2020. Please read on for further information.

BHP is planning to undertake vessel-based well intervention activities on the Crosby-3H1 well located in Production Licence WA-42-L in Commonwealth waters. The intervention activities will be short in duration, estimated to be up to 14 days, contingent on weather conditions. Current scheduling proposes commencing at the end of Quarter three or in Quarter four 2020 (calendar year) pending approvals, vessel availability and weather constraints. As schedules are subject to change and to allow our business maximum flexibility, the Environment Plan for this activity has been written to allow the activity to occur at any time of year.

A Fact Sheet is attached which provides information on the proposed activity, including a summary of potential key risks and associated management measures.

Activity Overview

Activity purpose:	To support ongoing production from the Pyrenees Operations	
Activity:	Well intervention activities (vessel-based) on the Crosby-3H1 well	
Activity location:	27 km north of the North West Cape peninsula, Exmouth, Western Australia	
Well location:	Crosby-3H1 well	21° 32' 43.063" S, 114° 05' 42.504" E
Approximate water depth:	~ 200 m	
Estimate start date:	Earliest expected start is September 2020.	
Approximate duration:	The subsea intervention vessel is expected to be on location in the production licence area for up to 14 days, contingent on weather conditions.	
Vessel:	Subsea installation vessel • Dynamic positioning • No anchoring required • No support vessels required	
Operational Area:	A 500-m operational area around the well.	

Your Feedback

Your feedback on the proposed activity and our response will be provided to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA), as is required under the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009.

As a relevant stakeholder you are invited to provide comments. The Environment Plan will contain a summary of all comments received, however BHP will not use or disclose your personal information in the Environment Plan. Full transcripts of all correspondence will be included in a separate sensitive information part of the Environment Plan provided to NOPSEMA.

Please provide comment as soon as practicable. Comments can be made by email, letter or by phone (refer to attached Fact Sheet for contact details).

Regards,

BHP

Consultation Fact Sheet (May 2020)

Petroleum

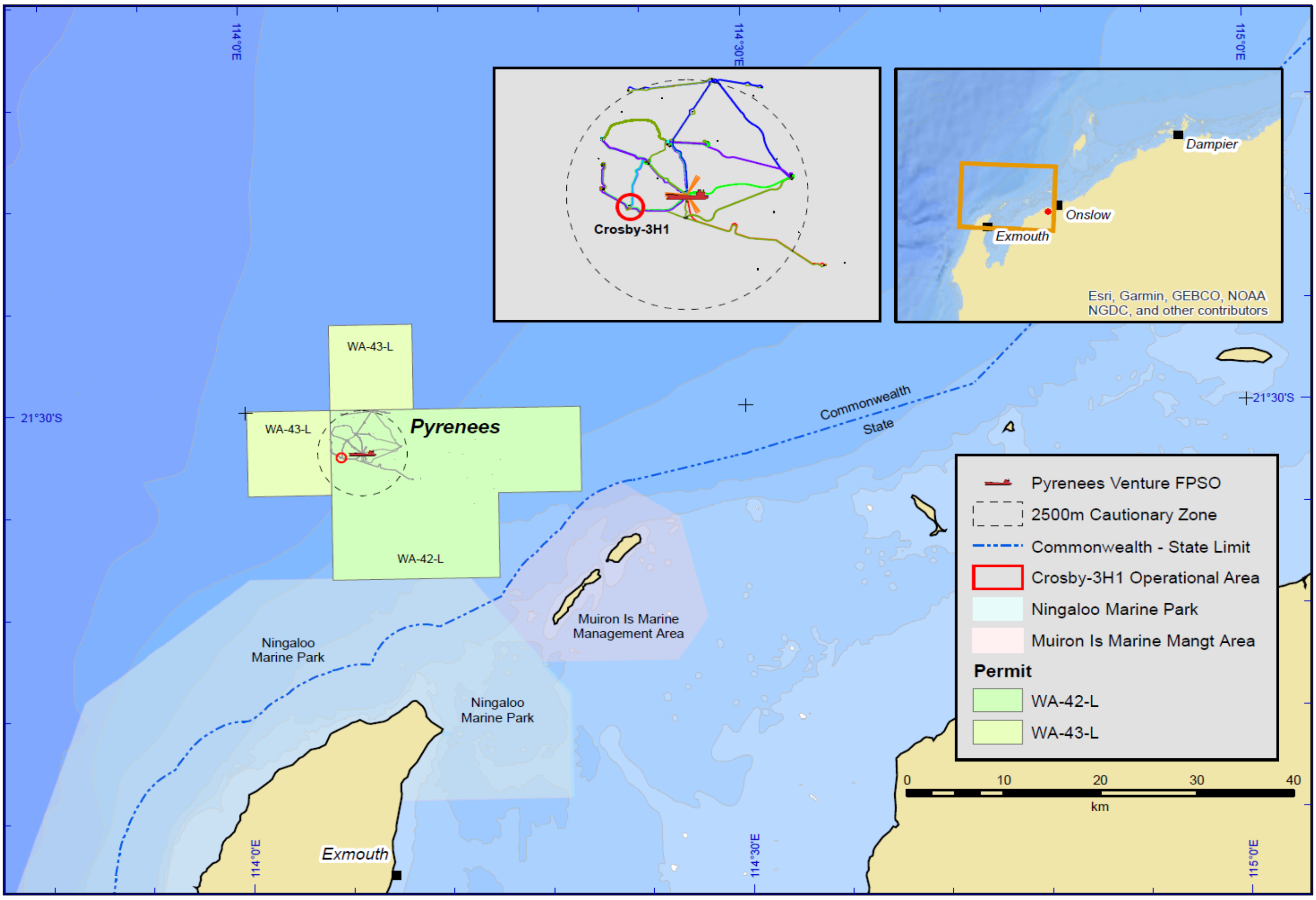
Invitation for Feedback: Stakeholder Information Fact Sheet

CROSBY-3H1 LIGHT WELL INTERVENTION ENVIRONMENT PLAN

Northern Carnarvon Basin, North West Australia

BHP is planning to undertake well intervention activities on the Crosby-3H1 well within Petroleum Production Licence WA-42-L in Commonwealth waters to support ongoing production from the Pyrenees Operations. These activities will be short in duration, with the subsea intervention vessel expected to be on location in the production licence area for up to 14 days, contingent on weather conditions and unforeseen circumstances. To account for potential delays or schedule changes, the environmental assessment encompasses the petroleum activity occurring at any time of year. The earliest expected start time is September 2020, pending vessel/ equipment availability and environment approval. BHP is preparing an Environment Plan for submission to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009.

BHP is the designated operator on behalf of the WA-42-L titleholders, BHP and Santos Limited.



This Stakeholder Fact Sheet relates to the submission of a new Environment Plan for the well intervention activities planned for the Crosby-3H1 well. The well forms part of the Pyrenees Development producing crude oil from six separate oil fields in production permits WA-42-L and WA-43-L. Production fluids from the Pyrenees fields are produced to the *Pyrenees Venture* Floating Production Storage and Offloading facility (FPSO), a double-hulled stand-alone facility.

Location of Activity and Operational Area

The Operational Area defines the spatial boundary within which the well intervention activities will take place. The Operational Area is a 500-m radius around the Crosby-3H1 well located in Production Licence WA-42-L. The closest landfall is the tip of the North West Cape, Exmouth, approximately 27 km to the south of the Operational Area.

The Operational Area lies approximately 15 km from the northern boundary of the Ningaloo Marine Park boundary (Commonwealth Waters).

Value/ Sensitivity	Approx. Distance from Operational Area
Ningaloo Coast - World Heritage / National Heritage Area	13 km
Ningaloo Marine Park (Cmth)	13 km
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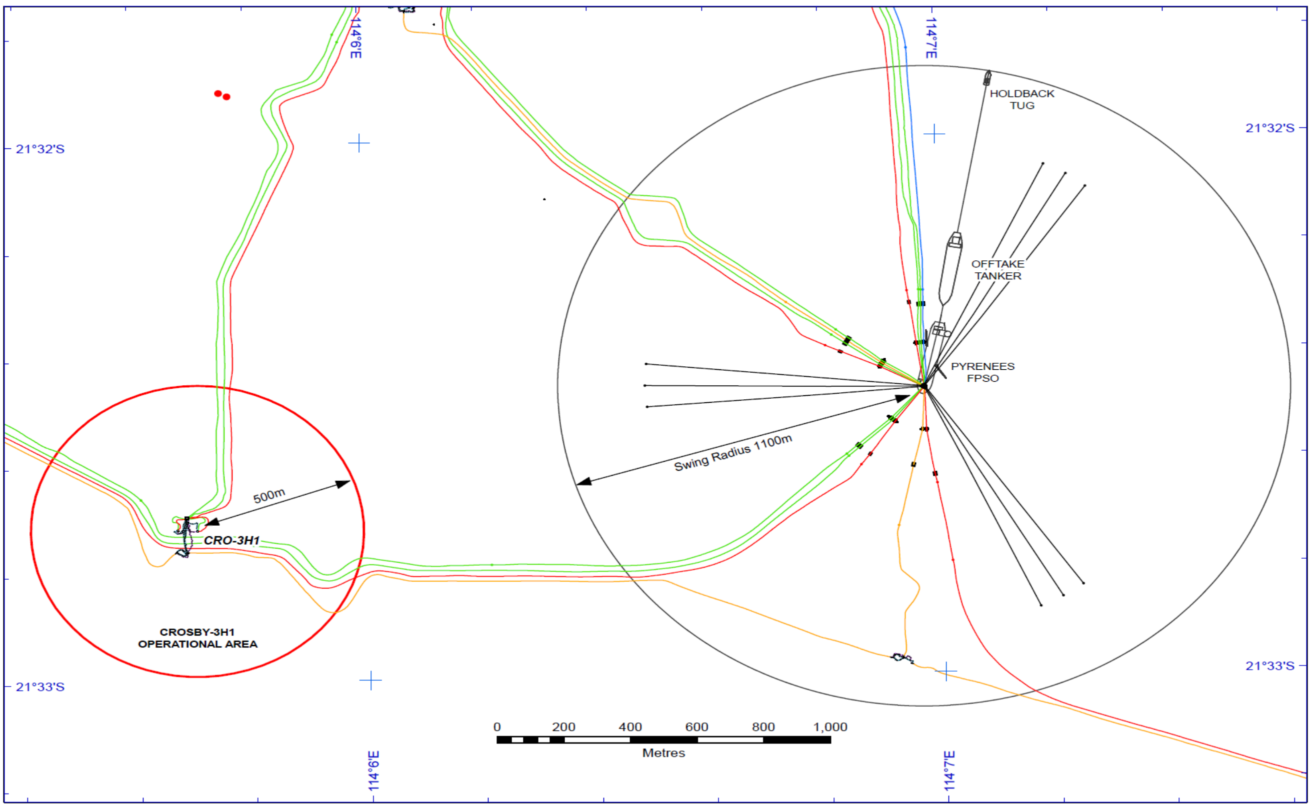
Muiron Islands Management Area	22 km

Description of Activity

Crosby-3H1 Well Intervention	
Earliest expected commencement date	September 2020.
Crosby 3H1 well location	21° 32' 43.063" S, 114° 05' 42.504" E
Approximate estimated duration	6 to 8 days depending on weather conditions
Water depth	~ 200 m
Project vessel (subsea intervention vessel)	Subsea intervention vessel (dynamic positioning)
Operational area	500-m radius around the well. The operational area sets the spatial boundary within which the well intervention activities will occur.



The well intervention activities will be carried out from a subsea intervention vessel mobilised to the Operational Area and positioned over the wellhead. These activities will involve the deployment of a subsea intervention device (SID) from the vessel on to the Crosby-3H1 Xmas Tree, the establishment of service and safety systems, hook up to the well and commencement of intervention activities. On completion, the SID will be retrieved to the vessel and the well made ready for return to production. In accordance with BHP Well Integrity Standard, a minimum of two well barriers to the reservoir will be in place at all times.

Summary of potential risks and associated management measures

Potential Risks	Management and / or Mitigations Measures
Planned Activities	
Emissions: Light	○ Lighting is minimised to that required for safety and navigational purposes.
Emissions: Underwater noise	○ Measures will be in place for interacting with protected marine fauna as per the EPBC Regulations (Part 8).
Physical presence: Interactions with other marine users	○ BHP's existing infrastructure is marked on nautical charts. ○ Establishment of a 500-m safety exclusion zone around the vessel for the duration of the activity. ○ Consultation with relevant stakeholders (e.g. adjacent petroleum titleholders, commercial fishers and their representative organisations, and government departments and agencies) to inform decision making for the proposed activity and the development of the Environment Plan. ○ BHP will notify relevant fishing industry representative organisations/associations and Government maritime safety agencies of the start and end dates for the activity, and vessel location details and any exclusion zones prior to commencement of the activity.
Planned discharges to the marine environment	○ Chemical use will be managed in accordance with BHP and contractor chemical selection and approval procedures. ○ All routine marine discharges will be managed according to legislative and regulatory requirements and BHP's Environment Performance Standards where applicable.
Waste generation	○ Waste generated on the vessel will be managed in accordance with legislative requirements and a Waste Management Plan. ○ Wastes will be managed and disposed of in a safe and environmental responsible manner that prevents accident loss to the marine environment. ○ Wastes transported onshore will be sent to appropriate recycling or disposal facilities by a licences waste contractor.
Unplanned Risks	
Invasive marine species	○ BHP contracted vessels comply with Australian biosecurity requirements and guidance, and Australian ballast water requirements. ○ Vessel will be assessed and managed in line with BHP procedures to prevent the introduction of invasive marine species.
Marine fauna interaction	○ Measures will be in place for interacting with protected marine fauna as per the EPBC Regulations (Part 8).
Vessel collision	○ Marine notifications will be made to relevant stakeholders, describing the location of the activity and the 500 m safety exclusion zone to prevent the risk of vessel collisions.
Unplanned releases including hydrocarbons	○ All personnel undertaking activities will undergo relevant inductions and training. ○ Procedures for lifts, equipment maintenance, inspections and bunding. ○ All offshore activities will be managed in accordance with BHP lifting and transfer procedures. ○ Well barrier management. ○ Recovery of hazardous solid wastes lost overboard where safe and practicable to do so. ○ Oil Pollution Emergency Plan. ○ Appropriate vessel spill response plan, equipment and materials will be in place and maintained.

Protecting Our People and the Environment

Safety of our people and the communities in which we operate always comes first. Identifying, controlling and mitigating safety risks is managed through an overarching, consistent approach guided by BHP's Risk Management governance framework, with supporting processes and performance requirements. All activities (routine and non-routine) will be performed in accordance with the industry leading standards established in BHP's Charter, HSEC Framework and Controls, BHP's Wells and Seismic Delivery Management System, Engineering Standards and Procedures, the Environment Plan and the NOPSEMA-approved Well Operations Management Plan (WOMP) and NOPSEMA-approved Vessel Safety Case.

Offshore petroleum activities are regulated through a robust and comprehensive environmental protection regime administered by NOPSEMA under the Commonwealth *Offshore Petroleum and Greenhouse Gas Storage Act 2006*. BHP undertakes risk assessments for all environmental aspects of a petroleum activity and stringently adheres to the regulatory regime.

The objective of the Environment Plan is to ensure that potential adverse impacts on the environment associated with activities, during both routine and non-routine activities, are identified, and will be continuously reduced to as low as reasonably practicable (ALARP) and an acceptable level. BHP is committed to understanding the impacts of our activities on stakeholders with an interest in the Pyrenees field and seeks feedback as part of the development of the EPs.

Responding to Emergencies

BHP's incident response plans are approved by the regulator NOPSEMA. The Commonwealth Oil Pollution Emergency Plan (OPEP) is required by law under the Environmental Regulations and forms an appendix to the full EP. The documents outline responsibilities, specific procedures and identify resources available in the unlikely event of an incident. BHP maintains a constant vigilance and readiness to prevent and/or respond to hydrocarbon loss of containment incidents. The readiness and competency of BHP to respond to incidents is maintained and tested by conducting a series of drills.

Should you have any questions, concerns or grievances regarding these activities or any other BHP Petroleum activities, please call BHP WA Community Hotline on **1800 421 077** or send an email to **bhppetexternalaffairs@bhp.com**

BHP believes in putting health and safety first, being environmentally responsible and supporting our communities.

State Fishers Letter issued by Post (15 May 2020)

BHP Petroleum Pty Ltd
125 St Georges Terrace
Perth WA 6000 Australia
GPO Box J668
Perth WA 6842 Australia
Tel +61 8 6321 1000
bhp.com

15 May, 2020

NAME
ADDRESS
ADDRESS
ADDRESS

Dear Stakeholder,

Re: Stakeholder Consultation – Crosby-3H1 Light Well Intervention Environment Plan

BHP is planning to undertake vessel-based well intervention activities on the Crosby-3H1 well located in Production Licence WA-42-L in Commonwealth waters. The intervention activities will be short in duration, estimated to be up to 14 days, contingent on weather conditions. The earliest expected start time is September 2020, pending vessel/equipment availability and environmental approval. As schedules are subject to change and to allow our business maximum flexibility, the Environment Plan for this activity has been written to allow the activity to occur at any time of year.

A Fact Sheet is attached which provides information on the proposed activity, including a summary of potential key risks and associated management measures.

Activity Overview

Activity purpose:	To support ongoing production from the Pyrenees Operations	
Activity:	Well intervention activities (vessel-based) on the Crosby-3H1 well	
Activity location:	27 km north of the North West Cape peninsula, Exmouth, Western Australia	
Well location:	Crosby-3H1 well	21° 32' 43.063" S, 114° 05' 42.504" E
Approx. water depth:	~200 m	
Estimate start date:	Earliest expected start is September 2020.	
Approximate duration:	The subsea intervention vessel is expected to be on location in the production licence area for up to 14 days, contingent on weather conditions.	
Vessel:	Subsea installation vessel • Dynamic positioning • No anchoring required • No support vessels required	
Operational area	A 500-m operational area around the well.	

Your feedback on the proposed activity and our response will be provided to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA), as is required under the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009.

As a relevant stakeholder you are invited to provide comments. The Environment Plan will contain a summary of all comments received, however BHP will not use or disclose your personal information in the Environment Plan. Full transcripts of all correspondence will be included in a separate sensitive information part of the Environment Plan provided to NOPSEMA.

Please provide comment as soon as practicable. Comments can be made by email, letter or by phone (refer to attached Fact Sheet for contact details).

Regards,

BHP

Fisheries Focused Fact Sheet (May 2020)

Petroleum

Invitation for Feedback: Stakeholder Information Fact Sheet

CROSBY-3H1 LIGHT WELL INTERVENTION ENVIRONMENT PLAN

Northern Carnarvon Basin, North West Australia

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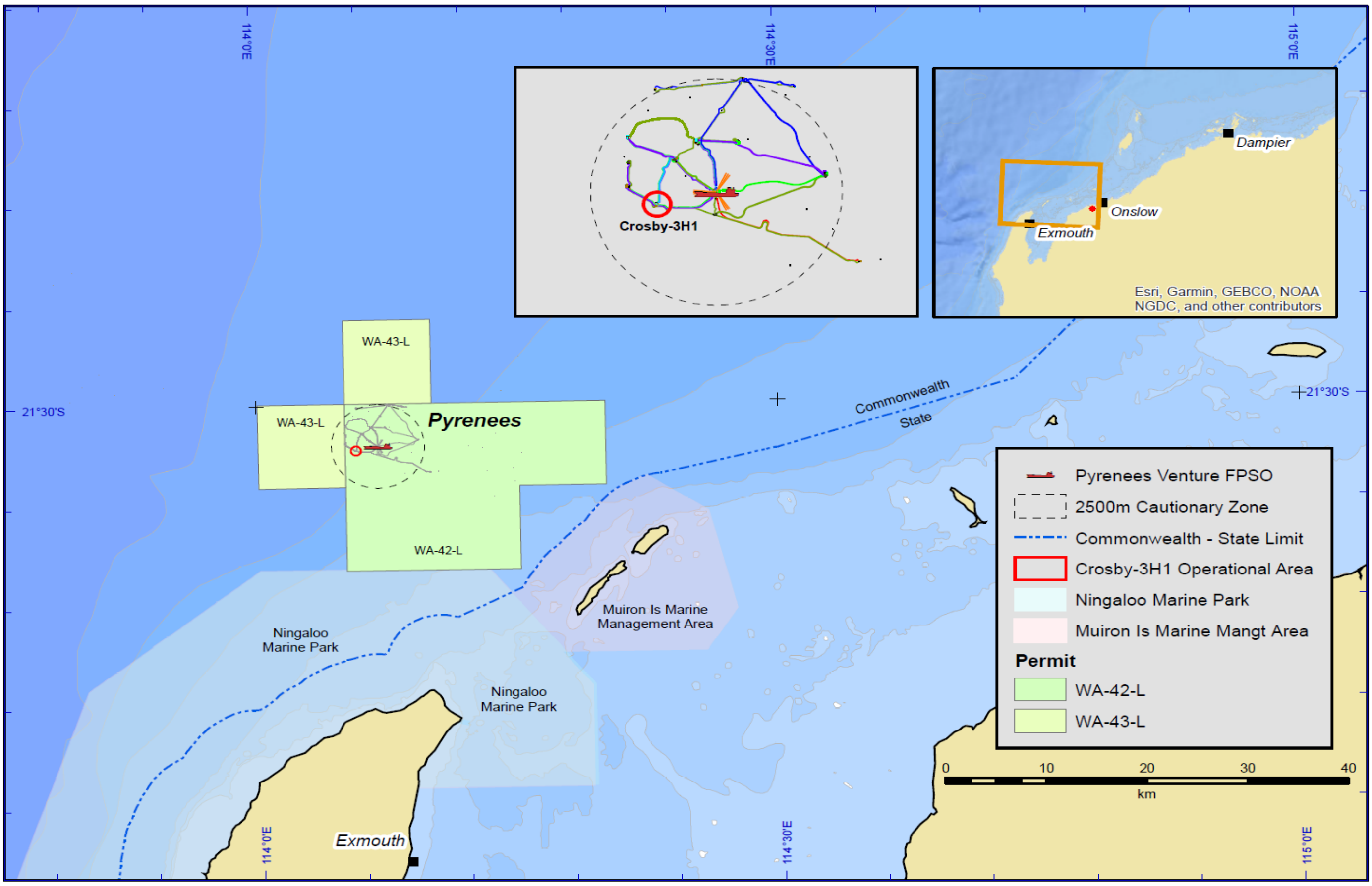

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Location of Activity and Operational Area

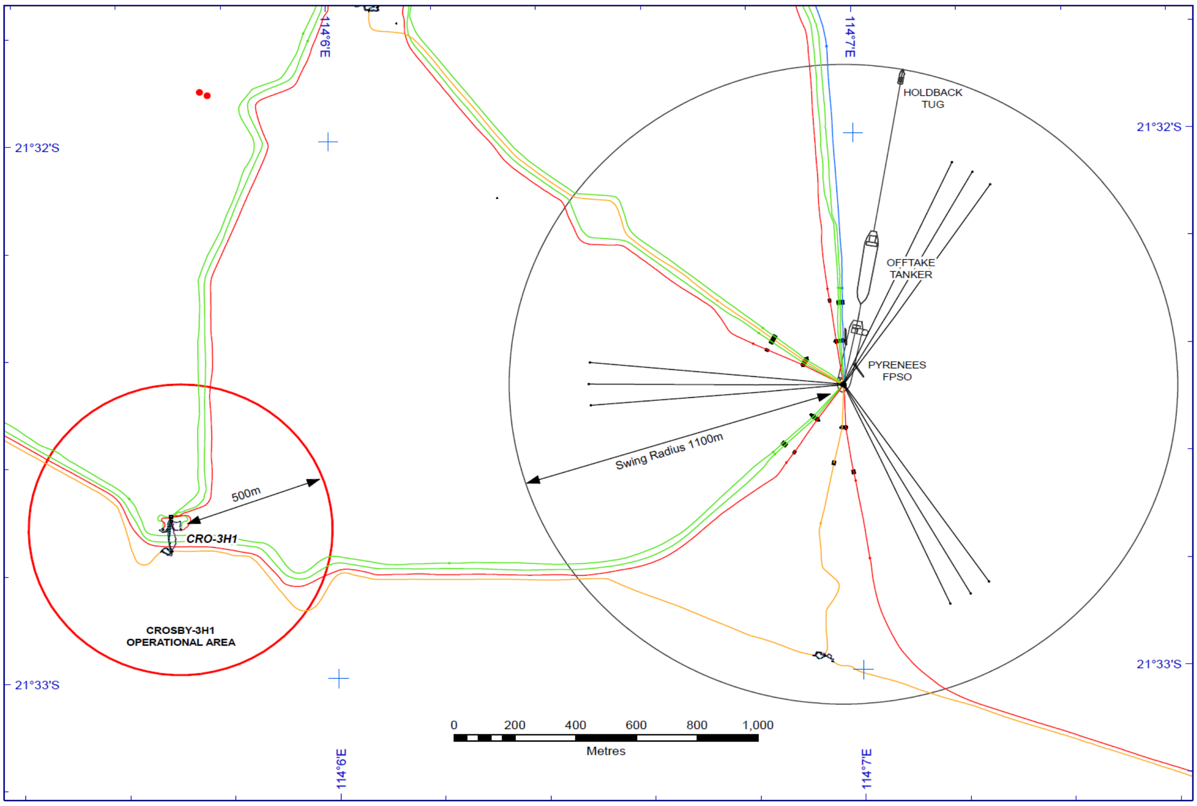
The Operational Area defines the spatial boundary within which the well intervention activities will take place. The Operational Area is a 500-m radius around the Crosby-3H1 well located in Production Licence WA-42-L. The closest landfall is the tip of the North West Cape, Exmouth, approximately 27 km to the south of the Operational Area.

The Operational Area lies approximately 15 km from the northern boundary of the Ningaloo Marine Park boundary (Commonwealth Waters).

Value/ Sensitivity	Approx. Distance from Operational Area
Ningaloo Coast - World Heritage / National Heritage Area	13 km
Ningaloo Marine Park (Cmth)	13 km
Gascoyne Marine Park (Cmth)	17 km
Ningaloo Marine Park (State)	20 km
Muiron Islands Management Area	22 km

Description of Activity

Crosby-3H1 Well Intervention	
Earliest expected commencement date	September 2020.
Crosby 3H1 well location	21° 32' 43.063" S, 114° 05' 42.504" E
Approximate estimated duration	The vessel may be on location for up to 14 days, depending on weather conditions.
Water depth	~200 m
Project vessel (subsea intervention vessel)	Subsea intervention vessel (dynamic positioning)
Operational area	500-m radius around the well. The operational area sets the spatial boundary within which the well intervention activities will occur.



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What Fisheries May be Affected

Commercial fisheries have been identified as being relevant on the basis of fishing licence overlap with the proposed operational (activity) area, as well as consideration of fishing effort data from recent years, fishing methods and water depth. Individual licence holders and representative fishing associations/organisations have been contacted as part of this consultation and relevant stakeholders include:

- State Fisheries:
    - Pilbara Demersal Scale (Line fishery)
    - Mackerel Managed
    - West Coast Deep Sea Crustacean
- Commonwealth Fisheries – None activity in the immediate vicinity
- Australian Fisheries Management Authority (AFMA)
- Commonwealth Fisheries Association (CFA)
- Department of Primary Industry and Resources (DPIRD)
- Pearl Producers Association (PPA)
- Recfish West
- Western Australian Fishing Industry Council (WAFIC)

Summary of potential risks to fishing sector

Potential Risks	Risk Description	Management and / or Mitigations Measures
Planned Activities		
Physical presence	○ The physical presence of the subsea installation vessel during the activities is not considered to affect other marine users. The 500-m operational area for the proposed activity lies within a pre-existing cautionary zone (marked on navigational charts) for the Pyrenees Facility and in-field subsea infrastructure.	○ BHP's existing infrastructure is marked on nautical charts. ○ Establishment of a 500-m safety exclusion zone around the vessel for the duration of the activity. ○ BHP will notify relevant fishing industry representative organisations/associations and Government maritime safety agencies of start and end dates for the activity, and vessel location details and any exclusion zones prior to commencement of the activity.
Emissions: Underwater noise	○ Underwater noise will be generated by the subsea installation vessel. The low acoustic source levels are not predicted to impact fish feeding, spawning or hearing.	○ Acoustic impacts to marine fauna from the vessel are considered not significant, with no lasting effects predicted. Acoustic source levels are in a similar range to other commercial vessels in the region.
Planned discharges to the marine environment	○ Discharges from the operation of the vessel include sewage, grey water, cooling water, desalination brine, deck drainage, ballast and bilge water. ○ Discharges from the operation of the subsea installation vessel will result in localised and short-term reduction in water quality. Discharges will be rapidly diluted and dispersed.	○ Chemical use will be managed in accordance with BHP and contractor chemical selection and approval procedures. ○ All routine marine discharges will be managed according to legislative and regulatory requirements and BHP's Environment Performance Standards where applicable.

Potential Risks	Risk Description	Management and / or Mitigations Measures
Unplanned Risks		
Invasive marine species	○ Introduction or translocation and establishment of invasive marine species via vessel ballast water or biofouling (e.g. hull, submersible equipment).	○ BHP contracted vessels comply with Australian biosecurity requirements and guidance, and Australian ballast water requirements. ○ Vessel will be assessed and managed in line with BHP procedures to prevent the introduction of invasive marine species.
Unplanned releases including hydrocarbons	○ Loss of solid hazardous and non-hazardous waste overboard (i.e. dropped objects or wind-blown rubbish, or improper storage). ○ Release of hydrocarbons to the marine environment, such as from: • a vessel collision resulting in a fuel tank rupture • a dropped object on subsea infrastructure (e.g. flowline) • a loss of well containment	○ All personnel undertaking activities will undergo relevant inductions and training. ○ Procedures for lifts, equipment maintenance, inspections and bunding. ○ All offshore activities will be managed in accordance with BHP and Contractor lifting and transfer procedures. ○ Well barrier management. ○ Recovery of hazardous solid wastes lost overboard where safe and practicable to do so. ○ Oil Pollution Emergency Plan. ○ Appropriate vessel spill response plan, equipment and materials will be in place and maintained.

Protecting Our People and the Environment

Safety of our people and the communities in which we operate always comes first. Identifying, controlling and mitigating safety risks is managed through an overarching, consistent approach guided by BHP's Risk Management governance framework, with supporting processes and performance requirements. All activities (routine and non-routine) will be performed in accordance with the industry leading standards established in BHP's Charter, HSEC Framework and Controls, BHP's Wells and Seismic Delivery Management System, Engineering Standards and Procedures, the Environment Plan and the NOPSEMA-approved Well Operations Management Plan (WOMP) and NOPSEMA-approved Vessel Safety Case.

Offshore petroleum activities are regulated through a robust and comprehensive environmental protection regime administered by NOPSEMA under the Commonwealth *Offshore Petroleum and Greenhouse Gas Storage Act 2006*. BHP undertakes risk assessments for all environmental aspects of a petroleum activity and stringently adheres to the regulatory regime.

The objective of the Crosby-3H1 Light Well Intervention EP is to ensure that potential adverse impacts on the environment associated with activities, during both routine and non-routine activities, are identified, and will be continuously reduced to ALARP and an acceptable level. BHP is committed to understanding the impacts of our operations on stakeholders with an interest in the Pyrenees field and seeks feedback as part of the development of the EPs.

Responding to Emergencies

BHP's incident response plans are approved by the regulator NOPSEMA. The Commonwealth Oil Pollution Emergency Plan (OPEP) is required by law under the Environmental Regulations and forms an appendix to the full EP. The documents outline responsibilities, specific procedures and identify resources available in the unlikely event of an incident. BHP maintains a constant vigilance and readiness to prevent and/or respond to hydrocarbon loss of containment incidents. The readiness and competency of BHP to respond to incidents is maintained and tested by conducting a series of drills.

Should you have any questions, concerns or grievances regarding these activities or any other BHP Petroleum activities, please call BHP WA Community Hotline on **1800 421 077** or send an email to **bhppetexternalaffairs@bhp.com**

BHP believes in putting health and safety first, being environmentally responsible and supporting our communities.

Appendix G

CROSBY-3H1 LIGHT WELL INTERVENTION OIL POLLUTION EMERGENCY PLAN (PHYSE-ER-0006)

CROSBY-3H1 LIGHT WELL INTERVENTION
OIL POLLUTION EMERGENCY PLAN

Document No: PYHSE-ER-0006

REVISION RECORD					
Rev	**Date**	**Description**	**Prepared by**	**Reviewed by**	**Approved by**
0	26/5/20	Initial OPEP	Principal CEM & Security	Manager HSE	Program Director AU Projects

Revision History		
Revision Label	Revision Date	Comments
C	26/05/20	Issued for internal Review
0	29/05/20	Issued for use

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1 Introduction

1.1 Purpose

This Oil Pollution Emergency Plan (OPEP) has been developed to establish the processes and procedures within BHP to respond to and effectively manage incidents that may occur during the Crosby-3H1 Light Well Intervention activities in petroleum production licence WA-42-L, offshore Western Australia.

This OPEP is an appendix to the Crosby-3H1 Light Well Intervention Environment Plan (EP) (PYHSE-E-0010) and is required under the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations* (the OPGGS (Environment) Regulations) for approval to undertake petroleum activities in Commonwealth waters.

The Pyrenees Development was assessed and accepted under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in March 2005 (referral number 2005/2034). The Ministerial Conditions Annexure 1 – Condition 2 states that: The person taking the action must submit for the Minister's approval an oil spill contingency plan to mitigate the environmental effects of any hydrocarbon spills. The specific requirements of this condition are documented in Appendix B of the Crosby 3H1 Light Well intervention EP.

1.2 Scope

This OPEP applies to BHP activities associated with the Crosby-3H1 Light Well Intervention.

This OPEP applies to oil spills resulting from well intervention activities approved or operating under an instrument of the OPGGS Act and the Ministerial Conditions.

Specifically in reference to oil spill preparedness, this OPEP contains:

- A summary description of the activity and locations (Section 1.4);
- A list of the spill scenarios that may occur during the activity (Section 2.1);
- An overview of the Operational Net Environmental Benefit Analysis (NEBA) in relation to the spill scenarios (Section 2.4);
- Details associated with each of the response strategies (Section 3).
- An outline of activities associated with the Response to an Oil Spill (Section 4); and
- The First Strike Response Plan (Appendix A)

This plan considers the Western Australia Department of Transport (WA DoT) State Hazard Plan – Maritime Environmental Emergency (SHP-MEE) and Industry Guidance Note (IGN) on Marine Oil Pollution (MOP): Response and Consultation Arrangements. BHP acknowledge that as per the IGN, DoT will be the controlling agency in a State waters response. BHP will provide all necessary resources including personnel and equipment to resource DoT's IMT and response, as agreed during consultations with DoT. BHP has access to staff for the Initial Personnel Requirements as outlined in Annex 2 of the IGN. Refer to Appendix C of this plan for these requirements and the Control and Coordination/ IMT structure that will be applied during an MOP response that impacts State waters.

This plan is to be reviewed and implemented in conjunction with the BHP Crosby-3H1 Light Well Intervention EP (PYHSE-E-0010).

1.3 Environmental Performance Outcomes

Environmental Performance Outcome	Measurement Criteria
Prevent impact to extreme and highly sensitive environmental receptors from a worst-case hydrocarbon spill and manage to ALARP impacts to other ecosystems.	Monitoring report results. Outcome of operational NEBAs recorded during an incident response.
No effects on water quality, marine biota or sensitive habitats or Aboriginal registered sites of cultural heritage after termination of the spill response.	Sampling analysis reports.
Keep stakeholders informed of status of the hydrocarbon spill response to aid in the mitigation of impacts to social and economic activities.	IMT Communication log indicating stakeholders have been advised throughout a response.

BHP aims to achieve the primary performance objectives of this OPEP by maintaining a constant vigilance and readiness to prevent and, where required, respond to and effectively manage incidents via the following strategies:

- Initiating **Source *Control*** activities as soon as reasonably practicable in order to minimise the spread of oil to the sea surface;
- ***Assessing*** spill characteristics in order to ***Report*** clear and accurate information;
- ***Monitoring*** spill in order to identify key marine and coastal resources in need of protection; and
- ***Responding*** to spill using response strategies, which are efficient and do not, themselves, damage the environment.

1.4 Activity Description and Location

The activity covered by this OPEP involves a riserless light well intervention (LWI) in relation to the Crosby-3H1 well located in petroleum production licence WA-42-L in Commonwealth waters, which forms part of the Pyrenees Development. The Pyrenees Development covers crude production from fields located in both WA-42-L and neighbouring WA-43-L. Crosby-3H1 is a dual-lateral well, originally drilled in 2010 with a second lateral drilled in November 2015, which requires artificial gas lift operation in order to produce from the well. In order to reduce excessive water production from the dual-lateral well, BHP proposes to isolate the water producing lower lateral to enable the remaining upper lateral to increase the oil production performance. The common term given to this technique applied to solve excessive unwanted water production is water shut-off. The LWI activities will be undertaken utilising a riserless light well intervention vessel to establish on the well and undertake the intervention activities utilising subsea intervention equipment and wireline technology.

1.5 Hydrocarbons and their Sources

There are three sources of hydrocarbons that could be released are as follows:

- Loss of well containment with a subsea release of 1930 m^3 of medium crude oil from the Crosby-3H1 production well;
- Loss of flowline inventory with a subsea release of 204 m^3 of medium crude, resulting from a dropped object; and
- Fuel tank rupture from a vessel collision resulting in a surface release of 186 m^3 Marine Diesel Oil (MDO).

Properties of hydrocarbons associated with the activities and the most persistent hydrocarbon is discussed in Section 8.24 of the EP.

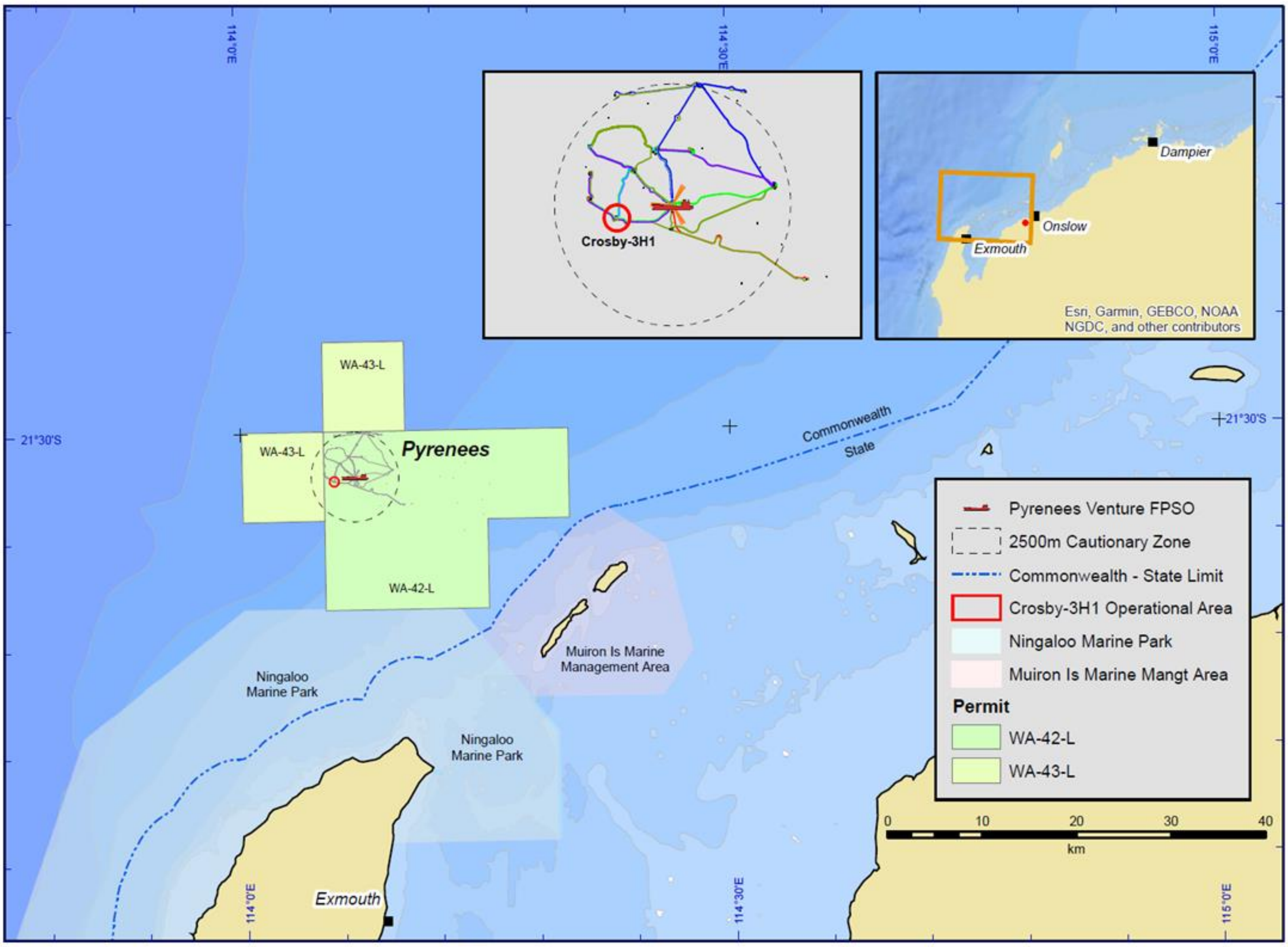


Figure 1: The Pyrenees Facility and Crosby-3H1 Well Location Area

1.6 Emergency Management and Oil Spill Response Documentation

Figure 2 shows the relationship of emergency management and oil spill documentation within BHP and Table 7 demonstrates the scope and content of tactical response plans (TRPs) developed by BHP. It excludes other tactical and industry plans, standard operating procedures and field guides prepared by DoT, DPAW/DBCA, AMOSC, OSRL, NOAA, IPIECA-OGP available to BHP to support the application of dispersant spraying, marine recovery, oiled shoreline assessment, shoreline clean up, oiled wildlife response and waste management.

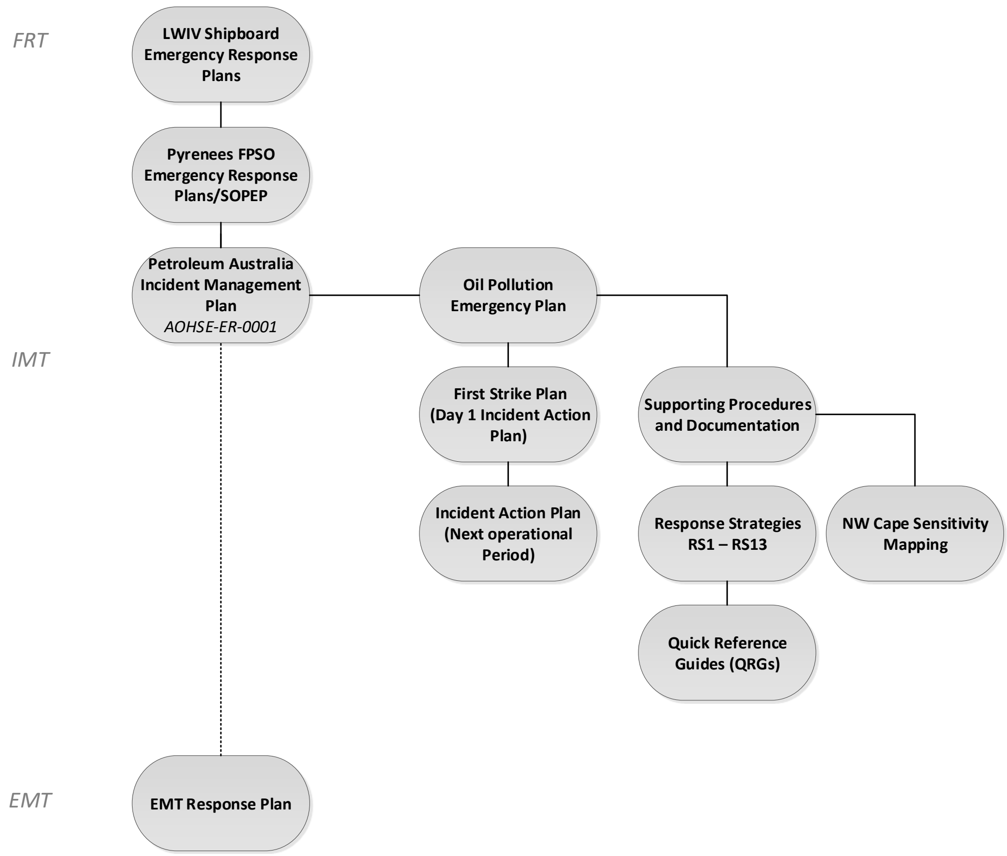


Figure 2: Relationship of Emergency Management and Oil Spill Response Documentation within BHP

2 Identified Risks

2.1 Spill Scenarios for Crosby Light Well Intervention

The spill scenarios in which hydrocarbons may be released to the marine environment during operations are provided in Table 1. The justification for the selection of these spill scenarios are described in the Section 8 of the EP.

Table 1: Hydrocarbon Spill Scenarios

Hydrocarbon	Activity	Scenarios	Average Frequency (per year)	Volume	Likelihood
Diesel	Light Well Intervention Vessel	Vessel collision – partial loss of storage. One time instantaneous release.	Not available	186 m^3	Highly Unlikely
Crude Oil	Subsea Infrastructure	Dropped object ruptures flowline. One time instantaneous release.	Not available	204m^3	Highly Unlikely
Crude Oil	Subsea Infrastructure	Subsea infrastructure loss of containment (91.9 m^3 per day for up to 3 weeks worst case).	Not available	1930 m^3	Highly Unlikely

Section 8 of the EP details the risk assessment and management for each of these scenarios respectively, which is not repeated in this document. This includes:

- Description of the spill scenarios;
- Spill frequency;
- Hydrocarbon properties;
- Environment that may be affected (EMBA);
- Risk analysis conclusion and ranking;
- Objectives for spill prevention; and
- Control measures.

2.2 Priority Areas

BHPs identification of sensitive resources at risk and priority areas for environmental, social, cultural and economic areas of significance is informed by:

- Part A: Joint Carnarvon Basin Operators North West Cape Sensitivities Mapping (June 2012) undertaken by AMOSC;
- WA (DoT) Oil Spill Response Atlas (OSRA).

The process has involved the following:

- Identified EMBA from stochastic modelling;
- Identified high value ecological and social receptors;
- Identified highest protection priorities;

- Protected Matters Search report; and
- Review of species literature, databases on Commonwealth Government Websites.

Particularly relevant values and sensitivities of the environment are captured in Section 4 of the EP and are reproduced below.

Table 2: Protection Priorities (in EP)

Priority	EP Section
World Heritage Areas	4.5.2
National Heritage Places	4.5.3
Wetlands of International Importance	4.5.4
Listed Threatened Species	4.5.6
Listed Migratory Species	4.5.6
Biologically Important Areas and Critical Habitats	4.5.6
Species Recovery Plans, Conservation Advice and Threat Abatement Plans	4.5.6
Marine Parks and Marine Management Areas	4.10
Key Ecological Features	4.10.3
Fisheries	4.11.3

The IMT has the following tools at its disposal to assess the oil spill scenario risk assessment, determine the environmental protection priorities and subsequent response needs for an emergency event related to the Crosby-3H1 LWI activities (within the wider Pyrenees operations).

NEBA

The NEBA response strategy evaluation process is a decision support tool that is used to help select the most appropriate response options that together make up the oil spill response strategies that the IMT are to implement in the event of a spill. Using the Strategic NEBA in the EP, the IMT has the foundation for preparing Operational NEBA to inform response priorities.

GIS – Petroleum Incident Management

This web based GIS modelling platform takes APU Basemap and overlays key sensitivities and other information in spatial format.

GIS – APU Oil Spill Response Plan

This web-based GIS modelling platform takes NW Cape-Sector Map, and allows a display of shore concentration by time and priority. For selected scenarios, it also provides data ‘graphs’ such as total shore volume by priority, oil load at each segment over time and protection priority and number of responders required by segment for selected OPEPs.

Oil Spill Response Atlas (OSRA)-Web Map Application (WMA)

Western Australian Oil Spill Response Atlas (OSRA) is a spatial database of environmental, logistical and oil spill response data. Using a geographical information system (GIS) platform, OSRA displays datasets collated from a range of custodians allowing decision makers to visualise environmental sensitivities and response considerations in a selected location. OSRA-WMA allows the layers found in OSRA to be viewed via a secure portal from the DoT website and provides basic functional tools.

North West Cape Sensitivities Mapping

The purpose of this shoreline sectorisation was to outline sensitive resources at risk, describe a baseline using the SCAT methodology, and outline important segment access information. The document describes localised environmental type (shoreline, substrate) and accessibility of shorelines, and permissions required.

2.3 Environment that may be Affected (EMBA)

Definition of the environment that may be affected (EMBA) for hydrocarbon spills from Crosby-3H1 well intervention activities is included in the EP. In defining the EMBA, a range of factors detailed in the NOPSEMA Oil Pollution Risk Management Guidance Note A382148 (NOPSEMA, 2018) have been considered. Specifically, the size of the EMBA has been based upon the quantity of oil, duration of discharge, concentration of hydrocarbons, film thickness of oil that can result in ecological impacts, zone of oil spill response activities and the environment conditions that contribute to largest distance travelled by the most persistent hydrocarbon. Figure 3 shows the EMBAs derived oil spill trajectory modelling commissioned by BHP for the worst-case subsea crude and MDO spills defined using low hydrocarbon exposure values. Refer to Section 8.2.5 of the EP for further information on the hydrocarbon exposure values used for the oil spill modelling.

2.3.1 Diesel (MDO)

The MDO spill scenario has a low contact probability of 5% for oil arriving at any shoreline, including individual contact probabilities of 2.5% at Ningaloo Region and Muiron Islands. The maximum accumulated shoreline loading from any realisation was 45 tonnes at Ningaloo Region with a similar maximum (40 tonnes) at Muiron Islands.

Surface oil above the low threshold (1 g/m^2) was predicted to extend up to ~250 km to the southwest and ~140 km northwest and northeast of the spill location. At the moderate threshold (10 g/m^2), surface oiling was reduced in spatial extent to within ~160 km to the southwest and ~90 km to the northwest and northeast. Exceedances of the high threshold (50 g/m^2) were limited in spatial extent within ~90 km of the release location.

MDO is a moderate weight, moderately persistent oil in the marine environment. Under low winds (1 m/s), 60% of the surface slick is predicted to remain after 120 hours (5 days). Under moderate winds (5 m/s), 40% of the initial surface slick is predicted to remain after 24 hours, decreasing further to ~10% after 48 hours and ~1% after 72 hours. With high winds (10 m/s), the surface slick is predicted to be almost entirely evaporated and dispersed after 12 hours.

MDO has a very low tendency for emulsion formation, with only ~1% water content entrained into the surface slick after 120 hours for all wind conditions assessed.

2.3.2 Crude Oil

Modelling was conducted for an assessment for a subsea crude oil spill of 3 week duration at a rate of 91.9 m^3 per day. In the absence of dispersant application, the modelling predicts that a 1930 m^3 release of oil from the Crosby-3H1 well.

AMSA guidance indicates that wave action alone is sufficient to clean shorelines with thickness <100 g/m^2. The output maps demonstrate the probabilities and locations of shoreline thickness ≥100 g/m^2.

Shoreline accumulated hydrocarbons above the low exposure value (>10 g/m^2) were predicted to occur between the Perth Region (~1,100 km to the south) and the Montebello Islands (250 km to the northeast). Very low (0.1 to 3.3 tonnes) maximum shoreline accumulations were predicted at the very low contact probabilities (<10%) at the Montebello Islands, Thevenard Island, Bernier Island, Dorre Island, the Abrolhos Islands and the Geraldton and Perth Regions; and at low contact probabilities (<23%) at Barrow Island, Dirk Hartog Island and the Shark Bay, Onslow and Carnarvon Regions. Shoreline loadings of 95 tonnes (97% contact probability) were predicted at the Ningaloo Region, and at the Muiron Island (33 tonnes with73% contact probability). The maximum length of oiled shorelines ranged from 201 km (Ningaloo Region), 31 km at Barrow Island, 26 km in the Shark Bay Region, down to between 3 to 14 km at the remaining receptor regions.

Across all shorelines combined, the predicted probability of contact at the low exposure value is 98%. Some seasonality was evident in the shoreline accumulation, with higher shoreline loading (>10 tonnes) typically occurring between October and March..

Shoreline accumulated hydrocarbons above the moderate exposure value (>100 g/m^2) were predicted to occur up to ~180 km to the southwest at the Ningaloo Region and ~160 km to the northwest at Barrow Island. Maximum predicted shoreline accumulations were ~92 tonnes at the Ningaloo Region, with a moderate-high contact probability (68%), with a minimum arrival time of 1.9 days and a maximum length of oiled shoreline of 82 km. Muiron Islands had a lower predicted contact probability (35%), with a maximum accumulated shoreline load of 33 tonnes , maximum oiled shoreline length of 14 km and a minimum arrival time of 2.1 days. Lastly, a very low contact probability (1%) was predicted for Barrow Island, with a maximum accumulated shoreline load of 1 tonnes, maximum oiled shoreline length of 3 km, and minimum arrival time of 19.3 days. No other receptor regions were contacted above the moderate exposure value.

Across all shorelines combined, the predicted probability of contact was 78%.

Shoreline accumulated hydrocarbons above the high exposure value (>1000 g/m^2)was limited to the Ningaloo Region and the Muiron Islands only, extending up to ~130 km to the southwest of the release location. Shoreline loadings were only predicted at the Ningaloo Region (50 tonnes), with a minimum arrival time of 3.3 days and maximum length of oiled shoreline of 14 km, and at the Muiron Islands (23 tonnes), with a minimum arrival time of 2.1 days and maximum length of oiled shoreline of 9 km.

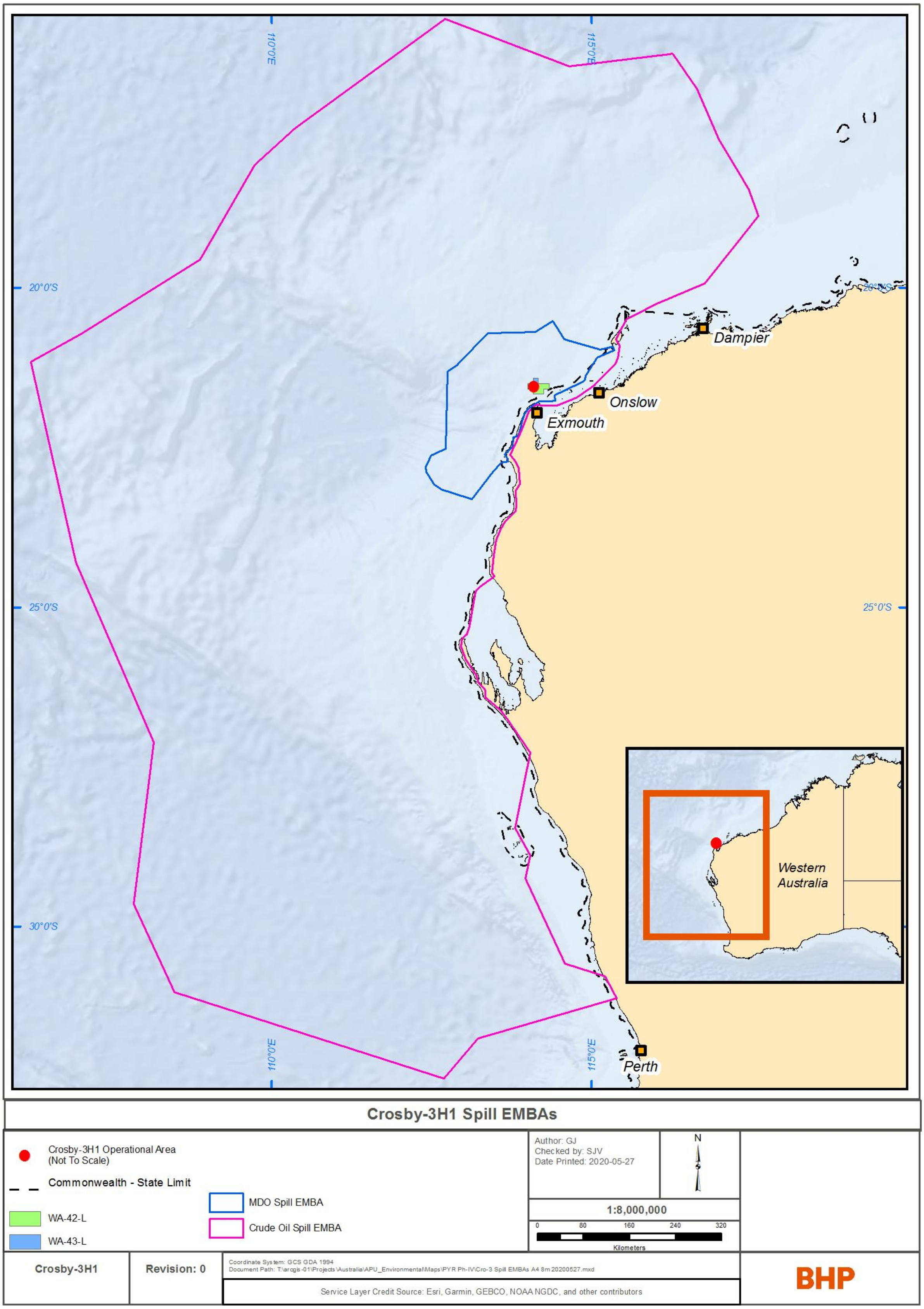


Figure 3: EMBAs for worst case Crude and Diesel spill scenarios

2.3.3 Sensitivity of Resources

The location of receptors and high conservation species, oil toxicity, impacts and associated risk assessment is covered in the Crosby-3H1 EP in Sections 4 and 8. To support development of this OPEP, the environmental resources have been ranked based on their sensitivity. The ranking has then been used to prioritise oil spill response techniques or allocation of resources (Table 3).

2.3.4 Dispersant Application Zone

If immediate attempts to control a subsea release via ROV intervention is unsuccessful, a decision to apply dispersant may be made. If this occurs BHP intends to apply the dispersant by injecting into the flow via a pre-existing line that connects the LWI vessel and the subsea infrastructure. Response planning has allowed a 4 hour period to implement the direct injection after the start of the release, with an application rate of 1:100 (1 part dispersant to 100 parts liquid crude) and a dispersant efficacy of 75%. Dispersant application is continuous from hour 4 until the end of week 2 (for the 3 week release scenario).

The preferred area for *aerial* dispersant application if used, is north and west of the Ningaloo and Muiron Island Marine Park boundaries. Dispersant will not be used in the Ningaloo Marine Park.

The window of opportunity for aerial dispersant application on Pyrenees crude is before the oil has weathered. This period has been estimated to be less than 48 hours.

Table 3: Summary of Receptors and Sensitivity Ranking.

Sensitivity	Open Ocean	Shallow Water	Response
Extreme	N/A	Migratory shorebirds and their habitat	The EMBA (Level 3 spill) intersects with migratory shorebirds and their habitats. Shoreline response measures will be put in place to manage the impact to this extremely sensitive environment.
	N/A	Mangroves	The EMBA (Level 3 spill) intersects with mangrove habitats and therefore is a priority area for response strategies such as protect and deflect booming.
High	Marine mammals (wWhales, dolphins, dugongs)	Marine mammals (Whales, dolphins, dugongs)	It has been identified that marine mammals may be present within the EMBA for all levels of a spill. The purpose of the response measures will be to manage these impacts by removing observable and detectable spilt hydrocarbons to the marine environment.
	Avifauna	Avifauna	There are many species of seabirds within the EMBA that could be affected by an oil spill. Response strategies will be to undertake oiled wildlife response and shoreline protection / response, therefore impacts to biota or sensitive habitats will be managed by all reasonable efforts to remove hydrocarbons.
	Marine reptiles (e.g. turtles)	Marine reptiles (e.g. turtles)	Known turtle foraging and nesting habitat occurs in the Ningaloo Marine Park and throughout the broader area. Additional impact to turtles would be shoreline hydrocarbons during a Level 3 spill on nesting beaches during nesting season. Response strategies will be to undertake oiled wildlife response and shoreline protection / response, therefore impacts to biota or sensitive habitats will be managed by all reasonable efforts to remove hydrocarbons.
	N/A	Corals and macroalgae	Smothering is expected to be the primary mechanism for harm. Reef flat and intertidal areas may be exposed to direct oiling if the oil becomes stranded as the tide falls. The best assessed course of action for remediation of corals and macroalgae from smothering is to allow natural wave energy

Sensitivity	Open Ocean	Shallow Water	Response
			to assist in the natural dispersion of weathered oil, any mechanical recovery or dispersant use may only increase the impact to the reef system (IPIECA, 1990-2005 Volume 3).
	Whale Sharks	N/A	The purpose of the response measures will be to manage these impacts with all reasonable efforts to remove hydrocarbons.
	Fishes	Fishes	There are fish and fish habitat within the EMBA that could be affected by an oil spill. Response strategies will be to undertake shoreline protection / response, where possible, therefore impacts to biota or sensitive habitats will be managed by all reasonable efforts to remove hydrocarbons.
	Fisheries	Fisheries	There are many fisheries within the EMBA that could be affected by an oil spill. Response strategies will be to undertake marine recovery and shoreline response, therefore impacts to fisheries will be managed by all reasonable efforts to remove hydrocarbons.
Moderate	N/A	Sandy beaches	High amenity beaches occur throughout the Ningaloo Marine Park. Shoreline protection / response will be undertaken so that impacts to biota or sensitive habitats will be managed by all reasonable efforts to remove hydrocarbons.
	N/A	Rocky shores	Shoreline response will be undertaken so that impacts to biota or sensitive habitats will be managed by all reasonable efforts to remove hydrocarbons.

2.4 NEBA and Decision Making Criteria for Response Strategy Selection

For oil spill response, the IAP response strategies are identified through a process that involves the review of key decision making criteria the outcome if which are used as inputs to the Operational Net Environmental Benefit Analysis (NEBA), as outlined in Figure 4. This ensures the most effective response strategies with the least detrimental impacts can be selected and implemented.

The IMT must first gain situational awareness by obtaining answers to the following key questions, which are fundamental to any oil spill response:

1) What type of oil has been released?
2) What is the expected behaviour of the oil that has been released?
3) What volume has been released?
4) Is the source under control?
5) Where is the oil going?
6) What environmental receptors/sensitivities are in the path of the predicted oil trajectory?
7) Can the oil be approached or are there safety concerns?
8) Can the oil be contained?
9) Can the oil be dispersed?
10) Will shoreline impact occur and clean-up be required?

To answer these questions, the Incident Commander must review key information such as Engineering advice on the volume and characteristics of the oil released, Oil Spill Trajectory Modelling, Oil Spill Tracker Buoys, the weather forecast, AIS vessel feed, aircraft data feeds, operational reports from field teams and environmental monitoring teams to determine presence and/or extent of environmental receptors, advice from the State Government Environmental Scientific Coordinator, any other external advice, the window of

Ecological Sensitivity (Section 4.5.6 of EP), oil spill reference documents (as detailed in each response strategy within the EP) and any other Daily Field Reports.

The outcome of this data review step is then used to update the Operational NEBA, which assesses the impacts and risks of response strategy options on environmental sensitivities. The spill response risk assessment applies pre-defined assessment classifications (3P to 3N), as shown in Table 3, assess the potential “impact” for the receptor sensitivities for each response option (Table 4). To aid interpretation where both positive and negative impacts have been indicated for a spill response in Table 4, cross-referencing potential impacts with the receptor’s protection priority can be used to weight benefit/risk to receptors; and those with higher protection priorities can be weighted as of greater importance than risk to lower priorities for the determination of net environmental benefit.

Where a response has “zero” scores for all receptors and sensitivities, this may still be assessed as being of Net Environmental Benefit (or carried forward to ALARP assessment) based on potential for indirect (rather than direct) reduction in risk. For example, RS2 Monitor and Evaluate has no direct impact on the spill due to implementation of this strategy, but the situational awareness gained from the response allows proactive and effective application of other response strategies thereby contributing to reduction of risk to ALARP.

The NEBA Matrix (Table 4) prioritises environmental sensitivities, and assesses the individual net effect that each response option may have on it allowing informed decision to be made. If there are conflicting outcomes for a particular response option then the sensitivity with the higher priority becomes the preferred response option. A NEBA is a decision-making process and will ultimately result in a trade-off of priorities and response strategies. It is possible for a response strategy to be used for one sensitivity, even if it has been identified that this response option may not benefit one or several other sensitivities. The final outcome of the response, however, should result in an overall net environment benefit. Spill response options identified by BHP are outlined in Section 3. An evaluation of the impacts and risks of the spill response options is provided in Section 9 of the EP.

The IMT will apply the Operational NEBA process to identify the response options that are preferred for the situation, oil type and behaviour, environmental conditions, direction of plume, and protection priority of sensitive receptors.

The steps in the Operational NEBA aim to identify:

1. Key ecological values, environmental, socioeconomic and cultural heritage receptors Section 4 of the EP, within the plume path and predicted EMBA based on oil spill modelling;
2. Protection priorities of either High, Medium or Low and determine if receptor is listed as Endangered (E), Threatened (T) or Migratory (M) under the EPBC Act (Table 5 in Section 4 of the EP);
3. Receptors within the window of Ecological Sensitivity (Table 4-6 in Section 4 of the EP) for the period of the oil spill;
4. New situational awareness information that becomes available such as updated spill trajectory models, observations of oil on the water and/or shorelines, locations of sensitive receptors, effectiveness of implemented response strategies, Daily Field Reports, any updated advice from the ESC / other external sources (e.g. consideration of recommendations from the WA Hazard Management Agency (HMA)) for inclusion into daily updates of the Operational NEBA to optimise the IAP. Some sensitive receptors are mobile (e.g. fish, mammals, birds) and may move in and out of the predicted oil path on numerous occasions throughout the response, requiring frequent review of the NEBA table and selection of response techniques documented in IAPs by the IMT; and
5. For Dispersant Application, evaluate the environmental trade-offs between applying or not applying dispersants (see Section 9.3.3 of EP for further details) to ensure that the response strategy has a positive benefit. Any dispersant application in or around State waters will require WA DoT approval – Oil Spill Response Coordinator.
6. Select response strategies to be included in the IAP work instruction

The Planning Section Chief will supervise the development of the IAP with the Incident Management Team. The Incident Commander authorises the IAP prior to releasing it to the Operations Section.

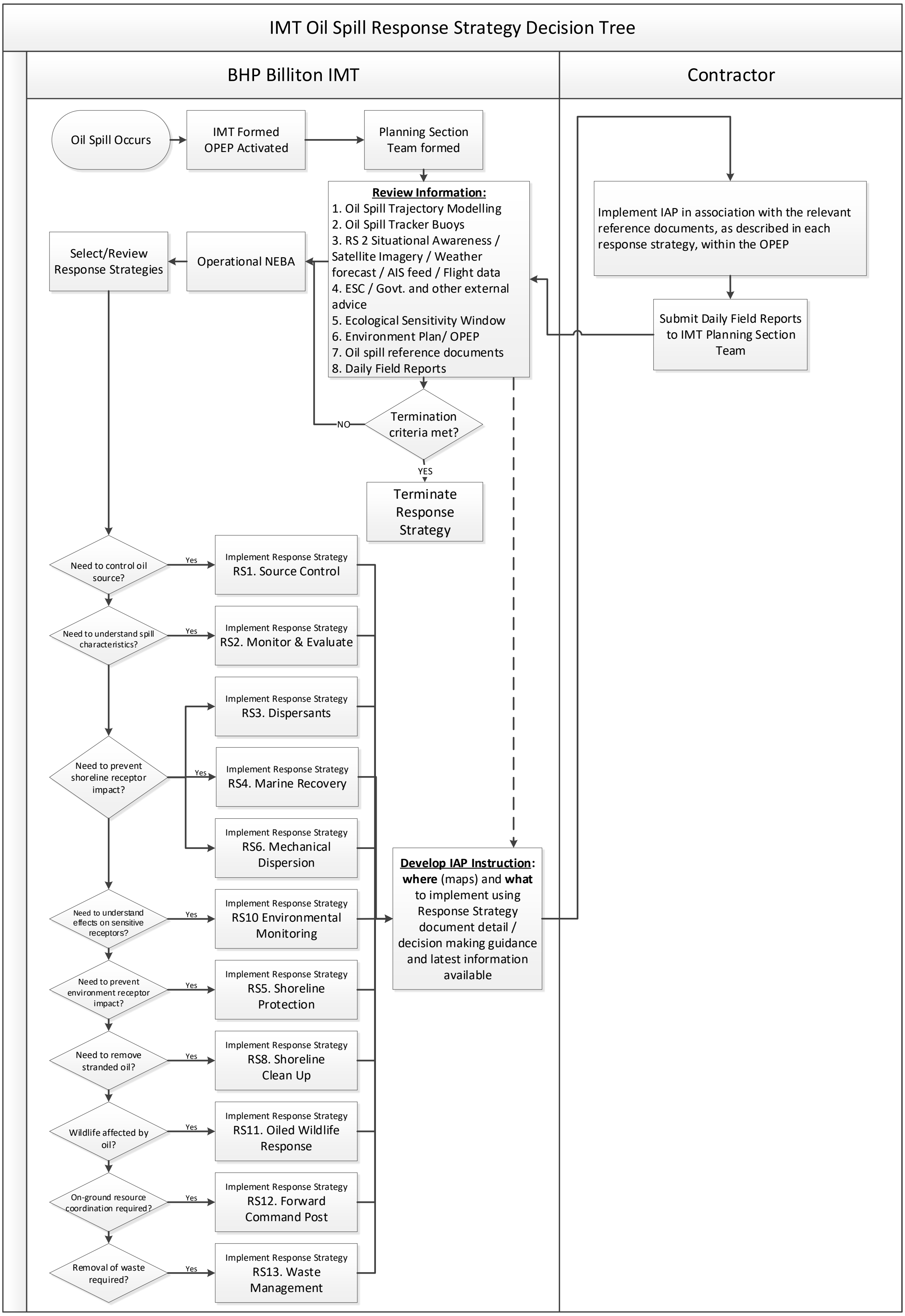


Figure 4: IMT Oil Spill Response Strategy Decision Tree

Table 4: NEBA impact categories. Categories identify potential change in impact due to response strategies, relative to the impact of the spill.

NEBA Categories			Degree of Impact	Potential Duration of Impact	Equivalent BHP Severity Risk Matrix Consequence Level
Positive	**3P**	**Major**	Likely to prevent: • Behavioural impact to biological receptors; • Behavioural impact to socio-economic receptors, e.g. changes day-to-day business operations, public opinion/behaviours (e.g. avoidance of amenities such as beaches), or regulatory designations.	Decrease in duration of impact by > 5 years	N/A
	2P	**Moderate**	Likely to prevent: • Significant impact single phase of reproductive cycle for biological receptors; or • Detectable financial impact, either directly (e.g. loss of income) or indirect (e.g. via public perception), for socio-economic receptors. This level of negative impact is recoverable and unlikely to result in closure of business/industry in the region.	Decrease in duration of impact by 1-5 years	N/A
	1P	**Minor**	Likely to prevent impact to: • Significant proportion of population or breeding stages, for biological receptors; or • Significant impact to the sensitivity of protective designation for socio-economic receptors; or significant long term impact to business/ industry.	Decrease in duration of impact by several seasons (< 1 year)	N/A
	0	**Non-mitigated spill impact**	No detectable difference to unmitigated spill difference		
Negative	**1N**	**Minor**	Likely to result in: • Behavioural impact for biological receptors; • Behavioural impact for socio-economic receptors, e.g. changes day-to-day business operations, public opinion/behaviours (e.g. avoidance of amenities such as beaches), or regulatory designations. **[Note 1]**	Decrease in duration of impact by several seasons (< 1 year)	Measureable but limited impact to the environment, where recovery of ecosystems function takes less than 1 year. BHP Petroleum Risk Matrix Severity Level 2, Non Material Risk
	2N	**Moderate**	Likely to result in: • Significant impact single phase of reproductive cycle for biological receptors; or • Detectable financial impact, either directly (e.g. loss of income) or indirect (e.g. via public perception), for socio-economic receptors. This level of negative impact is recoverable and unlikely to result in closure of business/industry in the region.	Increase in duration of impact by 1-5 years	Substantial impact to the environment, where recovery of ecosystem function takes between 3 and up to 10 years. BHP Petroleum Risk Matrix Severity Level 4, Non Material Risk
	3N	**Major**	Likely to result in impact to: • Significant proportion of population or breeding stages, for biological receptors; or • Significant impact to the sensitivity of protective designation for socioeconomic receptors; or • Significant long term impact to business / industry for socioeconomic receptors.	Increase in duration of impact by > 5 years or unrecoverable	Severe impact to the environment and where recovery of ecosystem function takes 10 years or more. BHP Petroleum Risk Matrix Severity Level 5, Material Risk
[Note 1]			Behavioural impacts tend to be short-term and limited in their impact (even on a regional scale). The maximum likely should be considered if a response strategy directly impacts behaviour that results in an impact to reproduction and/or the breeding population, e.g. failure of fish spawning aggregations, then score should be a 2 or 3 rather than 1.		

Table 5: Operational NEBA – Response Strategy Selection

Sensitivity	Protection Priority*	Seasonal presence on NWS												Response Strategy											
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	RS1 Source Control	RS2 Monitor and Evaluate	RS3.1 Surface Dispersant Application	RS3.2 Subsea Dispersant Application	RS4 Marine Recovery	RS5 Shoreline Protection	RS6 Mechanical Dispersion	RS7 In situ Burning	RS8 Shoreline Clean-up	RS10 Environmental Monitoring	RS11 Oiled Wildlife Response	RS 13 Waste Management
Ecological																									
Whales	High (T, M)	N	N	N	N	N	N	Y	Y	Y	Y	N	N	2P	0	1N	1N	1P	0	1N	2N	0	0	0	0
Dugongs	High (M)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	2P	0	1N	1N	1P	0	1N	0	0	0	0	0
Dolphins	High (M)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	2P	0	1N	1N	1P	0	1N	2N	0	0	0	0
Whale sharks	High (T, M)	N	N	Y	Y	Y	Y	N	N	N	N	N	N	2P	0	1N	1N	1P	0	1N	2N	0	0	0	0
Fishes (resident, demersal, pelagic)	High	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	2P	0	1N	2N	1P	0	1N	0	0	0	0	0
Turtles (foraging, interesting, nesting)	High (T, M)	Y	Y	Y	N	N	N	N	N	Y	Y	Y	Y	2P	0	1N	1N	1P	2P	1P	2N	1P	0	2P	0
Migratory birds	Extreme (T, M)	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	Y	2P	0	2P	2P	1P	1P	2P	2N	1P	0	2P	0
Seabirds	Medium	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	2P	0	2P	2P	1P	1P	2P	2N	0	0	2P	0
Shorebirds	Medium	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	2P	0	2P	2P	1P	1P	2P	2N	1P	0	2P	0
Coral spawning	Medium	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	Y	2P	0	1N	2N	1P	0	1N	2N	0	0	0	0
Habitat/Ecosystem																									
Mangroves	Extreme	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	2P	0	1P	1N	1P	2P	1P	3N	2N	0	0	0
Coral reef	Medium	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	2P	0	1N	2N	1P	0	1N	0	0	0	0	0
Seagrasses	Medium	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	2P	0	1N	1N	1P	0	1N	0	0	0	0	0
Sandy beaches	Low	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	2P	0	1P	1P	1P	1P	1P	1P	1P	0	0	2P
Rocky shore	Low	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	2P	0	1P	1P	1P	1P	1P	1P	0	0	0	0
Open waters	Low	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	2P	0	1N	1N	1P	0	1N	2N	0	0	0	0
Socio-economic																									
Tourism	Low	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	2P	0	1P	1P	1P	2P	1P	2N	2P	0	0	2P
Fisheries	Low	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	2P	0	1N	2N	0	0	1N	0	0	0	0	0
Cultural Heritage	High	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	2P	0	1P	1P	1P	2P	1P	0	2P	0	0	2P
Response strategy provides Net Environmental Benefit?														Yes	Yes	Potential	Potential	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Response strategy feasible?														Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Is response strategy recommended (and ALARP assessment required)?														Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes

***Protection priority**: This ranking is based on a combination of factors including the likelihood of impact (time of year), severity of impact (type of exposure to the sensitivity, where the sensitivity is listed as Threatened (T) or Migratory (M) under the EPBC Act) and recovery time after exposure to hydrocarbons).

Shoreline response: Where shoreline clean-up has been given a negative score, this indicates that the use of equipment, machinery and personnel in that environment is likely to have negative effect, potentially causing more damage and prolonging the recovery and environmental benefit to that sensitivity.

3 Applicable Response Strategies

A summary of the strategies selected during the NEBA process for each specific scenario assessed is summarised in Table 6. Further description of each strategy includes a risk assessment on carrying it out, the control options and a conclusion as to how the strategy demonstrates ALARP and BHP acceptability criteria.

Table 6: Summarised Response Strategies for Crosby 3H1 light well intervention scenarios

Response Strategy	186m^3 Diesel Loss from vessel storage tank (Level 2)	204 m^3 Crude Flowline content loss (level 2)	<1930 m^3 Crude Loss of containment (Level 3)
RS1.1: Source Control – Vessel Control	✓	✗	✓*
RS1.2: Source Control – Subsea Intervention / Well Control	✗	✗	✓
RS2: Monitor and Evaluate	✓	✓	✓
RS3.1: Dispersant - Surface Application	✗	✓	✓
RS3.2: Dispersant – Subsea Application	✗	✗	✓
RS4: Marine Recovery	✗	✓	✓
RS5: Shoreline Protection	✓	✓	✓
RS6: Mechanical Dispersion	✗	✗	✗
RS7: In-Situ Burning	✗	✗	✗
RS8: Shoreline Clean-up	✓	✓	✓
RS9: Natural Recovery	✓	✓	✓
RS10: Environmental Monitoring	✓	✓	✓
RS11: Oiled Wildlife Response	✓	✓	✓
RS12: Forward Command Post	✗*	✗*	✓
RS13: Waste Management	✗*	✓	✓

* Potentially activated depending on reports/observations of RS2 Monitor and Evaluate.

Each option has advantages and disadvantages with regard to effectiveness, operational constraints, and environmental impacts. Consequently, spill response strategies need to be assessed on a case by case basis, taking into account the nature of the spill, OSTM, the weather conditions, and the advantages and disadvantages of each response strategy.

Table 7: Summary of Response Plans

Response Strategy	Documentation	Purpose	Doc Number	Location
RS1.1: Source Control – Vessel Control	Vessel SOPEP	Provide guidance to the Master on board the vessel with respect to the steps to be taken when a pollution incident has occurred or is likely to occur when the vessel is under the command of the Master. For contracted vessel - applicable to all vessel activities when operating.	Specific for support vessels.	Vessel bridge
RS1.2: Source Control – Subsea Intervention/ Well Control	Well Operations Management Plan (WOMP) Light Well Intervention Vessel Safety Case	Provides the operational parameters for Operations of the Pyrenees wells, including controlling, limiting, diverting flowlines or other well control measures. Provides the process for LWIV to control the activity at the Subsea Intervention Device (via ROV or activation of SID functions, and or well kill by bullheading operations).	PYAIMS-PS-0005 63001-OPM-DOC-D-005 – Part 5 RLWI	APU OMS APU Projects OMS EMQnet
RS2: Monitor and Evaluate	Monitor & Evaluate Response Strategy	Describes capability that is maintained to prevent spill impacts to extreme and highly sensitive environmental receptors and to maintain situational awareness throughout emergency response activities. Provides a QRG for use of: • Aircraft (rotary and/or fixed wing); • Aerial observers; • Oil Spill Tracker Buoys (OSTBs); • Vessels and marine crew; • Trajectory monitoring through service providers; • Satellite imagery through service providers; • Environmental monitoring; and • Seagliders/UAV's.	AOHSE-ER-0053	AU/HSEC Network APU OMS IMT Room EMQnet
	APU Operational Response Guideline 3 - Oil Spill Trajectory Modelling. Initiation,	Describes capability that is maintained to conduct trajectory modelling.	AOHSE-ER-0044	AU/HSEC Network APU OMS IMT Room

Response Strategy	Documentation	Purpose	Doc Number	Location
	Data Collection and Progression	Outlines the process for trajectory modelling to inform response planning and situation awareness; (validating oil spill releases to the marine environment).		EMQnet
	APU Operational Response Guideline 4: Oil Spill Tracking Buoy- Deployment / Tracking	Describes capability that is maintained to prepare, deploy and track OSTBs. Outlines the steps to undertake spill monitoring: • To determine the size, quantity and location of the spill; • To determine the movement of the oil; and to forecast which marine and coastal resources or areas are under threat.	AOHSE-ER-0033	AU/HSEC Network APU OMS IMT Room EMQnet
	APU Operational Response Guideline 1 - Aerial Surveillance, Confirmation, Quantification and Monitoring of Oil Spills	Describe capability to conduct aerial surveillance and quantification of spills to prepare, conduct, record and report on aerial surveillance to inform response planning.	AOHSE-ER-0041	AU/HSEC Network APU OMS IMT Room EMQnet
RS3.1: Dispersants - Surface Application	Fixed Wing Aerial Dispersant Response Strategy Marine Vessel Dispersant Response Strategy	Summarises the 1st Strike, Response Strategy, Field Documents and Operating Considerations available for BHP dispersant application, both by Fixed Wing Aerial Dispersant or vessel operated spraying equipment. Record of guidelines followed before applying dispersants.	AOHSE – ER- 0054 (FWAD) AOHSE – ER – 0055 (Marine Application)	AU/HSEC Network APU OMS IMT Room EMQnet
	APU Operational Response Guideline 2 - Dispersant Strategies, Safety, Application, Resources and Effectiveness.	Provides guidance to aid in the decision making process on the use of aerial and vessel dispersant options including response considerations, application and resources.	AOHSE-ER-0042	
	APU Oil Spill Dispersant Spray System (DSS) application Procedure	Provides information and guidance to the Master of the OSV when the vessel is assigned to apply oil spill dispersant to the sea: • The oil spill dispersant spray system to be used on the OSV for applying dispersant; • Safe use of the oil spill dispersant (Dasic Slickgone NS), Ardrox 6120 or other approved dispersant); and	AOHSE-ER-0047	

Response Strategy	Documentation	Purpose	Doc Number	Location
		Technical information for applying the dispersant.		
RS3.2: Dispersants – Subsea Application	APU Response Strategy for subsea application	Provides information on and Guidance on the application of Subsea dispersants including the Subsea First Response Toolkit (SFRT) or via a connected Light Well Intervention Vessel.	AOHSE–ER-0056	AU/HSEC Network APU OMS IMT Room EMQnet
RS5: Shoreline Protection	Jurabi to Lighthouse Beaches Oil Spill Tactical Response Plan (Reference – Sensitivity Mapping Report NWC-01-H to NWC-01-N)	The Shoreline Protection and Shoreline Clean-up TRP's cover the 5 priority areas along the Northwest cape and Muiron islands. The TRPs identify the tactical objectives of a response and the resources required to meet those objectives including personnel and equipment. This pre-identification of the response requirements enables a quicker mobilisation in the event the identified resources are threatened by an incident. Describe the arrangements in place for shoreline protection and clean up for key sensitivities at risk. Provides a template for other locations. Provides the number of personnel and equipment and actions to be followed for pre-impact and post-impact shoreline cleaning.	AOHSE-ER-0064	EMQnet APU OMS AU/HSEC Network IMT Room
	Muiron Islands Oil Spill Tactical Response Plan (Reference – Sensitivity Mapping Report - No reference)		AOHSE-ER-0066	
	Turquoise Bay Oil Spill Tactical Response Plan (Reference – Sensitivity Mapping Report NWC-02-AF and NWC-02-AG)		AOHSE-ER-0067	
	Yardie Creek Oil Spill Tactical Response Plan (Reference – Sensitivity Mapping Report NWC-03-AC)		AOHSE-ER-0068	
	Mangrove Bay Oil Spill Tactical Response Plan (Reference – Sensitivity Mapping Report NWC-02-E & K)		AOHSE-ER-0065	

Response Strategy	Documentation	Purpose	Doc Number	Location
RS8: Shoreline Clean-up	AOHSE-ER-0058-RS8 Shoreline Clean-up	Describes requirements for Shoreline Group Supervisor, Incident Commander and IMT Planning Section to establish and maintaining a Waste Management capability. Define practices to be undertaken to ensure that BHP is capable of establishing and maintaining a Waste Management capability to prevent environmental impacts to sensitive environmental receptors.	AOHSE-ER-0058	
RS10: Environmental Monitoring	APU Monitoring of Oil Hydrocarbons in Marine Waters, Sediments and Effects on Benthic Infauna	Describes capability that is maintained to monitor spill impacts to extreme and highly sensitive environmental receptors throughout emergency response activities. Defines practices to be undertaken to ensure that BHP is capable of monitoring effects of an oil spill on the marine environment and to inform the effectiveness of response strategies associated with any oil spill event.	AOHSE-ER-0037	AU/HSEC Network IMT Room EMQnet
	APU Monitoring Effects of an Oil Spill on Birds		AOHSE-ER-0038	
	APU Monitoring Effects of an Oil Spill on Marine Mammals and Megafauna		AOHSE-ER-0039	
	APU Monitoring Effects of an Oil Spill on Benthic Habitats and Benthic Primary Producers		AOHSE-ER-0040	
	APU Monitoring Effects of an Oil Spill on Marine Reptiles		AOHSE-ER-0043	
	APU Monitoring Effects of an Oil Spill on Commercial and Recreational Fish Species		AOHSE-ER-0048	
	APU Monitoring Effects of an Oil Spill on Fishes		AOHSE-ER-0051	

Response Strategy	Documentation	Purpose	Doc Number	Location
RS12: Forward Command Post	APU Response Strategy 12 – Forward Command Post	Define practices to be undertaken to ensure that BHP is capable of establishing and maintaining a Forward Command Post to prevent environmental impacts to sensitive environmental receptors.	AOHSE-ER-0062	AU/HSEC Network APU OMS IMT Room EMQnet
	ICS204 Forward Command Post	Draft procedure to provide a local command post to enable effective coordination of on-ground resources and in field activities with response organisations and other stakeholders with the Perth IMT.	N/A – assigned in event of a spill and used by IMT	
RS13: Waste Management	APU Response Strategy 13 - Waste Management	Provides guidance to ensure that there is a systematic and documented approach to the management of waste generated during an oil spill. This plan contains details of the practices and principles to effectively manage oiled waste and minimise the environmental impact of an incident.	AOHSE-ER-0063	AU/HSEC Network APU OMS IMT Room EMQnet
	APU Waste Management Plan – Oil Spill		AOHSE-E-0014-001	As above

4 Response

4.1 IMT Incident Briefing Documents and Task Checklists

The purpose of the IMT is to gain control of an incident or event and bring it to a safe resolution whilst minimising the impact on personnel, the environment, assets and reputation. The key to achieving control of an incident is successful transition from an initial reactive mode to a proactive planning mode. This is achieved through a series of iterative stages that create and refine an Incident Action Plan (IAP) as summarised in Figure 5.

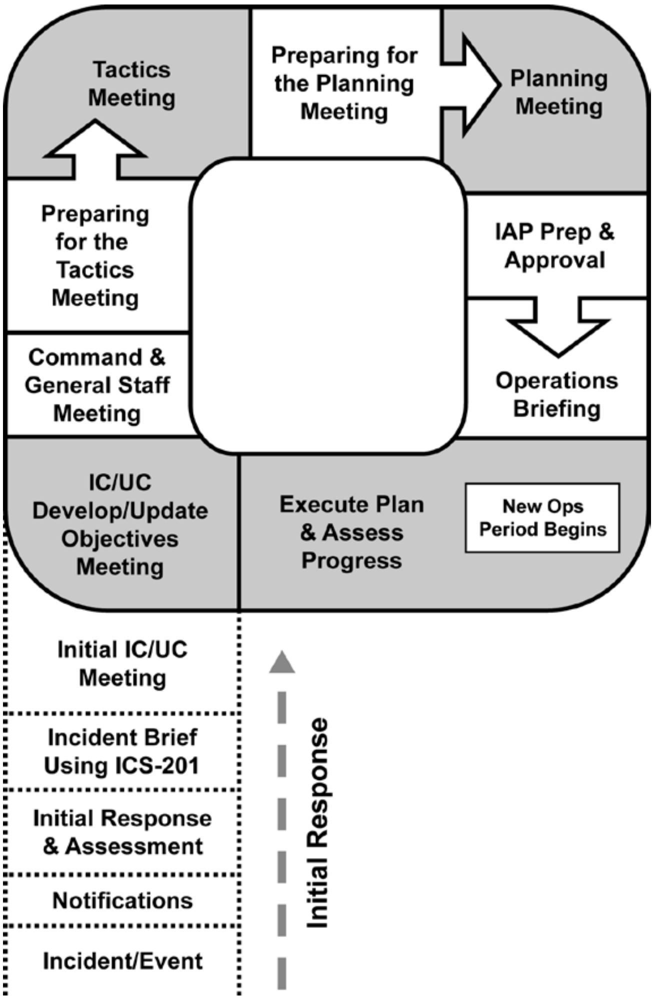


Figure 5: Planning cycle used by BHP IMT

The Crosby 3H1 – Light Well Intervention - First Strike Plan is listed in Appendix A of this Document.

The following First Strike Plan provides guidance to the BHP IMT in the first 24 hours of the spill to respond to a loss of hydrocarbons. Operational phases are listed in 2, 8, 16 and 24 hour periods post-mobilisation of the IMT. In some cases there may be no specific actions described for an activity period.

Post 24 hours, the BHP IMT will further develop Incident Action Plans (ICS Form based) and Operational NEBA's, which is described further in Section 3.2.

The First Strike Plan acts as the Incident Action Plan (IAP) for the initial response (i.e. within the first 24 hours of the incident) and is used and updated until Planning prepares the first incident IAP that is approved by Incident Commander. This checklist also acts as a permanent record of the initial response to the incident.

It should be noted that shoreline protection and shoreline cleanup measures for Barrow island are extablished and maintained by Chevron. Chevron's Oil Pollution Emergency Plan arrangements are to be enacted following joint consultation with Chevron and the Department of Transport. The need for activation would be identified during the implientation of RS2 Monitor and Evaluate response strategy. Should data indicate potential shoreline contact with Barrow island or any nearby receptors, Chevron are to be notified and mobilised via existing arrangements by the WA Department of Transport as the Controlling Agency.

The BHP Incident Management Manual (AOHSE-ER-0001) provide the IMT structure and guidance on systems, processes and procedures to establish the IMT during first hours of the response. During the Response IMT members will utilise the BHP Petroleum Incident Management Handbook.

4.2 First Strike Plan Summary

The time-steps provided in the First Strike Plan for each response strategy that follow are consistent with achieving the Objectives described in Section 1.3 and the performance standards described in the EP.

Table 8: IMT Actions in First 24 hours of a Spill

Response Strategy	Response Activity	Level 2	Level 2	Level 3
		186 m^3 diesel spill	204 m^3 crude oil - Loss of Flowline Inventory	<1930 m^3 crude oil - Loss of Well Containment
Notification & Establish Response Organisation	IMT	Activate*	Activate*	Activate*
	EMT	Notify*	Activate*	Activate*
	Regulatory Agency	Notify*	Notify*	Notify*
	Technical Support	Notify*	Activate	Activate
Source Control – Subsea intervention	Activate Source Control Options	Activate	Activate	Activate
Determine Potential Impacts	Oil Spill Trajectory Modelling	Activate	Activate	Activate
	Monitor and Evaluate - Aerial Surveillance	Activate	Activate	Activate
	Monitor and Evaluate - Marine Surveillance	Optional	Activate	Activate
Offshore Response	Subsea Dispersant Application	×	×	Optional
	Aerial Dispersant Application	×	Optional	Activate
	Marine Dispersant Application	×	Optional	Activate
	Marine Recovery	×	Based on OSTM	Based on OSTM
	Mechanical Dispersion	×	×	×
	Natural Recovery	Applicable	Applicable	Applicable
Shoreline Response	Forward Command Post (Exmouth)	×	Optional	Activate
	Shoreline Protection	×	Activate	Activate[1]
	Shoreline Clean-up	×	Activate	Activate[1]

Response Strategy	Response Activity	Level 2 186 m^3 diesel spill	Level 2 204 m^3 crude oil - Loss of Flowline Inventory	Level 3 <1930 m^3 crude oil - Loss of Well Containment
	Environmental Monitoring Procedures	Notify*	Activate	Activate
	Oiled Wildlife Response	×	Standby	Standby
	Waste Management Plan	×	Standby	Standby

* Process described in detail in the BHP Incident Management Manual

[1] Including notification and activation of other Title Holders for affected areas via DoT (Example Chevron – Barrow Island)

A working copy of the first strike plan in Spreadsheet format allows the IMT and Functional groups to execute the plan within the IMT environment. The First strike plan covers the first 24 hours of activity during the initial response phase.

A copy of the editable spreadsheet is available in the APU IMT Fast Facts section of EMQnet.

5 Response Equipment

5.1 Equipment

Oil spill response equipment from AMOSC, OSRL, AMSA National Plan and WA DoT can be called upon if required. The National Plan equipment, stored in regional stockpiles around Australia is sufficient to deal with spills of up to 20,000 tonnes. The major Western Australian stockpile is in Fremantle with a smaller stockpile located at Dampier and a regional stockpile in Exmouth.

5.1.1 OSRA Spill Response Equipment

Oil spill response equipment maintained by AMOSC (Exmouth, Fremantle and Geelong) and OSRL (Singapore) is available to BHP during a spill response as part of contractual arrangements that are currently in place with these agencies. A complete list of equipment maintained by BHP OSRA's including stockpiles in Exmouth / Dampier from the MOSES database (DoT; equipment owners include AMSA, DoT, and other Title Holders) is provided in B.

5.1.2 Aerial Support

A contract arrangement is in place through AMSA via National Plan, to make fire attack aircraft available for dispersant spraying. The contract with Aerotech 1st Response ensures aircraft are available within four hours of mobilisation. One of these bases is located in Jandakot, Perth, WA. Mobilisation of this service is through the AMSA Environment Protection Response Duty Officer via AusSAR. The AMOSC Duty Officer should also be notified to enable AMOSC to assist in smooth mobilisation.

5.1.3 Vessel Support

The marine response strategies outlined in this plan can be undertaken independently or concurrently. It is expected that in a Level 2 or 3 spill response that marine strategies will be undertaken concurrently. Table 9 outlines the multiple expected vessel requirements for the response strategies. During a response, the IMT may determine that additional vessels are either required or are available to be used and therefore can supplement the expected arrangements. BHP has the ability, through supplier contracts, to scale up (or down) the response to meet the needs of the response. Table 9 provides an indication of expected vessel usage across the spill response strategies.

Table 9: Response strategy vessel requirements

Response Strategy	Vessel Type	Number	Location	How accessed	Comment	Earliest need
Vessel based Dispersant application	Small utility vessels or tugs	3	Local/ Regional	Toll Provider. 2 utility vessels through MOU or vessel of opportunity.	Exmouth/Onslow/Dampier based	Day 1 Day 2
Marine Recovery	Supply vessels/ Small utility vessels or tugs	4	Local/ Regional	Utilise vessels once marine dispersant ceases.	Exmouth/Onslow/Dampier based	Day 2
Shoreline Protection	Small recreational craft	4-8	Local/ Regional	Vessel of opportunity	DoT has boats in Exmouth	As identified
Oiled Wildlife	Small recreational craft	2	Local/ Regional	Vessel of opportunity	Exmouth/Onslow/Dampier based	As identified
	Small utility vessels	2	Local/ Regional	Vessel of opportunity	Cray boats suitable	As identified
Operational Scientific Monitoring	Small utility vessels	1-2	Local/ Regional	Vessel of opportunity	1 initially, ramping to 2 as spill develops for water quality.	Day 2
	Commercial fishing vessel	4	Local/ Regional	charter	Benthic habitats Trap/line/trawl fishing vessels Fish monitoring	As identified
	Small recreational craft	12	Local/ Regional	Vessel of opportunity	Marine mammals	As identified
Shoreline Clean-Up	Landing craft	2	Local/ Regional	Vessel of opportunity	For island clean-up operations.	As identified
	Crew transfer vessel	2	Local/ Regional	Vessel of opportunity	Crew transfer to vessels or offshore islands.	As identified
Waste Recovery	PSV	2	Regional	Vessel of opportunity	Waste transfer from vessels / marine recovery.	As identified
Options	Barge	1-4	Regional	Vessel of opportunity	For temporary storage at sea of waste/dispersant supply.	As identified
	Tug	1-4	Regional	Vessel of opportunity	Support/towing of barges.	As identified
	Supply vessels/ small utility vessels or tugs	8+	Regional / Australian/ International	Vessel of opportunity	Standby Marine recovery.	As identified

BHP maintains oversight of monthly availability of larger vessels that would be required to undertake a response via subscription to live vessel feeds on the MarineBase capability. Whilst vessel availability and locations are dependent on levels of activity, BHP has sufficient confidence in the ability to source these vessels in the timeframes expected for the oil spill response and outlined in the EP based on current tracking of vessel utilisation and locations.

Port facilities at Exmouth, Onslow and Dampier will be used throughout the response. BHP has access to a supply base in Dampier, which is immediately available to support response operations. A logistics plan will be developed by the IMT with a look ahead to replace or supplement vessels during the response operations to maintain the operational capability.

There may be circumstances where additional support vessels may be required to assist with spill response, e.g. additional dispersant spraying capability, deployment of equipment for an inshore response on North West Cape or transportation of equipment and people to offshore installations or island locations. Requests for offshore vessel support can be made by AMSA.

5.2 Dispersants

If immediate attempts to control a subsea release via ROV intervention is unsuccessful, a decision to apply dispersant may be made. If this occurs BHP intends to apply the dispersant by injecting into the flow via the continually connected service line between the LWIV and the SID.

The Dispersant Response Strategy includes the following:

- **Subsea application** – The immediate response by the Light Well Intervention Vessel will be to directly inject dispersant into the flow at the SID via the existing connected service line that connects the LWI vessel and the subsea infrastructure. Response planning has allowed a 4 hour period to effect the direct injection after the start of the release. This conservative timeframe includes the problem solving, information flow, equipment preparation and decision making timeframes. With an application rate of 1:100 (1 part dispersant to 100 parts liquid crude) and a dispersant efficacy of 75%. Dispersant application is continuous from hour 4 until the end of week 2 (for the 3 week release scenarios). The LWIV will carry at least three IBC's of dispersant allowing a minimum of three days application with an option to resupply as required.
- **Vessel application:** Dispersant application from vessels is a secondary response strategy. The current contracted Supply vessel (e.g. Toll Provider) has the capacity to be used as an immediate dispersant vessel in a spill incident. The vessel should be utilised to undertake spot dispersant spraying for observed actionable surface spills if they appear;
- **Aerial application:** Aerial application will be a backup capability in the case that subsurface dispersant application cannot be continued. AMSA (through the National Plan) and AMOSC maintain a contractual arrangement to make fire attack aircraft available for dispersant spraying. Fixed wing aircraft types AT802 will initially be made available from Jandakot, WA. It is expected that each AT802 can carry 3 m^3 and make 10 flights per day out to the Pyrenees Field. In addition to the supply of aircraft, Aerotech 1st Response are contracted to provide the ground crew, including a Liaison Officer and Dispersant Loading personnel. The Liaison Officer is responsible for assisting with the management and supervision of Aerotech's aircraft and dispersant loading operations during an incident. The Loading Crew will have sufficient expertise and knowledge to load dispersant and refuel Aerotech's aircraft. It is estimated that the mobilisation of the AT802 will take less than 12 hours to Exmouth airport (as confirmed by Operation Thomas). BHP will establish a forward command post in Exmouth and arrange for the labour and machinery to refuel and refill the AT802 with dispersant via AMOSC; and
- International guidance on dispersant application (IPIECA, 2015[1]; ITOPF, 2011[2]; IPIECA OGP, 2014[3]), considers the benefits and impacts of dispersant usage and authorisation. Primary guidance, which has been adopted internationally, suggests limiting application areas within a certain water depth

1 IPIECA 2001. Dispersants: Surface application. London, UK.72 pp. and IPIECA 2001. Dispersants: Subsea Application. London, UK.76 pp.

2 ITOPF 2011. Use of dispersants to treat oil spills. Technical Information Paper 4. London, UK.12 pp.

3 IPIECA OGP 2014. Regulatory approval of dispersant products and authorisation of their use. London, UK.30 pp

and/or distance from shoreline. This control reduces the risk of impact to coastal sensitivities; with the water depth identified being typically <10 m with a distance to shore of >1 km. BHP has exceeded this primary standard by assigning a dispersant application zone that has a water depth criteria as >50 m water depth, distance to shore >13 km and does not intersect the boundary of the Ningaloo Marine Park. Moreover, this also takes into account other stakeholder considerations such as additional approvals required to apply within State waters.

By restricting dispersant application to open seas, in sufficient water depth, it reduces the risk to environmental sensitivities that may be affected by entrained oil such as coral reefs. Critically, once dispersed, the oil will no longer be affected by wind and will be driven by currents only increasing the potential time to impact to nearshore habitats as the prevailing currents are along-shore (i.e. parallel) and not directed onshore.

5.3 Dispersant Stockpiles

Through contractual arrangements with AMOSC and OSRL, BHP has access to stockpiles of dispersant as listed in Table 10.

In the event of a Level 3 hydrocarbon spill, BHP IMT will liaise with its OSRA's regarding production of 'Just in Time Dispersant' for deployment throughout the oil spill response. This will take into consideration the start-up, continuous production and termination of production of relevant dispersant based on the requirements and status of the incident response. AMOSC have provided the following advice in relation to dispersant manufacture and mobilisation:

- Day 5 – 75 m^3 / day of Ardrox 6120;
- Day 12 – 115 m^3 / day of Nalco Corexit; and
- Day 15 – 108 m^3 / day of Dasic Slickgone NS.

Table 10: Dispersant stockpiles by location and owner, as at December 2019#

Location	Owner	Type	Amount (m^3)
Exmouth	AMOSC	Slickgone NS	75
North Geelong	AMOSC	Corexit 9500A	62
North Geelong	AMOSC	Slickgone NS	75
Fremantle	AMOSC	Slickgone NS	8
Fremantle	AMOSC		27
Dampier	AMSA		*
Fremantle	AMSA		*
Australia (excl. Dampier / Fremantle)	AMSA		*
Australia SFRT	AMOSC	Slickgone NS	500
Singapore	OSRL (SLA)	Slickgone NS	339
Singapore	OSRL (SLA)		185
Singapore	OSRL (SLA)		21
Singapore	OSRL (SLA)	Finasol OSR52	67
Singapore	OSRL (SLA)	Corexit 9527	84

Location	Owner	Type	Amount (m^3)
Singapore	OSRL (SLA)	Slickgone EW	18
Singapore	GDS (OSRL)	Slickgone NS	350
Singapore	GDS (OSRL)	Finasol OSR52	350
UK Southampton	GDS (OSRL)	Finasol OSR52	500
UK Southampton	GDS (OSRL)	Slickgone NS	500
USA - Ft Lauderdale	GDS (OSRL)	Corexit 9500A	500
France	GDS (OSRL)	Finasol OSR52	1500
Brazil	GDS (OSRL)	Corexit 9500A	500
South Africa - Cape Town	GDS (OSRL)	Finasol OSR52	800
TOTAL (OSCA transitioned)			1,295
TOTAL (all)			**6,461**

Exact volumes subject to change as stocks are rotated/ used / replaced due to operational and/or logistics requirements.
**** 50% of OSRL stockpile is accessible to any one client.

5.3.1 Dispersant Deployment Times

Table 11 outlines the timeframes for mobilisation of stockpiles of oil dispersant from their locations in Australia to Exmouth, the method of transport and the likely method of application.

Table 11: Oil dispersant estimated deployment times to Exmouth

Location	Volume (m^3)	Transport	Application	Estimated time to application in field	Estimated delivery time ****
Light Well Intervention Vessel	1-3	LWI Vessel	Direct into the Lower SID via direct service line from the LWIV	1-4 Hour	Immediate
Pyrenees Facility	1.6	Support vessel	Support vessel spraying system	4-8 hours	Day 1
Exmouth, Naval Base	75	Road to Exmouth Marina	Supply vessel, with Viko Spray Unit	4 hours	
			FWADC air tractors	7-9 hours	
AMOSC Fremantle/ Jandakot	20	Road to Exmouth for load out at Exmouth Boat Harbour to support vessel or Learmonth.	Support vessel spraying system	28 hours	Day 2
			FWADC air tractors	28 hours	
	250*** (SFRT)	Road to Exmouth for load out at Exmouth Boat Harbour (Service	FWADC air tractors	28 hours	Day 3 onwards

Location	Volume (m^3)	Transport	Application	Estimated time to application in field	Estimated delivery time ****
		Wharf) to support vessel or Learmonth.			
AMOSC Geelong	146.6	Road to Exmouth for load out at Exmouth Boat Harbour (Service Wharf) to support vessel or Learmonth.	Support vessel spraying system	2 – 3 days	Day 3 onwards
			FWADC air tractors	2 – 3 days	
AMSA Australia	367.6*****	Road to Exmouth for load out at Exmouth Boat Harbour (Service Wharf) to support vessel or Learmonth.	Support vessel spraying system	2 – 7 days	
			FWADC air tractors	2 – 7 days	
OSRL	265*	Air to Learmonth	FWADC air tractors, OSRL C130 Herc, Subsea.	1 week	Week 1 onwards
Just in Time Dispersant	75 / Day 5 - Ardrox 115 / Day 115 - Corexit 108 / Day 15 - Slickgone	Road to Exmouth for load out at Exmouth Boat Harbour (Service Wharf) to support vessel or Learmonth.	FWADC air tractors, OSRL C130 Herc, Subsea.	1 week	
Global Dispersant Stockpile (OSRL)	5000	Air to Learmonth	FWADC air tractors, OSRL C130 Herc, Subsea.	>3 weeks**	Week 2 onwards

NB: Arrangements must be made to refuel aircraft at Learmonth Airport; typically the Air Truck will require 1,200 litres of Jet-A1 on arrival Learmonth and uses 300 litres per hour in service.
* 50% of OSRL stockpile is accessible to any one client.
** Assumes delivery is staggered as required and that 700 m3 is available for use on Day 11 via the Singapore GDS.
*** Half the SFRT dispersants stockpile (250m^3) is available to be released for surface response from SFRT members
**** Allows for approx. 40m3/day + 50% more = 60m3/day
*****Delivery times ok but 2018 dispersant stock requires confirmation from AMSA.

5.4 Marine Recovery

Current AMOSC/AMSA/MOU equipment stockpiles for offshore boom and skimmers to enable the response are detailed in Appendix B – Oil Spill Equipment.

Appendix A – 1st Strike Plan

Response	Subtitle	Diesel Spill	Crude	External Stakeholder	Action	Timing	Responsible	Sub team/Role	Reference Documentation
Notifications	Internal	Yes	Yes	BHP Duty Incident Commander	Duty Incident Controller to be notified of release.	Immediately	Vessel Master/Project Leader	N/A	Emergency Response Plan
Notifications	External	NA	N/A	AMSA – Response Coordination Centre (RCC)	If Spill from Vessel (Marine Diesel Oil). Verbally notify AMSA RCC of the hydrocarbon spill. Follow up with a written Marine Pollution Report (POLREP) as soon as practicable following verbal notification. RCC 1800 641 792	As soon as practicable	Incident Commander (or delegate)	N/A	LWIV Emergency Response Plan
Notifications	External	Yes	Yes	NOPSEMA	Verbal Notification to NOPSEMA. Record notification using Initial Verbal Notification Form or equivalent and send to NOPSEMA as soon as practicable (cc to NOPTA and DMIRS). (08) 6461 7090	Within 2 hours	Incident Commander (or delegate)	N/A	NOPSEMA online notification form API IMT Emergency Contact Directory
Notifications	External	Yes	Yes	NOPSEMA, NOPTA, DMIRS	Provide a written NOPSEMA Incident Report Form as soon as practicable (no later than 3 days after notification) (cc to NOPTA and DMIRS). NOPSEMA: submissions@nopsema.gov.au NOPTA: resources@nopta.gov.au DMIRS: petreps@dmirs.wa.gov.au	Within 3 Days	Incident Commander (or delegate)	N/A	NOPSEMA online notification form API IMT Emergency Contact Directory
Notifications	External	Yes	Yes	Department of Environment and Energy	Director of National Parks to be notified in the event of oil pollution within a marine park, or where an oil spill response action must be taken within a marine park, so far as reasonably practicable, prior to response action being taken.	As soon as practicable	Incident Commander (or delegate)	N/A	API IMT Emergency Contact Directory
Notifications	External	Yes	Yes	Australian Maritime Oil Spill Centre (AMOSC) *	Notify AMOSC Duty Manager that a spill has occurred and follow-up with an email from the IC, to formally activate AMOSC. Determine what resources are required consistent with the AMOS Plan and detail in a Service Contract that will be sent to BHP from AMOSC upon activation 03 5272 1555 or 0438 379328	As soon as practicable	Incident Commander (or delegate)	N/A	AMOS PLAN
Notifications	External	N/A	Yes	Oil Spill Response Limited (OSRL) *	Contact OSRL Duty Manager and request assistance from technical advisor in Perth. For mobilisation of resources, send the Mobilisation Form to OSRL as soon as practicable. Singapore Office +65 62661566	As soon as practicable	Incident Commander (or delegate)	N/A	OSRL Agreement Form xxx Incident Commander / IMT Leader / EMT Leader / Power of Attorney (POA) Execution Authority / Senior Drilling and Completions Manager
Notifications	External	N/A	Yes	WA Department of Transport	Marine Duty Manager to verbally notify DoT that a spill has occurred. DoT to be notified if spill is likely to extend into WA State waters. Request DoT to provide Liaison to BHP IMT. Follow up with a written POLREP as soon as practicable following verbal notification.	As soon as practicable	Incident Commander (or delegate)	N/A	API IMT Emergency Contact Directory
Notifications	External	N/A	Yes	WA Department of Biodiversity, Conservation and Attractions (DBCA)	Duty Officer to be notified if there is potential for oiled wildlife or the spill is expected to contact land or waters managed by WA Department of Biodiversity, Conservation and Attractions (08) 9219 9108	As soon as practicable	Incident Commander (or delegate)	N/A	API IMT Emergency Contact Directory
Notifications	External	N/A	Yes	The Response Group (TRG) *	Make initial contact for ongoing support personnel as required +1 (281) 880-5000	As soon as practicable	Incident Commander (or delegate)	N/A	API IMT Emergency Contact Directory
IMT Activation	IMT	Yes	Yes	Houston ECC	Initiate IMT Callout - consider additional resources to support Event Emergency Response and Oil Spill Response requirements	First 30 minutes	Incident Commander	N/A	Incident Management Manual Incident Management Handbook
IMT Activation	IMT	Yes	Yes	Houston ECC	Prepare backup IMT	Within 8 hours of IMT mobilisation	Incident Commander	N/A	API IMT Emergency Contact Directory
IMT Activation	Forward Operating Base	N/A	Yes	-	Identify Forward Operating Base Manager	Within 2 Hours	Operations Section Chief/Logistics Section Chief	N/A	AOHSE-ER-0062 RS12 Forward Operating Base
IMT Activation	Forward Operating Base	N/A	Yes	Dept. Defence Harold E Holt	Inform Harold E Holt of intention to setup Forward Operating Base (FOB) at designated building. Logistics Coordinator to determine what BHP resources can be mobilised to Learmonth	Within 2 hours	Logistics Section	N/A	API IMT Emergency Contact Directory – Department of Defence Harold E Holt
IMT Activation	Forward Operating Base	N/A	Yes		Deploy Forward Operating Base Manager with Grab bag	Within 4 Hours	Logistics Section	N/A	AOHSE-ER-0062 RS12 Forward Operating Base

IMT Activation	Forward Operating Base	N/A	Yes	Dept. Defence Harold E Holt	Fully Activate Forward Operating Base Response Strategy.	FOB to be in place and setup within 24 hours	Logistics Section	N/A	AOHSE-ER-0062 RS12 Forward Operating Base
IMT Activation	Forward Operating Base	N/A	Yes	Dept. Defence Harold E Holt	Identify and establish staging areas for Shoreline, Marine and Aviation Branches.	Staging Areas to be identified by 24 hours	Operations Section	N/A	AOHSE-ER-0062 RS12 Forward Operating Base
IMT Activation	Forward Operating Base	N/A	Yes	Dept. Defence Harold E Holt	Identify and establish Staging areas for Shoreline Response Teams.	Staging Areas to be identified by 24 hours	Operations Section	N/A	AOHSE-ER-0062 RS12 Forward Operating Base
Source Control	Well intervention	N/A	Yes	Light Well Intervention Vessel Operator	Confirm Loss of well control and estimated from rate	Immediate	Operations Section / Source Control Group	Light Well Intervention Vessel Field Response Team	Sapura Safety Case 63001-OPM-DOC-D-0005_1 - Part 5 RLWI
Source Control	Well intervention	N/A	Yes	Light Well Intervention Vessel Operator	Attempt Closure of the SCSSV (venting control pressure)	Immediate	Operations Section / Source Control Group	Light Well Intervention Vessel Field Response Team	Sapura Safety Case 63001-OPM-DOC-D-0005_1 - Part 5 RLWI
Source Control	Well intervention	N/A	Yes	Light Well Intervention Vessel Operator	Deploy ROV to manually close wireline rams or gate valve	within 6 hours	Operations Section / Source Control Group	Light Well Intervention Vessel Field Response Team	Sapura Safety Case 63001-OPM-DOC-D-0005_1 - Part 5 RLWI
Source Control	Well intervention	N/A	Yes	Light Well Intervention Vessel Operator	If ROV unsuccessful begin Well Kill (Bull Heading) - Flow into reservoir via existing service line circulation path	within 6 hours	Operations Section / Source Control Group	Light Well Intervention Vessel Field Response Team	Sapura Safety Case 63001-OPM-DOC-D-0005_1 - Part 5 RLWI
Source Control	Subsea Dispersant Application	N/A	Yes	Light Well Intervention Vessel Operator	in conjunction with concurrent source control activities, begin Subsea application of dispersant where Well intervention actions have not been achieved.	within 2 hours	Operations Section / Field Response Team	Light Well Intervention Vessel Field Response Team	AOHSE -ER-00XX - RS3.2 Dispersants - Subsea application
Source Control	Well intervention	N/A	Yes	Light Well Intervention Vessel Operator	If previous controls unsuccessful - pressure cap available on the vessel to be deployed with ROV and placed over the mandrel and locked in place. This will stem any leak emanating from the wireline mandrel/GIH.	within 6 hours	Operations Section / Source Control Group	Light Well Intervention Vessel Field Response Team	-
Source Control	Well intervention	N/A	Yes	Light Well Intervention Vessel Operator	If previous controls unsuccessful - begin Kill Well – via Gas Lift (Unitech fitting) – 2” line from vessel	within 12 hours	Operations Section / Source Control Group	Light Well Intervention Vessel Field Response Team	Sapura Safety Case 63001-OPM-DOC-D-0005_1 - Part 5 RLWI
Source Control	Well intervention	N/A	Yes	Light Well Intervention Vessel Operator	If previous controls unsuccessful begin Kill Well – Access well from annulus side (TCT) – annulus kill	within 1.5 days	Operations Section / Source Control Group	Light Well Intervention Vessel Field Response Team	BHP WOMP
Source Control	Well intervention	N/A	Yes	Alternate Light Well Intervention Vessel	If LWIV vessel inoperable - deploy ROV from alternate vessel to achieve above actions	within 21 days	Operations Section / Field Response Team	Light Well Intervention Vessel Field Response Team	-
Monitor and Evaluate	Aerial Surveillance	Yes	Yes	CHC Helicopters, AMOSC	Notify CHC Helicopters and provide spill location, options also include mobilising from Karratha or Barrow Island	within 2 hours	Operations Section	Deputy Operations Section Chief (Aviation)	AOHSE-ER-0053-Oil Spill Response Strategy - RS2 Monitor & Evaluate
Monitor and Evaluate	Aerial Surveillance	Yes	Yes	AMOSC	Inform Learmonth (Exmouth shire and RAAF) of additional aircraft movements.	within 2 hours	Operations Section	Deputy Operations Section Chief (Aviation)	API IMT Emergency Contact Directory
Monitor and Evaluate	Aerial Surveillance	Yes	Yes	CHC Helicopters	Mobilise personnel from Pyrenees FPSO for initial observation is necessary	within 2 hours	Operations Section	Deputy Operations Section Chief (Aviation) AMOSC	-
Monitor and Evaluate	Aerial Surveillance	Yes	Yes	CHC Helicopters	Complete observation Flights and return data to IMT Planning Team	within 8 hours	Operations Section	Deputy Operations Section Chief (Aviation)	-
Monitor and Evaluate	Aerial Surveillance	Yes	Yes	Babcock/AMOSC	Develop and confirm schedule of observation flights for next 24 hours	within 16 hours	Operations Section	Deputy Operations Section Chief (Aviation) AMOSC	AOHSE-ER-0041 APU Operational Response Guideline 1 - Aerial Surveillance. Confirmation, Quantification and Monitoring of Oil Spills
Monitor and Evaluate	Aerial Surveillance	Yes	Yes	Babcock	Establish long term aerial observation plans with additional aircraft and trained observers from BHP, AMOSC or OSRL. Babcock Helos	within 24 hours	Operations Section	Deputy Operations Section Chief (Aviation) AMOSC	AOHSE-ER-0041 APU Operational Response Guideline 1 - Aerial Surveillance. Confirmation, Quantification and Monitoring of Oil Spills
Monitor and Evaluate	Aerial Surveillance	Yes	Yes		Fully Activate Response Strategy 2 - Monitor and Evaluate - Aerial Surveillance	within 24 hours	Planning Section	N/A	AOHSE-ER-0053-Oil Spill Response Strategy - RS2 Monitor & Evaluate
Monitor and Evaluate	Vessel Surveillance	Yes	Yes	Light Well Intervention Vessel Operator	Activate Fast Response Vessel into the area to provide on water observation until Aerial Surveillance flights are in the area. Advise surveillance vessel of spill location and any safety precautions necessary	within 2 hours	Operations Section	Deputy Operations Section Chief (Marine)	-
Monitor and Evaluate	Vessel Surveillance	Yes	Yes	Light Well Intervention Vessel Operator	If in field Activate Fast Response Vessel into the area to provide on water observation until Aerial Surveillance flights are in the area. Advise surveillance vessel of spill location and any safety precautions necessary	within 2 hours	Operations Section	Deputy Operations Section Chief (Marine)	-

Monitor and Evaluate	Vessel Surveillance	Yes	Yes	Light Well Intervention Vessel Operator	Complete vessel surveillance and provide information to IMT Planning Team	within 8 hours	Operations Section	Deputy Operations Section Chief (Marine)	-
Monitor and Evaluate	Vessel Surveillance	Yes	Yes	-	Fully Activate Response Strategy 2 - Monitor and Evaluate - Vessel Surveillance	within 24 hours	Planning Section	Deputy Operations Section Chief (Marine)	AOHSE-ER-0053-Oil Spill Response Strategy - RS2 Monitor & Evaluate
Monitor and Evaluate	Oil Spill Trajectory Modelling	Yes	Yes	Light Well Intervention Vessel Operator	Deploy Oil Spill Tracking Buoy	Immediately	Planning Section	Deputy Operations Section Chief (Marine)	AOHSE-ER-0033 Operational Response Guideline 4: Oil Spill Tracking - Buoy Deployment /Tracking
Monitor and Evaluate	Oil Spill Trajectory Modelling	Yes	Yes	-	Collect all data on the location, type, volume and other necessary data for Oil Spill Tracking Modelling	As soon as practicable	Planning Section	GIS Specialist	AOHSE-ER-0033 Operational Response Guideline 4: Oil Spill Tracking - Buoy Deployment /Tracking
Monitor and Evaluate	Oil Spill Trajectory Modelling	Yes	Yes	RPS-Asia-Pacific Applied Science Associates (RPS-APASA)*	contact AMOSC, activate OSTM standby contract. Communicate all necessary data to enable modelling to commence	As soon as practicable	Planning Section	Planning Section Chief	API IMT Emergency Contact Directory
Monitor and Evaluate	Oil Spill Trajectory Modelling	Yes	Yes	AMOSC /APASA	receive Oil Spill Tracking Modelling and update Common Operating Picture	within 4 hours	Planning Section	GIS Specialist	-
Monitor and Evaluate	Oil Spill Trajectory Modelling	Yes	Yes	Neighbouring facilities/ externally affected company operations	Communicate Modelling with all relevent operators that may be affected/impacted. Liaise with appropriate organisational IMT's	within 4 hours	Planning Section	Planning Section Chief	API IMT Emergency Contact Directory
Monitor and Evaluate	Oil Spill Trajectory Modelling	Yes	Yes	-	Provide trajectory model results to operations section for aerial surveillance planning	within 8 hours	Planning Section	Deputy Operations Section Chief (Aviation) /AMOSC	-
Monitor and Evaluate	Oil Spill Trajectory Modelling	Yes	Yes	-	Confirm EMBA and determine areas for 'post-spill / pre-impact' monitoring	within 8 hours	Planning Section	Environmental Unit Leader	PYHSE-E-0010 - Crosby-3H1 Light Well Intervention Environment Plan
Monitor and Evaluate	Oil Spill Trajectory Modelling	N/A	Yes	-	Consider and activate subsea surveillance via mobilisation of sea gliders through service agreement with third party preferred vendor	within 8 hours	Planning Section	Planning Section Chief	-
Monitor and Evaluate	Oil Spill Trajectory Modelling	Yes	Yes	-	Correlate spill trajectory modelling with real time data from oil spill tracker buoy and communicate to AMOSC for update of trajectory modelling	within 16 hours	Planning Section	Planning Section Chief	-
Monitor and Evaluate	Oil Spill Trajectory Modelling	Yes	Yes	-	Obtain most recent spill trajectory modelling and place on the Common Operating Picture.	within 16 hours	Planning Section	GIS Specialist	-
Monitor and Evaluate	Oil Spill Trajectory Modelling	Yes	Yes	AMOSC	Determine need and, if required, frequency of additional tracker buoy deployments	within 16 hours	Planning Section	Planning Section Chief	API IMT Emergency Contact Directory
Monitor and Evaluate	Oil Spill Trajectory Modelling	Yes	Yes	-	Complete daily safety analysis for the next 24 h period	within 24 hours	Command Section	Safety Officer	-
Monitor and Evaluate	Oil Spill Trajectory Modelling	Yes	Yes	-	Complete modelling requirements as per IAP	within 24 hours	Planning Section	Planning Section Chief	-
Monitor and Evaluate	Oil Spill Trajectory Modelling	Yes	Yes	-	Ensure complete activation of Response Strategy 2 - Monitor and Evaluate - Oil Spill Trajectory	within 24 hours	Planning Section	Planning Section Chief	AOHSE-ER-0053-Oil Spill Response Strategy - RS2 Monitor & Evaluate
Monitor and Evaluate	Satellite Imagery	N/A	Yes	AMOSC/KSAT	Activate satellite imagery acquisition via contract with OSRL	within 2 hours	Planning Section	Planning Section Chief	-
Monitor and Evaluate	Satellite Imagery	N/A	Yes	AMOSC/KSAT	Determine Area of Interest coordinates, image frequency and details of receiving imagery. Include in OSRL Notification	within 2 hours	Planning Section	GIS Specialist	-
Monitor and Evaluate	Satellite Imagery	N/A	Yes	AMOSC/KSAT	Receive Satellite imagery and incorporate into Common Operating Picture	within 24 hours	Planning Section	GIS Specialist	-
Monitor and Evaluate	Satellite Imagery	N/A	Yes	-	Ensure complete activation of Response Strategy 2 - Monitor and Evaluate - Satellite Imagery	within 24 hours	Planning Section	Planning Section Chief	AOHSE-ER-0053-Oil Spill Response Strategy - RS2 Monitor & Evaluate
Monitor and Evaluate	Operational NEBA	Yes	Yes	-	Complete the daily operational NEBA - identify the potential use of dispers	Within 4 hours	Planning Section	Environmental Unit Leader	PYHSE-E-0001 Pyrenees Operations Environmental Plan
Dispersant	Mobilisation	N/A	Yes	-	Initiate Response Strategy 3 Dispersant (FWAD)	Within 2 hours	Planning Section	Planning Section Chief	AOHSE-ER-0054 RS3 Dispersant including Fixed Wing Aerial Dispersant

Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	AMOSC (FWAD Contract - Aerotech)	Request AMOSC/AMSA to activate the Fixed Wind Aerial Dispersant Contract	Within 2 hours	Operations Section	Aviation Operations Branch Director	API IMT Emergency Contact Directory
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	AMOSC (FWAD Contract - Aerotech)	Request Aerial Attack supervisor through AMOSC/AMSA/DOT	Within 2 hours	Operations Section	Aviation Operations Branch Director	API IMT Emergency Contact Directory
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	AMOSC (FWAD Contract - Aerotech)	Advise AMOSC of incident, request to mobilise dispersant stockpiles in Exmouth, Fremantle, Dampier and Geelong	Within 2 hours	Operations Section	Deputy Operations Section Chief (Aviation) AMOSC	API IMT Emergency Contact Directory
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	AMOSC (FWAD Contract - Aerotech)	Confirm with AMOSC labour at Learmonth for loading / unloading dispersant and planes	Within 2 hours	Operations Section	Deputy Operations Section Chief (Aviation) AMOSC	AMOSC FWAD JSOP
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	AMOSC (FWAD Contract - Aerotech)	Mobilise dispersant at Harold Holt to Learmonth airport or wharf via Exmouth Light Industrial.	Within 2 hours	Operations Section	Deputy Operations Section Chief (Aviation) AMOSC	AMOSC FWAD JSOP
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	WA Department of Transport	Advise of potential use of dispersant to AMSA and DoT and arrange authorisation	Within 4 hours	Planning Section	Environmental Unit Leader	API IMT Emergency Contact Directory
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	AMOSC (FWAD Contract - Aerotech)	Arrange spotter aircraft for dispersant application	Within 4 hours	Operations Section	Deputy Operations Section Chief (Aviation)	API IMT Emergency Contact Directory
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	OSRL	Consider mobilisation of Hercules from OSRL - place on standby	Within 4 hours	Operations Section	Deputy Operations Section Chief (Aviation)	API IMT Emergency Contact Directory
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	AMOSC (FWAD Contract - Aerotech)	Conduct first Aerial Dispersant sorties	Within 8 hours	Operations Section	Deputy Operations Section Chief (Aviation)	AMOSC FWAD JSOP
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	AMOSC (FWAD Contract - Aerotech)	Assist development ongoing Concept of Operations for FWAD	within 8 hours	Operations Section	Deputy Operations Section Chief (Aviation) AMOSC	AOHSE-ER-0042 Operational Response Guideline 2 - Dispersant Strategies. Safety, Application, Resources and Effectiveness
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	AMOSC (FWAD Contract - Aerotech)	Arrange for AMOSC to develop logistics plan for supplies of dispersant for Days 2 to 5	Within 8 hours	Operations Section	Deputy Operations Section Chief (Aviation)	AOHSE-ER-0054 RS3 Dispersant including Fixed Wing Aerial Dispersant
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	AMOSC (FWAD Contract - Aerotech)	Confirm with AMOSC pumping equipment for loading dispersant is mobilised	Within 8 hours	Operations Section	Deputy Operations Section Chief (Aviation)	AMOSC FWAD JSOP
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	-	Aerial Surveillance to provide report on effectiveness of dispersant to Planning Section	within 12 hours	Operations Section	Deputy Operations Section Chief (Aviation)	-
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	-	Update IAP with availability of dispersant	within 12 hours	Planning Section	Planning Section Chief	-
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	AMOSC/Aerotech	Develop ongoing Flight Operations Plan for additional sorties for next 48 hours	within 12 hours	Operations Section	Deputy Operations Section Chief (Aviation) AMOSC	AMOSC FWAD JSOP
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	AMOSC/Aerotech	Arrange accommodation for pilots and loading crew	within 16 hours	Logistics Section	Deputy Operations Section Chief (Aviation)	APU IMT Contact Directory
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	OSRL	Consider mobilisation of Hercules from OSRL - place on standby	within 16 hours	Operations Section	Deputy Operations Section Chief (Aviation)	APU IMT Contact Directory

Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	AMOSC (FWAD Contract - Aerotech)	Arrange for AMOSC / OSRL to develop logistics plan for supplies of dispersant for Days 5 to 15	within 16 hours	Operations Section	Deputy Operations Section Chief (Aviation)	APU IMT Contact Directory
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	AMOSC / OSRL	AMOSC/OSRL to initiate arrangements for manufacture of dispersant	within 16 hours	Operations Section	Deputy Operations Section Chief (Aviation)	APU IMT Contact Directory
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	Shire of Exmouth/Department of Defence	Arrange for payment of aviation fuel from Learmonth Airport	within 16 hours	Logistics Section	Aviation Operations Branch Director / AMOSC	APU IMT Contact Directory
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	OSRL	Arrange to receive international dispersant via OSRL	Within 24 hours	Logistics Section	Logistics Section Chief	-
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	AMOSC (FWAD Contract - Aerotech)	Confirm requirement for additional dispersant aircraft	Within 24 hours	Planning Section	Planning Section Chief	-
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	AMOSC (FWAD Contract - Aerotech)	Complete calculation of daily dispersant use	Within 24 hours	Operations Section	Deputy Operations Section Chief (Aviation)	-
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	AMOSC/OSRL	Advise OSRA's on rate of use of dispersant	Within 24 hours	Operations Section	AMOSC/OSRL	APU IMT Contact Directory
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	AMOSC/OSRL	AMOSC/OSRL to initiate GDS for maintaining dispersant supply as necessary	within 48 hours	Operations Section	AMOSC/OSRL	APU IMT Contact Directory
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	-	Complete daily safety analysis and NEBA for next 24 h period	Within 24 hours	Planning Section	Environmental Unit Leader Safety Officer	PYHSE-E-0010 - Crosby-3H1 Light Well Intervention Environment Plan
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	-	Update IAP with Air Operations Plan for next operational period	within 24 hours	Planning Section	Planning Section Chief	
Dispersant	Fixed Wing Aerial Dispersant	N/A	Yes	-	Update safety analysis and NEBA for next operational period	within 24 hours	Planning Section	Environmental Unit Leader Safety Officer	PYHSE-E-0010 - Crosby-3H1 Light Well Intervention Environment Plan
Environmental Monitoring	Environmental Monitoring Plan	Yes	Yes	-	Activate Response Strategy 10 - Environmental Monitoring	Within 2 hours	Planning Section	Environmental Unit Leader	PYHSE-ER-0060 RS10 Environmental Monitoring
Environmental Monitoring	Environmental Monitoring Plan	Yes	Yes	GHD, SGS, Bennelongia	Consider the premobilisation of Environmental Monitoring Contractors	Within 2 hours	Planning Section	Environmental Unit Leader	APU IMT Contact Directory
Environmental Monitoring	Environmental Monitoring Plan	Yes	Yes	GHD, SGS, Bennelongia	Begin Operational NEBA and determine appropriate Environmental Response Strategies	Within 4 hours	Planning Section	Environmental Unit Leader	AOHSE-ER-0036 Sensitivity Mapping Exmouth AOHSE-ER-0037 Monitoring of oil in marine waters AOHSE-ER-0038 Monitoring Effects on birds AOHSE-ER-0039 Monitoring Effects on marine mammals AOHSE-ER-0040 Monitoring effects on benthic habitats AOHSE-ER-0043 Monitoring Effects on marine reptiles AOHSE-ER-0048 Monitoring Effects on fish species AOHSE-ER-0051 Monitoring Effects on fishes

Environmental Monitoring	Environmental Monitoring Plan	Yes	Yes	GHD, SGS, Bennelongia	Monitoring contractors to specify logistics requirements for sampling plan to logistics. Confirm ETA of monitoring contractor to site with IMT Planning Section Chief	within 8 hours	Planning Section	Environmental Unit Leader	APU IMT Contact Directory
Environmental Monitoring	Environmental Monitoring Plan	Yes	Yes	GHD, SGS, Bennelongia	Develop logistics plan for accommodation and transport for Contract Environmental Monitoring organisations	within 8 hours	Logistics Section	Environmental Unit Leader	-
Environmental Monitoring	Environmental Monitoring Plan	Yes	Yes	GHD, SGS, Bennelongia	Sampling locations confirmed by Planning team	within 16 hours	Planning Section	Environmental Unit Leader	-
Environmental Monitoring	Environmental Monitoring Plan	Yes	Yes	GHD, SGS, Bennelongia	Deploy Initial Environmental Monitoring Team members to Exmouth	Within 24 hours	Logistics Section	Environmental Unit Leader	PYHSE-ER-0060 RS10 Environmental Monitoring
Environmental Monitoring	Environmental Monitoring Plan	Yes	Yes	-	Complete Risk Assessment for Monitoring teams included in IAP for next operating period	Within 24 hours	Command Section	Safety Officer	-
Environmental Monitoring	Environmental Monitoring Plan	Yes	Yes	GHD, SGS, Bennelongia	Initial Sampling Plan complete and ready for inclusion within IAP for future Operating Period	within 24 hours	Planning Team	Environmental Unit Leader	PYHSE-ER-0060 RS10 Environmental Monitoring
Environmental Monitoring	Environmental Monitoring Plan	Yes	Yes	-	Complete Activation of Response Strategy 10 - Environmental Monitoring	Within 24 hours	Planning Section	Environmental Unit Leader	AOHSE-ER-0060 RS10 Environmental Monitoring
Shoreline Protection	Mobilisation	N/A	Yes	-	Activate Response Strategy 5 - Shoreline Protection	within 2 hours	Planning Team	Planning Section Chief	AOHSE-ER-0057 - RS5 Shoreline Protection
Shoreline Protection	Mobilisation	N/A	Yes	-	From initial Oil Spill monitoring data identify likely impacted sensitive receptors	within 4 hours	Planning Section	Environmental Unit Leader	PYHSE-E-0010 - Crosby-3H1 Light Well Intervention Environment Plan AOHSE-ER-0064 - Oil Spill Tactical Response Plan - Jurabi to Lighthouse Bay Beaches AOHSE-ER-0065 - Oil Spill Tactical Response Plan – Mangrove Bay AOHSE-ER-0066 - Oil Spill Tactical Response Plan – Muiron Islands AOHSE-ER-0067 - Oil Spill Tactical Response Plan – Turquiose Bay AOHSE-ER-0068 - Oil Spill Tactical Response Plan – Yardie Creek
Shoreline Protection	Mobilisation	N/A	Yes	AMOSC	Determine what resources are required consistent with the AMOS Plan and detail in a Service Contract that will be sent to BHP from AMOSC. Arrange for AMOSC to Mobilise the Exmouth stockpile	within 4 hours	Planning Section	Environmental Unit Leader	Northwest Cape Sensitivity Mapping (AOHSE-ER-0036 Tactical Response Plans
Shoreline Protection	Mobilisation	N/A	Yes	Department of Transport	Advise DoT of potential shoreline contact and intention to deploy protective boom to identified sensitive resources based on OSTM	Within 4 Hours	Planning Section	Planning Section Chief	As per the WA DoT IGN, DoT will become the controlling agency in a State waters response, utilising BHP resources and plans to achieve the best outcome for the oil pollution response
Shoreline Protection	Mobilisation	N/A	Yes	-	Nominate a Shoreline Group supervisor. Finalise the Organisation chart and deployment plan for the Shoreline Group	Within 8 hours	Operations Section	Shoreline Group Supervisor	-
Shoreline Protection	Mobilisation	N/A	Yes	-	Develop logistics plan for accommodation and transport for Contract Environmental Monitoring organisations	within 8 hours	Logistics Section	Logistics Section Chief	APU IMT Contact Directory
Shoreline Protection	Mobilisation	N/A	Yes	AMOSC / Dept. Defence Harold E Hold Naval Base	AMOSC arrange for access to Harold Holt base to mobilise boom equipment	within 16 hours	Logistics Section	Logistics Section Chief	APU IMT Contact Directory
Shoreline Protection	Mobilisation	N/A	Yes	-	Deploy initial Shoreline Group personnel for initial SCAT teams to Exmouth	within 16 hours	Operations Section	Shoreline Group Supervisor	-
Shoreline Protection	Mobilisation	N/A	Yes	-	Mobilise boom equipment from Harold Holt base to selected location	within 24 hours	Logistics Section	Logistics Section Chief	-

Shoreline Protection	Mobilisation	N/A	Yes	-	Complete Risk Assessment for Shoreline Protection and SCAT teams included in IAP for next operating period	Within 24 hours	Command Section	Safety Officer	-
Shoreline Protection	Mobilisation	N/A	Yes	-	Complete Assignment lists for SCAT teams and Shoreline Protection Teams and include in the IAP for the next Operational period	Within 24 hours	Operations Section	Shoreline Group Supervisor	-
Shoreline Protection	Mobilisation	N/A	Yes	-	Complete Activation of appropriate Response Strategy 5 - Shoreline Protection	Within 24 hours	Planning Section	Planning Section Chief	AOHSE-ER-0057 - RS5 Shoreline Protection
Shoreline Clean-up	Mobilisation	N/A	Yes	-	Activate Response Strategy 8 - Shoreline Clean-up	Within 2 Hours	Planning Section	Planning Section Chief	AOHSE-ER-0058 - RS8 Shoreline Clean-up
Shoreline Clean-up	Mobilisation	N/A	Yes	AMOSC/OSRL/DoT	Advise AMOSC/OSRL and DoT that SCAT Teams and trained shoreline responders are to be placed on standby for mobilisation to Exmouth	Within 2 Hours	Planning Section	Planning Section Chief	APU IMT Contact Directory
Shoreline Clean-up	Mobilisation	N/A	Yes	-	utilise initial Oil Spill modelling and oil fate modelling to determine size of shoreline impacts and unskilled workforce required	within 4 hours	Planning Section	Environmental Unit Leader	-
Shoreline Clean-up	Mobilisation	N/A	Yes	Department of Transport	SCAT Team Coordinator to work with Shire/DoT to access predicted impact shorelines	within 8 hours	Planning Section	Planning Section Chief	APU IMT Contact Directory
Shoreline Clean-up	Mobilisation	N/A	Yes	BHP Minerals Australia	Activate BHP Mutual Aid arrangements with Minerals Australia for the deployment if Personnel, Equipment, Accommodation and Transport of Shoreline Clean-up teams	within 8 hours	Logistics Section	Logistics Section Chief	APU IMT Contact Directory
Shoreline Clean-up	Mobilisation	N/A	Yes	Personnel Resource Company pool (various)	Activate contracts with personnel resource company and request mobilisation of unskilled workforce to Exmouth to supplement Shoreline Clean-up Teams	within 8 hours	Logistics Section	Logistics Section Chief	APU IMT Contact Directory
Shoreline Clean-up	Mobilisation	N/A	Yes	-	SCAT Team Coordinator to update IMT with predicted scale and scope of oiling and any pre-emptive shoreline clean up	Within 16 hours	Planning Section	Planning Section Chief	-
Shoreline Clean-up	Mobilisation	N/A	Yes	-	Confirm shoreline protection priorities and begin mobilisation of priority equipment.	within 24 hours	Planning Section	Environmental Unit Leader	-
Shoreline Clean-up	Mobilisation	N/A	Yes	BHP Minerals Australia	Confirm and mobilise remaining Mutual Aid resources from within the Minerals Australia Business	within 24 hours	Operations Section	Operations Section Chief	APU IMT Contact Directory
Shoreline Clean-up	Mobilisation	N/A	Yes	Dot/DBCA	Dependent on OSTM and potential impacts to priority sensitivities, SCAT Teams and trained shoreline responders to begin mobilising to Exmouth	within 24 hours	Operations Section	Operations Section Chief	-
Shoreline Clean-up	Mobilisation	N/A	Yes	-	Complete Activation of appropriate Response Strategy 8 - Shoreline Clean-up	Within 24 hours	Planning Section	Planning Section Chief	AOHSE-ER-0058 - RS8 Shoreline Clean-up
Wildlife Response	Wildlife Response	Yes	Yes	-	Initiate Response Strategy 11 Oiled Wildlife	within 2 hours	Planning Section	Environmental Unit Leader	AOHSE-ER-0061 Oil Spill Response Strategy - RS11 Oiled Wildlife
Wildlife Response	Wildlife Response	Yes	Yes	AMOSC	Advise AMOSC of potential for wildlife recovery equipment and team mobilisation	within 2 hours	Planning Section	Environmental Unit Leader	APU IMT Contact Directory
Wildlife Response	Wildlife Response	Yes	Yes	Dot/DBCA	Advise DoT/DBCA of the potential need for oiled wildlife response, and ETA of equipment and personnel	within 8 hours	Planning Section	Environmental Unit Leader	APU IMT Contact Directory
Wildlife Response	Wildlife Response	Yes	Yes	-	Develop logistics plan for accommodation and transport for Contract Environmental Monitoring organisations	within 8 hours	Logistics Section	Logistics Section Chief	-
Wildlife Response	Wildlife Response	Yes	Yes	-	Carry out wildlife response as per IAP under advisement of wildlife response experts	Planning Section	Planning Section	Environmental Unit Leader	-
Wildlife Response	Wildlife Response	Yes	Yes	-	Complete risk assessment and safety analysis for oil wildlife response teams and include in the IAP for the next Operational Period	within 24 hours	Command Section	Safety Officer	-

Wildlife Response	Wildlife Response	Yes	Yes	-	Confirm activation of appropriate components of Initial Response Strategy 11 Oiled Wildlife	within 24 hours	Planning Section	Environmental Unit Leader	AOHSE-ER-0061 Oil Spill Response Strategy - RS11 Oiled Wildlife
Waste Management	Mobilisation	Yes	Yes	-	Initiate Response Strategy 13 Waste Management	within 2 hours	Planning Section	Planning Section Chief	AOHSE-ER-0063 Oil Spill Response Strategy - RS13 Waste Management AOHSEAOHSE-E-0014-001 - Waste Management Oil Spill
Waste Management	Mobilisation	Yes	Yes	Veola/Northwest Waste Alliance	Activate waste management contracts and other third party agreements for the provision of equipment / supplies and resources.	within 4 hours	Logistics Section	Logistics Section Chief	APU IMT Contact Directory
Waste Management	Mobilisation	Yes	Yes	WA Department of Transport	Notify WA DoT that waste management contractors have been activated and mobilising to Exmouth. Request regulatory agency liaison for waste management sites	within 4 hours	Logistics Section	Logistics Section Chief	APU IMT Contact Directory
Waste Management	Mobilisation	Yes	Yes	-	identify priority locations for temporary waste storage suitable for volumes predicted by SCAT teams and information gathered as part of RS2 Monitor and evaluate	within 6 hours	Logistics Section	Logistics Section Chief/Waste Management Contractor	AOHSE-ER-0063 Oil Spill Response Strategy - RS13 Waste Management AOHSEAOHSE-E-0014-001 - Waste Management Oil Spill
Waste Management	Mobilisation	Yes	Yes	Veola/Northwest Waste Alliance	Begin development of logistics plan	within 12 hours	Logistics Section	Logistics Section Chief/Waste Management Contractor	AOHSE-ER-0063 Oil Spill Response Strategy - RS13 Waste Management AOHSEAOHSE-E-0014-001 - Waste Management Oil Spill
Waste Management	Mobilisation	Yes	Yes	Veola/Northwest Waste Alliance	Complete Waste Management logistics Plan	within 24 hours	Logistics Section	Logistics Section Chief/Waste Management Contractor	AOHSE-ER-0063 Oil Spill Response Strategy - RS13 Waste Management AOHSEAOHSE-E-0014-001 - Waste Management Oil Spill
Waste Management	Mobilisation	Yes	Yes	-	Complete activation of Response Strategy 13 Waste Management	within 24 hours	Planning Section	Planning Section Chief	AOHSE-ER-0063 Oil Spill Response Strategy - RS13 Waste Management AOHSEAOHSE-E-0014-001 - Waste Management Oil Spill

Appendix B – Oil Spill Equipment

Product Totals by Location Report

Thursday, 2 April 2020
1:25:07 PM

Quantity	Available	Length	Product#	Product Name	Product Category	Bay Location
Broome						
2	2		G-033	Afedo Spray System 200-TS	Dispersant Spray Equipment	Supply Base 3
1	1		G-041	Lamor Hydraulic Power Pack	Power Packs, Pumps & Accessories	Supply Base 3
1	1		G-052	Minimax Brush Skimmer	Skimmer	Supply Base 3
2	2	400	G-092	200m HDB 1300 Boom on Hyd Reel	Boom	Supply Base 3
4	4	100	G-110	Beach Guardian Boom	Boom	Supply Base 3
8	8	200	G-111	Zoom Boom	Boom	Supply Base 3
1	1		G-130	Beach Guardian Deployment Kit	Boom Accessories	Supply Base 3
4	4		G-133	Zoom Boom Anchor Kit	Boom Accessories	Supply Base 3
1	1		G-141	Vikotank 13000 litres	Waste Storage	Supply Base 3
16	16		G-150	Sorbent Boom	Sorbents	Supply Base 3
3	3		G-151	Sorbent Squares	Sorbents	Supply Base 3
3	3		G-184	Shipping Container	General	Supply Base 3
2	2		G-188	I SPHERE Satellite Drift Buoys	Communications	Supply Base 3
1	1		G-330	Oiled fauna kit	Decontamination	Supply Base 3
1	1		G-331	Decontamination Kit	Decontamination	Supply Base 3
1	1		G-400	Boom Cage	Misc	Supply Base 3
1	1		G-401	Boom Cage	Misc	Supply Base 3
1	1		G-500	Response tool box	General	Supply Base 3
15	15		G-607	Ardrox 6120	Dispersant	DG Shed
1	1		G-610	Dispersant Agitator	General	Supply Base 3
Exmouth						
1	1		G-030	Vikospray Spray Unit	Dispersant Spray Equipment	Harold Holt
1	1		G-031	Simplex Helicopter Bucket	Dispersant Spray Equipment	Harold Holt
1	1		G-032	Dispersant Transfer Pump	Dispersant Spray Equipment	Harold Holt
1	1		G-033	AFEDO Ecospray 80W	Dispersant Spray Equipment	Harold Holt
1	1		G-040	Ro-Boom Power Pack	Power Packs, Pumps & Accessories	Harold Holt
1	1		G-051	Komara 12K Skimmer	Skimmer	Harold Holt
1	1		G-052	Minimax Brush Skimmer	Skimmer	Harold Holt

Quantity	Available	Length	Product#	Product Name	Product Category	Bay Location
1	1		G-054	Passive Weir Skimmer Kit	Skimmer	Harold Holt
1	1		G-070	Ro-Vac	Skimmer	Harold Holt
1	1		G-079	GT 185 Weir Skimmer	Skimmer	Harold Holt
2	2		G-090	Hydraulic Powered reel Winder	Boom Accessories	Harold Holt
2	2	400	G-091	Ro-Boom	Boom	Harold Holt
20	20	500	G-110	Beach Guardian Boom	Boom	Harold Holt
20	20	500	G-111	Zoom Boom	Boom	Harold Holt
3	3		G-130	Beach Guardian Deployment Kit	Boom Accessories	Harold Holt
1	1		G-132	Shoreline Boom Anchoring kit	Boom Accessories	Harold Holt
10	10		G-133	Zoom Boom Anchor Kit	Boom Accessories	Harold Holt
2	2		G-140	Fastank Temporary Storage	Waste Storage	Harold Holt
1	1		G-160	Rope Mop 240 Oil Skimming Machine	Skimmer	Harold Holt
1	1		G-181	General Support Trailer	Trailer	Harold Holt
2	2		G-184	Shipping Container	General	Harold Holt
10	10		G-186	Wheelbarrow	General	Harold Holt
1	1		G-260	15kva Generator	Trailer	Harold Holt
1	1		G-330	Oiled fauna kit	Decontamination	Harold Holt
1	1		G-335	Decontamination Kit (PPE)	Decontamination	Harold Holt
1	1		G-336	Decontamination Kit Locker	Decontamination	Harold Holt
1	1		G-337	Shoreline Accessories Cage	General	Harold Holt
3	3		G-400	Boom Cage	Misc	Harold Holt
5	5		G-401	Boom Cage	Misc	Harold Holt
30	30		G-604	Slickgone NS	Dispersant	Harold Holt
45	45		G-605	Slickgone NS	Dispersant	Harold Holt
1	1		G-610	Dispersant Agitator	General	Harold Holt

Fremantle

Quantity	Available	Length	Product#	Product Name	Product Category	Bay Location
1	1		G-029	Boom Vane Dispersant Spray System	Dispersant Spray Equipment	Outside Warehouse
5	5		G-033	AFEDO Spray System	Dispersant Spray Equipment	Outside Warehouse
1	1		G-034	Global Dispersant Spray System	Dispersant Spray Equipment	Outside Warehouse
1	1		G-035	GTA 30 Oil Transfer Pump	Power Packs, Pumps & Accessories	2A
4	4		G-037	GX-160 Honda Water Pump	Power Packs, Pumps & Accessories	Outside Warehouse
9	9		G-039	2 Stroke Air Blower	General	Outside Warehouse

Quantity	Available	Length	Product#	Product Name	Product Category	Bay Location
1	1		G-040	Ro-Boom Power Pack	Power Packs, Pumps & Accessories	Outside Warehouse
3	3		G-042	Hydraulic Power Pack LPP 36	Power Packs, Pumps & Accessories	4A, 4C, 4D, 4F, 5A, 5C, 5D, 5F, 6A, 6C, 6F
1	1		G-044	Spare Control Stand for LPP36	Power Packs, Pumps & Accessories	6D
3	3		G-045	Hydraulic Air Blower	General	4E, 5E, 6E
1	1		G-051	Komara 12K Skimmer	Skimmer	1A, 1D
2	2		G-052	Minimax Brush Skimmer	Skimmer	
1	1		G-053	Komara 20K Skimmer	Skimmer	1B, 1E
1	1		G-054	Passive Weir Skimmer Kit	Skimmer	1C, 1F
2	2		G-060	Lamor Rock Cleaner	General	
3	3		G-081	LWS500 Weir Skimmer	Skimmer	4B, 5B, 6B
6	6		G-090	Hydraulic Powered reel Winder	Boom Accessories	Outside Warehouse
6	6	1200	G-091	Ro-Boom	Boom	Outside Warehouse
23	23	575	G-110	Beach Guardian Boom	Boom	Outside Warehouse
30	30	750	G-111	Zoom Boom	Boom	7 A/D, Outside Warehouse
18	18	540	G-112	450mm Curtain Boom	Boom	Outside Warehouse
2	2		G-130	Beach Guardian Deployment Kit	Boom Accessories	7E
3	3		G-131	Ro-Boom Anchoring System	Boom Accessories	Outside Warehouse
28	28		G-133	Zoom Boom Anchor Kit	Boom Accessories	Outside Warehouse
2	2		G-140	Fastank Temporary Storage	Waste Storage	Outside Warehouse
2	2		G-142	25000lt Lancer Storage Barge	Waste Storage	Outside Warehouse
3	3		G-143	25 Cube Deck Storage Tanks	Waste Storage	Outside Warehouse
4	4		G-144	LCT 11.4 Collapsable Storage Tank	Waste Storage	Outside Warehouse
1	1		G-161	Rope Mop 260 Oil Skimming Machine	Skimmer	Outside Warehouse
2	1		G-172	Forklift	Vehicle	Warehouse, SFRT Warehouse
1	1		G-180	Mobile Workshop Trailer	Trailer	SFRT Warehouse
2	2		G-181	Galvanised Tandem Trailer	Trailer	Outside Warehouse
5	5		G-183	Aluminium Container	General	Outside Warehouse
9	9		G-184	Shipping Container	General	Outside Warehouse
6	6		G-188	I SPHERE Satellite Drift Buoys	Communications	3A
2	2		G-189	Spot Gen 3	Communications	Head Office
6	6		G-195	Communications Radio	Communications	Warehouse Office
1	1		G-199	Bird Scarer	Wildlife Support	3D

Quantity	Available	Length	Product#	Product Name	Product Category	Bay Location
1	1		G-200	Zodiac Pro 500	Vessel	
2	2		G-259	Portable Generator	General	Warehouse, Wildlife Container
1	1		G-262	Vehicle Washdown Trailer	Trailer	Warehouse
1	1		G-332	Wildlife washdown container	Wildlife Support	Outside Warehouse
1	1		G-333	Shoreline Support Kit	General	7B
1	1		G-334	Shoreline Flushing Kit	Power Packs, Pumps & Accessories	2D
1	1		G-336	Decontamination Kit Locker	Decontamination	11 C/F
1	1		G-400	Boom Cage	Misc	7 A/D
8	8		G-605	Slickgone NS	Dispersant	Outside Warehouse, Dispersant Area
27	27		G-606	Corexit 9500	Dispersant	Outside Warehouse, Dispersant Area
1	1		G-700	Phantom 4 Drone	General	Head Office
1	1		G-750	Aerial Surveillance Kit	General	Head Office
2	2		G-808	Gas Alert Monitor (Microclip)	General	Koolinda House
4	4		G-850	Ancilliaries box 1	General	Outside Warehouse
4	4		G-851	Ancilliaries Box 2	General	Outside Warehouse
2	2		G-889	Oil sampling kit	General	Outside Warehouse
1	1		G-950	AMOSC Vehicle	Vehicle	Warehouse
1	1		G-960	CF Moto u550	Vehicle	Warehouse

Nth Geelong

Quantity	Available	Length	Product#	Product Name	Product Category	Bay Location
1	1		G-029	Boom Vane Dispersant Spray System	Dispersant Spray Equipment	Dispersant Area
3	3		G-030	Vikospray Spray Unit	Dispersant Spray Equipment	R1M, R1T, R1B, R1M
1	1		G-031	Simplex Helicopter Bucket	Dispersant Spray Equipment	R2B, R2T
1	1		G-032	Dispersant Transfer Pump	Dispersant Spray Equipment	R1M
3	3		G-033	Afedo Spray System 200 DFWE	Dispersant Spray Equipment	Dispersant Area, Outside Warehouse
1	1		G-035	GTA 30 Oil Transfer Pump	Power Packs, Pumps & Accessories	Bay G
2	2		G-039	2 Stroke Air Blower	General	Warehouse
1	1		G-040	Ro-Boom Power Pack	Power Packs, Pumps & Accessories	Bay 12
3	3		G-042	Hydraulic Power Pack LPP 36	Power Packs, Pumps & Accessories	Bay 14, Bay 15, Bay 13
1	1		G-043	Hydraulic Power Pack LPP7	Power Packs, Pumps & Accessories	Bay F
1	1		G-044	Spare Control Stand for LPP36	Power Packs, Pumps & Accessories	Bay G
3	3		G-045	Hydraulic Air Blower	General	Bay 14, Bay 13, Bay 15
2	2		G-050	Komara 30K Skimmer	Skimmer	Bay A

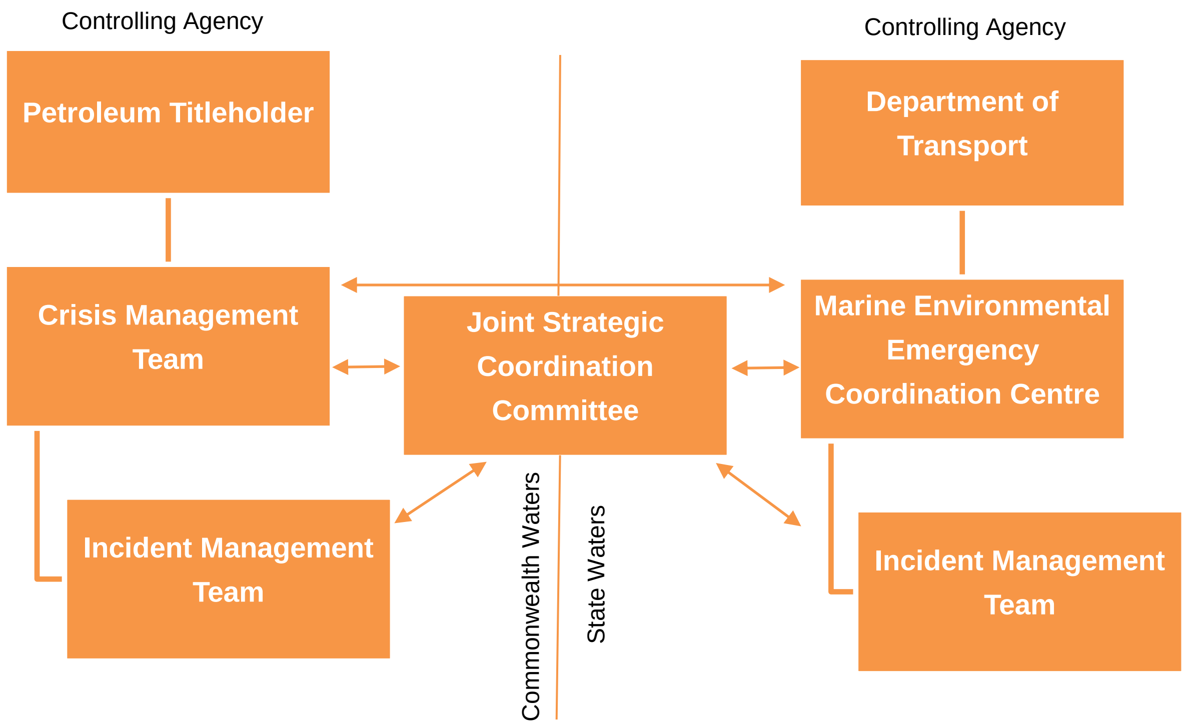
Quantity	Available	Length	Product#	Product Name	Product Category	Bay Location
2	2		G-051	Komara 12K Skimmer	Skimmer	Bay C
1	0		G-052	Minimax Brush Skimmer	Skimmer	
1	1		G-054	Passive Weir Skimmer Kit	Skimmer	Bay B
2	2		G-060	Lamor Rock Cleaner	General	Bay H, Bay I
3	3		G-070	Ro-Vac	Skimmer	Bay B, Bay D, Bay C
1	1		G-079	GT 185 Weir Skimmer	Skimmer	R11T, R11M, R11B, R12B
1	1		G-080	Desmi 250 Weir Skimmer	Skimmer	Bay 16
3	3		G-081	LWS500 Weir Skimmer	Skimmer	Bay 13, Bay 15, Bay 14
2	2		G-082	Ro-Skim Weir Boom System	Skimmer	Bay 16
1	1		G-083	Canadyne Multi Head Skimmer	Skimmer	Bay D
1	1		G-084	Versatech Multi Head Skimmer	Skimmer	R9T, R10T, R14B
8	8		G-090	Hydraulic Powered reel Winder	Boom Accessories	Bay 13, Bay 14, Bay 15
7	7	1400	G-091	Ro-Boom	Boom	Bay 13, Bay 14, Bay 15
1	1	36	G-093	36m Ro-Boom	Boom	Bay 13
51	51	1275	G-110	Beach Guardian Boom	Boom	Bay 10, Bay 2
141	141	3525	G-111	Zoom Boom	Boom	Bay 12, Bay 2
40	40	1200	G-112	450mm Curtain Boom	Boom	Bay 11
1	1		G-113	Current Buster 2	Boom	R7B, R7T
1	1		G-114	Speed Sweep	Boom	Bay 16
3	3		G-120	General Purpose Pump	Power Packs, Pumps & Accessories	Bay D
1	1		G-121	DOP 250 Pump	Power Packs, Pumps & Accessories	Bay F
8	8		G-130	Beach Guardian Deployment Kit	Boom Accessories	Bay 1, Bay H, Bay 2
3	3		G-131	Ro-Boom Anchoring System	Boom Accessories	Bay 15
4	4		G-132	Shoreline Boom Anchoring kit	Boom Accessories	Bay I
22	22		G-133	Zoom Boom Anchor Kit	Boom Accessories	Bay 1, Bay 2, Bay I, Bay J
2	2		G-135	Dual Hull magnet - 1000Kg	Boom Accessories	Hot Work Area
4	4		G-140	Fastank Temporary Storage	Waste Storage	Bay 1, Bay 2, R14M
1	1		G-141	Vikotank 13000 litres	Waste Storage	R14M
2	2		G-142	25000lt Lancer Storage Barge	Waste Storage	Bay E
3	3		G-143	Deck Bladder	Waste Storage	Bay E, Bay F, Bay G
65	65		G-150	Sorbent Boom	Sorbents	East Wall
40	40		G-151	Sorbent Squares	Sorbents	R5T, R5M, R5B

Quantity	Available	Length	Product#	Product Name	Product Category	Bay Location
96	96		G-152	Viscous Oil Snares	Sorbents	R6T, R6M, R6B
11	11		G-153	Sorbent Roll	Sorbents	R5T
31	31		G-154	Spare Rope Mops	Sorbents	R6T, R6M, R6B
1	1		G-160	Rope Mop 240 Oil Skimming Machine	Skimmer	Bay 5
1	1		G-161	Rope Mop 260 Oil Skimming Machine	Skimmer	Bay 7
1	1		G-162	Egmopol Barge	Skimmer	Bay 9
2	2		G-172	2 ton forklift	Vehicle	Warehouse
1	1		G-180	Decon Support Trailer	Trailer	Bay 3
3	3		G-181	General Support Trailer	Trailer	Bay 1, Bay 2, Bay 4
1	1		G-182	Egmopol Trailer	Trailer	Bay 9
1	1		G-183	Aluminium Container	General	R9T, R10T
11	11		G-184	Shipping Container	General	Outside Warehouse, Bay 11, Bay 12, Dispersant Area
13	13		G-185	IBC	Waste Storage	East Wall
4	4		G-188	I SPHERE Satellite Drift Buoys	Communications	R3B, Bay B
5	5		G-189	Spot Gen 3	Communications	Head Office
1	1		G-190	VHF/UHF Base station	Communications	R17T
18	18		G-195	Communications Radio	Communications	Bay 9, Warehouse Office
1	1		G-201	9m Aluminium Catamaran	Vessel	
3	3		G-259	Portable Generator	General	Bay B, Wildlife Container
1	1		G-260	Trailer/Generator/Karcher Pressure Washer Unit	Trailer	Bay 3
1	1		G-261	4in shore line flushing kit	General	Bay K
1	1		G-262	Vehicle Washdown Trailer	Trailer	Bay 3
2	2		G-263	Diesel Pressure Washer	Power Packs, Pumps & Accessories	Bay J
2	2		G-330	Oiled fauna kit	Decontamination	Bay G, Bay F
1	1		G-332	Wildlife washdown container	Wildlife Support	Outside Warehouse
1	1		G-334	3 in Shoreline Flushing Kit	Power Packs, Pumps & Accessories	Bay J
1	1		G-335	Decontamination Kit (First Strike Support)	Decontamination	Bay L
1	1		G-336	Decontamination Kit Locker	Decontamination	Bay L
1	1		G-338	Shoreline Impact Lance Kit	Power Packs, Pumps & Accessories	Bay K
24	24		G-400	Boom Cage	Misc	Bay 12, Bay 11
13	13		G-401	Boom Cage	Misc	Bay 10, Bay 11
1	1		G-500	Response tool box	General	Warehouse Store

Quantity	Available	Length	Product#	Product Name	Product Category	Bay Location
8	8		G-604	Slickgone NS	Dispersant	Bay 0
67	67		G-605	Slickgone NS	Dispersant	Bay 0
62	62		G-606	Corexit 9500	Dispersant	Bay 0
1	1		G-610	Dispersant Agitator	General	Store
2	2		G-700	DJI Spark	General	Head Office
1	1		G-750	Aerial Surveillance Kit	General	Head Office
1	1		G-760	Dispersant Effectiveness Field Test Kit	Dispersant	Head Office
1	1		G-770	Shoreline Surveillance Kit	Misc	Head Office
6	6		G-808	Gas Alert Monitor (Microclip)	General	Head Office
1	1		G-809	Air Quality Monitoring System	Misc	Bay B
1	1		G-889	Oil sampling kit	General	Outside warehouse
3	3		G-950	AMOSC Vehicle	Vehicle	Bay 6, Head Office
1	1		G-960	CF Moto u550	Vehicle	Bay 8

Appendix C – WA DoT IMT Coordination

Control and Coordination IMT Structure with WA DoT



Note: DoT IMT contains an appropriate number of appropriately qualified persons from the Petroleum Titleholder in hey areas commensurate with their level of introduced risk.

Appendix H

ALARP ASSESSMENT FOR SPILL RESPONSE STRATEGIES

Table 1: RS1 Source Control Response Strategy risk assessment including evaluation of effectiveness of controls, environmental benefit gained compared with practicability and ALARP summary

Risk Assessment				ALARP Assessment												Performance Standard
						Implementation Time		Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity (Volume of Oil Treated)	Units	(Days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	
Eliminate	Negative environmental impact from the execution of this response strategy.	No source control.	Do nothing option.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No environment benefit would be gained from this option. Halting the release of hydrocarbons and spill clean-up activities are essential.	The do nothing option is not considered acceptable.	**Reject:** Source control is a recognised strategy for the mitigation of oil spill impacts.	-
Engineer	Uncontrolled release through the SID.	Prefabricated pressure retaining cap onboard LWI Vessel for duration of activity.	To halt release of oil by installation of pressure retaining cap.	Large (all)	1	6 hours	Minor	H	H	H	H	H	Halt of release of crude to the subsea environment.	Controls has high effectiveness and will be maintained on the LWI vessel as part of reponse kit.	**Accept:** Control, is practicable and cost anticipated to be minor. Source control a primary tactic for control.	**PS RS1.8 and PS RS1.10**
Administrate	Ad hoc response with no plan for source control immediately following surface release.	Dependent on nature and scale of spill, spill response executed in accordance activity-specific OPEP *(Crosby-3H1 LWI OPEP (PYHSE-ER-0006)* or vessels' MARPOL-compliant SOPEP.	Control is based on legislative requirements – OPGGS (Environment) Regulations and MARPOL Annex I (Prevention of Pollution by Oil).	Medium	1	0-2 hours	Minor	H	H	H	H	H	Implements response plan to quickly and efficiently deal with unplanned hydrocarbon spills in order to reduce impacts to the marine environment.	Controls have high effectiveness; are available, functional and reliable and in general are serviceable and compatible with other control measures. Controls have minor cost implications for the operation.	**Accept:** Controls based on legislative requirements must be accepted. Controls are practicable and the cost sacrifice is not disproportionate to the environmental benefit gained.	**PS RS1.5 and PS RS1.10**
	Ad hoc response with no plan for source control immediately following subsea release.	Subsea intervention and spill response executed in accordance with LWI vessel operating procedures and safety case.	LWI vessel activities designed specifically for intervention and well control contingencies.	Large	1	0-2 hours	Minor	H	H	H	H	H	Implements response plan to quickly and efficiently deal with unplanned hydrocarbon spills in order to reduce impacts to the marine environment.	Controls have high effectiveness; are available, specific to the task, reliable, serviceable and compatible with other control measures. Controls have minor cost implications for the operation.	**Accept:** Controls are practicable and the cost is covered under the primary contract and is proportionate to the environmental benefit gained. Source Control is accepted as the best option for any subsea release.	**PS RS1.8 and PS RS1.10**

Risk Assessment				ALARP Assessment												Performance Standard
Function	Risk	Control Measure	Rationale	Response Capacity (Volume of Oil Treated)	Units	Implementation Time (Days)	Cost	Effectiveness (High / Low) Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	
	Response activities not considered in preparedness planning therefore not allowing for input into the NEBA.	Operational NEBA to include evaluation of requirement for implementation of source control.	Source control activated and supported by Operational NEBA to provide a net environmental benefit to prevent environmental impacts to sensitive environmental receptors.	N/A	N/A	0-2 hours	Minor	H	H	H	H	H	Positive environmental benefit from identification of the most effective response strategies with the least detrimental impacts. The Operational NEBA will be completed based on specific circumstances of the spill incident, using real-time information (spill trajectory modelling, spill observations, weather and sea state conditions etc.) to confirm the appropriate response strategies to adopt for protection of priority locations and sensitive receptors. Shoreline protection will be activated if the Operational NEBA indicates a benefit would be gained in protecting any shoreline sensitivities that may come into contact with the released diesel.	Strategic NEBA is included in the OPEP and the Operational NEBA must be undertaken to gain understanding of net environmental benefit of implementation of response strategies.	**Accept**: Controls are practicable and the cost is covered under the primary contract and is proportionate to the environmental benefit gained. Source Control is accepted as the best option for any subsea release.	**PS RS1.1**
	Source control equipment not operational or poorly maintained.	Spill clean-up equipment tested, maintained and available on the LWI vessel.	Control is based on legislative requirements – OPGGS (Environment) Regulations and MARPOL Annex I (Prevention of Pollution by Oil).	N/A	N/A	0-2 hours	Minor	H	H	H	H	H	Implements response plan to quickly and efficiently deal with unplanned hydrocarbon spills in order to reduce impacts to the marine environment.			**PS RS1.6 and PS RS1.9**
	Subsea intervention control equipment not operational or poorly maintained.	Subsea intervention equipment tested, maintained and available on the LWI vessel.	Control is based on standard equipment suite maintained on LWI vessel.	N/A	1	Immediate	Minor	H	H	H	H	H	Implements response plan to quickly and efficiently deal with unplanned hydrocarbon spills in order to reduce impacts to the marine environment.			**PS RS1.8 and PS RS1.9**

Risk Assessment				ALARP Assessment												Performance Standard
Function	Risk	Control Measure	Rationale	Response Capacity (Volume of Oil Treated)	Units	Implementation Time (Days)	Cost	Effectiveness (High / Low): Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	
	No arrangements in place to access source control personnel in the event of a spill.	Contract/ MoUs for sources control personnel arrangements in place prior to activity.	Prompt deployment of personnel in the event of a spill.	N/A	1	0-2 hours	Minor	H	H	H	H	H	Implements response source control personnel to quickly and efficiently deal with unplanned hydrocarbon spills in order to reduce impacts to the marine environment.			**PS RS1.4**
	Deck leaks enter the environment via drainage channels.	Scupper plugs or equivalent deck drainage control measures available on vessel where hazardous chemicals and hydrocarbons stored and frequently handled.	Control is based on legislative requirements – MARPOL Annex I (Prevention of Pollution by Oil).	N/A	N/A	0-2 hours	Minor	H	H	H	H	H	Implements response plan to quickly and efficiently deal with unplanned hydrocarbon spills in order to reduce impacts to the marine environment.			**PS RS1.7**
	Predictive spill trajectory unknown when undertaking Operational NEBA.	Modelling predictions of spill trajectory to be undertaken to support the Operational NEBA.	Used as tool to gain situational awareness through real-time spill trajectory modelling to enable evaluation of which sensitive receptors require priority protection.	N/A	N/A	0-2 hours	Minor	H	H	H	H	H	Positive environmental benefit gained as oil spill trajectory modelling will assist in the effectiveness of response strategies and will enable real-time evaluation of which sensitive receptors require priority protection.			**PS RS1.2**
	Response continues with no end point or is removed early.	Response strategy activities continued until termination criteria met.	Ensures that the source control – vessel control response strategy continues until the performance outcome has been achieved.	N/A	N/A	Immediately and on-going	Minor	H	H	H	H	H	Positive environmental benefit gained from ensuring that the source control – vessel control response strategy continues until the performance outcome has been achieved.			**PS RS1.3**
Scalable Options																
Administrate	Slow response times for vessels to reach area and provide source control.	Dedicated support vessel on standby at Pyrenees Facility or Dampier Supply Base with offshore boom equipment to surround casualty.	On standby 24/7 during operations to expedite initiation of booming containment operations.	Small	1	0-1	Major $35K/day x 14 days = $500K	H	H	H	H	H	Positive environment benefit gained by having dedicated boom deploying vessels on standby to immediately surround casualty and contain the spatial extent of any spilled diesel.	Dedicated standby vessels and has substantial costs, in the order of ~$500K for standby vessels that would be incurred for the duration of the operation.	**Reject**: This control has high costs that are disproportionate to any environmental benefit that might be gained. This takes into consideration additional fuel required for having vessels on standby at site, additional	-

Risk Assessment				ALARP Assessment												Performance Standard
Function	Risk	Control Measure	Rationale	Response Capacity (Volume of Oil Treated)	Units	Implementation Time	Cost	Effectiveness (High / Low)					Environmental Benefit Gained	Practicability	ALARP Summary	
						(Days)		Availability	Functionality	Reliability	Survivability	Independence / Compatibility				
															collision risk, and interference with other sea users, when weighed against the containment potential of the booming operations that is unlikely to be successful in offshore conditions, the environment benefit is deemed to be negligible.	

Table 2: RS2 Monitor and Evaluate Response Strategy risk assessment including evaluation of effectiveness of controls, environmental benefit gained compared with practicability and ALARP summary

Risk Assessment				ALARP Assessment												Performance Standard
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (Days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	
Eliminate	Negative environmental impact from the execution of this response strategy.	No situational awareness.	Do nothing option	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No environment benefit would be gained from this option. Developing a monitoring and evaluate response strategy is a necessary contingency to have in place prior to and during operations and cannot be eliminated. Monitoring and evaluation is integral to the management and verification of spill response strategies for all spill scenarios.	The do nothing option is not considered acceptable.	**Reject:** The monitor and evaluate strategy is a mandatory response strategy to have in place and cannot be eliminated.	-
Administrate	Response strategy executed adhoc with no real planning.	Monitor and evaluate operations to be reviewed and managed by IMT through Incident Action Plan (IAP) process.	Within the first 24 hours, BHP IMT will enact the first trike plan in conjunction with development of an IAP.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit from identification of the most effective monitor and evaluate response activities to track the spill trajectory and to feed into real-time decision-making for further strategies for responding to and managing spill event. The review/evaluation of monitor and evaluate options will be implemented immediately for all levels of spills.	Controls have High effectiveness; are available, functional and reliable and in general are serviceable and compatible with other control measures. Controls have minor cost implications for the operation.	**Accept**: Controls are practicable and the cost sacrifice is not disproportionate to the environmental benefit gained.	**PS RS2.1**
	Spill trajectory not known in early stages of the response.	Spill fate modelling initiated within 2 hours of incident notification to support Operational NEBA.	Used as tool to gain situational awareness through real-time spill trajectory modelling to enable evaluation of which sensitive receptors require priority protection.	N/A	N/A	0-2 hours	Minor	H	H	H	H	H	Positive environmental benefit gained as oil spill trajectory modelling will enable real-time evaluation of which sensitive receptors require priority protection.			**PS RS2.2**

Risk Assessment				ALARP Assessment												Performance Standard
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (Days)	Cost	Effectiveness (High / Low): Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	
	Response activities not considered in preparedness planning therefore not allowing for input into the NEBA.	Operational NEBA to include evaluation of requirement for various monitoring and evaluation activities to be employed i.e. aerial/vessel surveillance; autonomous underwater vehicles; oil spill tracker buoys (OSTBs); and satellite imagery.	Various techniques for tracking, monitoring and evaluating the spill. The methods employed will be dependent on the volume of the spill, sea state/ weather conditions and health/safety considerations.	N/A	N/A	0-2 hours	Minor	H	H	H	H	H	Positive environmental benefit from identification of the most effective monitor and evaluate response strategy to track the spill dependent on sea state and weather conditions, spill volume and health/safety considerations. The Operational NEBA will be completed based on specific circumstances of the spill incident, using real-time information (spill trajectory modelling, spill observations, weather and sea state conditions etc.) to confirm the appropriate response strategies to adopt for protection of priority locations and sensitive receptors. Information received from the various monitor and evaluate activities implemented will be crucial in decision-making for the activation of other response strategies. For example, if the spill is heading off shore, then the requirement for chemical dispersants would be evaluated. Other considerations include the time of year of the spill to take account of environmental sensitivities i.e. peak turtle nesting season; coral spawning events; whale and whale shark migration; and seabird nesting periods.			**PS RS2.3, PS RS2.9 and PS RS2.12**
Current Capability																
Administrate	Aerial surveillance resources not available.	Contract in place with CHC helicopters and backup by Babcock helicopters.	BHP contract in place for the provision of aerial surveillance mobilising from Karratha (or alternatively from Barrow Island) in the event of a hydrocarbon spill.	N/A	2	0-2 hours	Minor	H	H	H	H	H	Positive environmental benefit gained from having aircraft/ vessels already on contract or readily obtained through MOU's for spill surveillance activities. Dependent on the size of the spill, vessel/ aerial surveillance would be initiated immediately.	The response capacity is small but the effectiveness is generally High (vessel operations are only possible during daylight hours). The cost of using all available BHP marine vessels, those available through Mutual Aid and on the local spot-charter market in Exmouth / Dampier / Broome has minor cost implications. Cost during activation would be moderate.	Accept: Controls are practicable and the cost sacrifice is not grossly disproportionate to the environmental benefit gained.	**PS RS2.4**

Risk Assessment				ALARP Assessment												
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (Days)	Cost	Effectiveness (High / Low): Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	Performance Standard
	Marine based resources (vessels) not available to respond when required.	Access to support vessels (BHP, mutual aid, local charter).	BHP Marine Fleet (Contracted OSV), Mutual aid MOU's (Santos / Woodside) and vessels of opportunity available on the local spot charter market in Exmouth, Onslow an Dampier. Vessels already on contract or readily obtained through MOU's, no additional standby cost.	N/A	1-4	0-1 days	Moderate	H	H	H	H	H				
	Spill modelling resources not available.	Contract in place with AMOSC who maintains call-off contract with RPS-APASA* to provide spill modelling in the event of a hydrocarbon spill.	Real-time monitoring and evaluation of the spill is a mandatory primary response strategy implemented for Level 1 – 3 spills required for real-time decision-making during a spill event. BHP has agreements and contracts in place to expedite implementation of monitor and evaluate activities.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit gained from implementation of this control measure. Oil spill trajectory modelling will be conducted to predict the extent of impacts to offshore habitat, for any physical disturbance that may impact shoreline, nearshore areas, or areas protected for the purpose of conservation. The IMT will engage RPS-APASA* via a call-off contract maintained by AMOSC to start modelling the spill, and correlate it with real data received from aerial surveillance, OSTB and/ or seagliders.	Control has High effectiveness; it is available, functional and reliable and in general it is reliable and compatible with other control measures. Control has minor cost implications for operations.		**PS RS2.5**
	Spill modelling not available within the needed timeframe and to the expected standard.	Ensure spill modelling capability meets and exceeds the industry standards for oil spill modelling..											From these sources, RPS-APASA will develop an oil spill trajectory model for the next 5 days, which will allow the IMT to direct resources for the next phase of the response. Alternative oil spill modelling agencies may be selected dependent on operational requirements.	Control has High effectiveness; it is available, functional and reliable and in general it is reliable and compatible with other control measures. Control has minor cost implications for operations.		**PS RS2.5,**
	Tracker buoys not immediately available for deployment.	OSTB's located on LWI vessel deployed within 2 hours of spill incident.	BHP has access to OSTB's located on the LWI vessel.	N/A	4	Immediate deployment from LWI vessel.	Moderate	H	H	H	H	H	Positive environment benefit by having vessels already on contract or and mobilised from Pyrenees Facility.	The response capacity is small for vessel operations but the control effectiveness is generally High (vessel operations are only possible during daylight hours). The cost of using all available BHP marine vessels is minor. Cost during		**PS RS2.6**

Risk Assessment				ALARP Assessment												
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (Days)	Cost	Effectiveness (High / Low) Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	Performance Standard
														activation would be moderate.		
	Real time monitoring arrangements not in place as part of response preparedness.	BHP has agreement in place with OSRL/ third party for the provision of satellite imagery.	Real-time monitoring and evaluation of the spill is a mandatory primary response strategy implemented for Level 1 – 3 spills required for real-time decision-making during a spill event. BHP has agreements in place to expedite acquisition of satellite imagery in the event of a spill.	N/A	N/A	< 24 hours for acquisition of first satellite image.	H	H	H	H	H	H	Positive environmental benefit by having access to monitor and evaluate resources obtained via contractual arrangements and service agreements with OSRL and other third party vendors ensures activation of response strategy activities are expedited in the event of a spill.	The response capacity is minor but the control effectiveness is generally High The cost of having agreements/contracts in place is minor. Cost during activation would be moderate.		**PS RS2.6**
	Real time monitoring arrangements not in place as part of response preparedness.	Service agreement in place with third party preferred vendor for monitoring of subsea hydrocarbons (via seagliders) during operations.	BHP has a service agreement in place with a third party preferred vendor for the provision of subsea surveillance (via seagliders).	N/A	N/A	7	H	H	H	H	H	H	Monitoring of subsea hydrocarbons serves as a potential trigger for environmental monitoring (refer to RS10: Environmental Monitoring): ·- Seabirds and migratory shorebirds; ·- Marine mammals and megafauna (inc. whale sharks); ·- Benthic habitats and primary producers; ·- Marine reptiles; ·- Commercial and recreational fisheries; and ·- Fish monitoring.	Response Strategy current for Pyrenees Operations OPEP and apply to the Crosby activity. Contracts already in place.		**PS RS2.4** and **PS RS2.8**
	Response Strategy ceases early or continues with negative environmental impact.	Response strategy activities continued until termination criteria met.	Ensures that the response strategy continues until the performance outcome has been achieved.										Positive environmental benefit gained from ensuring that the monitor and evaluate response strategy continues until the performance outcome has been achieved.			**PS RS2.11**
	Aerial surveillance resources not available.	Aerial observers from Pyrenees Facility.	BHP employees and contractors on roster at Pyrenees Facility.	N/A	4	<4 hours	Minor	H	H	H	H	H	Positive environment benefit by having vessels already on contract or and mobilised from Pyrenees Facility.	The response capacity is small but the control effectiveness is generally High. The cost of using all available BHP employees is minor.		**PS RS2.10**

Risk Assessment				ALARP Assessment												
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (Days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	Performance Standard
Scalable																
Administrate	Marine based resources (vessels) not available to respond when required.	Support vessels (Australia, SE Asia).	Acquisition of charter vessels on the spot-market from around Australia and/or SE Asia.	Medium	As required	3-8	Minor	H	H	H	H	H	Positive environmental benefit by implementation of this control measure. The ongoing charter of more support vessels will continue on an 'as required' basis during the spill response.	The response capacity is small for vessel operations but the control effectiveness is generally High (vessel operations are only possible during daylight hours) and the cost of using marine vessels available as required through the spot-charter market around Australia and SE Asia has minor cost implications. Cost during activation would be moderate.	**Accept**: Controls are practicable and the cost sacrifice is not grossly disproportionate to the environmental benefit gained.	**PS RS2.4**
	Tracker buoys not immediately available for deployment.	Access to additional OSTB's in Exmouth and Geelong through AMOSC.	BHP has agreements in place to expedite resourcing additional OSTB's through AMOSC in the event of a spill.	N/A	2	< 2 hours (Exmouth);< 48 hours (Geelong)	Moderate	H	H	H	H	H	Positive environment benefit gained from implementation of this control measure BHP has agreements in place to expedite resourcing additional OSTB's through AMOSC in the event of a spill.	The response capacity is small but the control effectiveness is generally High. The cost of using resources/ equipment already under contract to BHP is minor.		**PS RS2.4** and **PS RS2.8**
	Aerial surveillance resources not available.	Access to aerial surveillance and trained observers from AMOSC Core Group or OSRL.	BHP has agreements in place to expedite resourcing additional aerial surveillance and trained observers in the event of a spill.	N/A	100	24-48 hours	Moderate	H	H	H	H	H	Positive environment benefit gained from implementation of this control measure BHP has agreements in place to expedite resourcing additional aerial surveillance and trained observers in the event of a spill.	Control is altready in place for existing OPEPS (specifically Pyrenees Operations EP and OPEP)		**PS RS2.4**
	Aerial surveillance resources not available.	Access to aerial surveillance and trained observers via mutual aid.	BHP has mutual aid MoU's in place to expedite resourcing additional aerial surveillance and trained observers in the event of a spill.	N/A	50	24-48 hours	Moderate	H	H	H	H	H	Positive environment benefit gained from implementation of this control measure BHP has mutual aid MoU's in place to expedite resourcing additional aerial surveillance and trained observers in the event of a spill.	Control is altready in place for existing OPEPs (specifically Pyrenees Operations EP and OPEP).		**PS RS2.4**
	Marine based resources (vessels) not available to respond when required.	Dedicated OSR vessel on standby at Pyrenees Facility.	On standby 24/7 during operations to expedite initiation of vessel dispersant application.	N/A	1	0-1	Moderate $35K/day x 14 days = ~$500K	H	H	L	H	H	Positive environment benefit gained by having dedicated aircraft/ vessels on standby to immediately monitor the spill.	Dedicated standby vessels and aircraft have substantial costs, that do not provide a measurable	**Reject**: This control has high costs that are disproportionate to any environmental	-

Risk Assessment				ALARP Assessment												Performance Standard
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (Days)	Cost	Effectiveness (High / Low)					Environmental Benefit Gained	Practicability	ALARP Summary	
								Availability	Functionality	Reliability	Survivability	Independence / Compatibility				
	Marine based resources (vessels) not available to respond when required.	Dedicated OSR vessel on standby at Exmouth, Naval Base.	On standby 24/7 during operations to expedite initiation of vessel surveillance. Requests for offshore vessel support can be made by AMSA.	N/A	1	0-1	Moderate $35K/day x 14 days = ~$500K	H	H	L	L	H		advantage over utilising assets already in the field during the short term 14-day activity.	benefit that might be gained. This takes into consideration additional fuel required for having vessels on standby at site, additional collision risk, and interference with other sea users.	-
	Marine based resources (vessels) not available to respond when required.	Dedicated OSR vessel on standby at Dampier Supply Base.	On standby 24/7 during operations to expedite initiation of vessel surveillance. Requests for offshore vessel support can be made by AMSA.	N/A	1	0-1	Moderate $35K/day x 14 days = ~$500K	H	H	L	L	H				-

Table 3: RS3 Dispersants Strategy risk assessment including evaluation of effectiveness of controls, environmental benefit gained compared with practicability and ALARP summary

Risk Assessment				ALARP Assessment												Performance Standard
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (Days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Analysis	Practicability Analysis	ALARP Summary	
Eliminate	Negative environmental impact from the execution of this response strategy	No dispersant application.	Do nothing option.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No environment benefit would be gained from this option; modelling with dispersant application shows that volumes of oil ashore are reduced when dispersants are used. Dispersants work by breaking oil slicks into small droplets (i.e. the surface area to volume ratio of the oil is increased) that then disperse into the water column below entrained thresholds of concern for marine fauna and other sensitive receptors. This reduces the effect of oil from being driven by wind towards shore and promotes oil biodegradation of the oil in the water column, hence enabling prevention of contact with sensitive environmental receptors.	There may be occasions when dispersants are not applied during an oil spill response such as, for example, the presence of migratory EPBC listed species occurring within the dispersant application zone, but in general, the 'do nothing' option is not considered within the external context (e.g. stakeholder views) to be a viable option.	**Reject:** The use of dispersants is a recognised strategy for the mitigation of oil spill impacts.	-
Substitute	Environmental impact from dispersant use	Only dispersants with the highest environmental profiles will be used to treat an oil spill.	Reduce environmental effects by only selecting dispersants with the best environmental profile.	N/A	N/A	N/A	Minor	L	L	L	H	H	The objective of chemical dispersant application is to increase the surface area of the released oil by making the oil droplets smaller thereby increasing the potential for bacterial biodegradation to breakdown the hydrocarbons faster. In addition, dispersant application is intended to reduce concentrations of oil to below thresholds of concern faster than with natural weathering alone.	Dispersant efficacy relates to the dispersant type and oil characteristics that are treated. Not all dispersants have equal efficacy. Using dispersants with only the highest environmental profiles does not guarantee best performance or a net environmental benefit. Those dispersants that have been tested have been chosen for the efficacy, their approval for use based on their environmental profile in Australian waters and availability for immediate use.	**Reject**: The control is not practicable and it is possible that no environmental benefit may be gained.	-

Risk Assessment				ALARP Assessment												Performance Standard
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (Days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Analysis	Practicability Analysis	ALARP Summary	
Engineer	Single mass use of dispersant regardless of time in water.	Partially weathered oil could be treated more effectively by applying dispersant in two stages.	The first application would be at low dosage rate (Dispersant to Oil Ratio, DOR, 1:50) to break the surface slick and reduce the viscosity. This would be followed by a second application at normal dose rates (DOR 1:20) to disperse the oil itself. To effectively achieve this course of action, aerial dispersant capability available to BHP has a control system onboard aircraft that allows an efficient change of DOR via pilot controls.	N/A	N/A	N/A	Minor	H	L	L	H	H	The objective of chemical dispersant application is to increase the surface area of the released oil by making the oil droplets smaller thereby increasing the potential for bacterial biodegradation to breakdown the hydrocarbons faster. In addition, dispersant application is intended to reduce concentrations of oil to below thresholds of concern faster than with natural weathering alone.	The first application would be at a low rate (Dispersant to Oil Ratio DOR 1:50) to break the surface slick and reduce the viscosity. This would be followed by a second application at normal dose rates (DOR 1:20) to disperse the oil itself. To effectively achieve this course of action, aerial dispersant capability available to BHP has a control system on board the aircraft that allows an efficient change of DOR via pilot controls.	<u>Accept</u>: Control is practicable and the cost sacrifice is not grossly disproportionate to the environmental benefit gained. However, operational requirements on the day may determine that this control is not efficient and better environmental outcomes may be gained through application at normal DOR.	<u>PS RS3.10</u>
Separate	Single mass use of dispersant regardless of time in water	Dispersant will be applied to oil that is within the window of opportunity for efficient dispersal and directed at the thickest portion of the spill (leading edge).	The window of opportunity for the application of dispersant is nominally 48 hours. To be effective, film thickness of oil must be >10 µm.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit gained by only applying to oil that is amenable to chemical dispersant, i.e. before the oil has weathered and generally within the first 48 hours after a loss of containment and by targeting the worst portion of the slick (i.e. thickest portion). In the event of a spill, the IMT will be informed by real-time spill surveillance activities and spill trajectory modelling to enable IMT to direct dispersant spray crew to target worst portions (leading edge and thickest portions) of the spill maximising the effectiveness of dispersant. Dispersant application to weathered oil and oil with film thickness is less than 10 µm will be avoided as not deemed to be effective use of dispersant in the case of crude oil.	Controls have high effectiveness; are available, functional and reliable and in general are survivable and compatible with other control measures. Controls have minor cost implications for the operation.	<u>Accept</u>: Controls are practicable and the cost sacrifice is not disproportionate to the environmental benefit gained.	<u>PS RS3.10</u>
	Dispersant use in sensitive shallow water habitats	Dispersant application restricted to water depths exceeding 50 m.	Limit application of dispersant on sensitive shallow water habitats, e.g. not within Exmouth Gulf.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environment benefit gained by not applying dispersant in areas with a water depth of less than 50 m, thereby reducing the likelihood of impacts from dispersant and dispersed oil (through the application of dispersant) on sensitive shallow water habitats and receptors such as coral reefs, seagrasses, macroalgal beds and marine fauna such as fishes and cetaceans, by maximising the time for dispersal before contact and potentially reducing the			<u>PS RS3.11</u>

Risk Assessment				ALARP Assessment													Performance Standard
								Effectiveness (High / Low)									
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (Days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Analysis	Practicability Analysis	ALARP Summary	
													concentrations of oil to below thresholds of concern.			
	Dispersant use in sensitive shallow water habitats	Dispersant application restricted to a Dispersant Application Zone with a 50 km radius around the Pyrenees Facility but not intercepting the Ningaloo Marine Park boundary.	Apply dispersants only on oil amenable to chemical dispersants within a defined area but that excludes sensitive areas such as the NMP or shallow water habitats around islands or within Exmouth Gulf.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environment benefit gained by not applying dispersant inside the boundary of the Ningaloo Marine Park thereby reducing potential impacts to sensitive receptors such as coral reefs, seagrasses, macroalgal beds and marine fauna such as fishes and cetaceans.			**PS RS3.11**
	Dispersant use when EPBC Act listed migratory are in the area	Operational control to prevent impacts on EPBC Act Listed migratory species.	If EPBC Act Listed migratory species such as humpback whales or whale sharks are observed in the immediate vicinity of dispersant operations as determined from situational awareness reports from the 'monitor and evaluate' response strategy and/or from the platforms applying dispersant, dispersant operations would cease until the animal has moved out of the area and has not been sighted for 30 minutes, unless advised otherwise by the DoT OSRC.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environment benefit gained by reducing the potential impacts associated with applying dispersant in areas where EPBC Act Listed migratory species have been observed, as determined from situational awareness reports. Operations would cease until the animal has moved out of the area and has not been sighted for 30 minutes to reduce the potential of interaction with dispersed oil.			**PS RS3.13**

Risk Assessment				ALARP Assessment												Performance Standard
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (Days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Analysis	Practicability Analysis	ALARP Summary	
	Dispersant use during periods of important windows of ecological sensitivity, e.g. coral spawning; turtle nesting season; migratory shorebirds arriving /departing the region and during migrations of EPBC Act Listed species.	Temporal / seasonal windows of ecological sensitivity to be considered in Operational NEBA.	Dispersant application is a key response strategy to facilitate the protection of sensitive shorelines and adjacent shallow water habitats particularly those occurring within the NMP. However, dispersant application during periods of important windows of ecological sensitivity, e.g. coral spawning; turtle nesting season; migratory shorebirds arriving /departing the region and during migrations of EPBC Act Listed species such as whales and whale sharks (as described in Section 4); will be a key component of the Operational NEBA and will be subject to operational constraints.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environment benefit gained by reducing the potential impacts associated with applying dispersant during windows of important ecological sensitivity, as described in Section 4. For example, dispersants would not be applied in areas with visible coral spawning slicks; during turtle nesting season dispersant may be applied so as to protect 'high value' turtle nesting beaches such as Jurabi; for migratory shorebirds, dispersant operations may be considered more desirable to reduce the risk to oiled wildlife and/or oiling of intertidal foraging habitats; during periods of whale and whale shark migration consideration is required to balance the trade-off between exposure of surface oil compared with dispersed oil on whales and whale sharks. This will be dependent on the location of the surface slick and observations of migratory animals.			**PS RS3.14**
Administrate	Dispersant use without a clear emergency plan or issued IAP's	Dispersant Operations to be reviewed and managed by IMT through Incident Action Plan (IAP) process.	Within the first 24 hours, the BHP IMT will develop IAPs.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit from identification of the most effective response strategies with the least detrimental impacts. The review/evaluation of dispersant operations (subsea and surface dispersant) will take place almost immediately in the event of a Level 3 spill. The dispersant operations would be adapted based on real-time information regarding the spill incident: whether sea state and weather conditions are conducive to dispersant application, dispersant efficacy testing and applicability with other response strategies.	Controls have high effectiveness; are available, functional and reliable and in general are survivable and compatible with other control measures. Controls have minor cost implications for the operation.	**Accept**: Controls are practicable and the cost sacrifice is not disproportionate to the environmental benefit gained.	**PS RS3.1**

Risk Assessment				ALARP Assessment												Performance Standard
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (Days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Analysis	Practicability Analysis	ALARP Summary	
	Response activites not considered in preparedness planning thereforenot allowing for input into the NEBA.	Operational NEBA to include evaluation of requirement for implementation of subsea and surface dispersants.	Surface chemical dispersants will be applied if Operational NEBA indicates the implementation of Dispersants Response Strategy would provide a net environmental benefit to prevent environmental impacts to sensitive environmental receptors.	N/A	N/A	0-2 hours	Minor	H	H	H	H	H	Positive environmental benefit from identification of the most effective response strategies with the least detrimental impacts. The Operational NEBA will be completed based on specific circumstances of the spill incident, using real-time information (spill trajectory modelling, spill observations, weather and seastate conditions etc.) to confirm the appropriate response strategies to adopt for protection of priority locations and sensitive receptors.Surface and subsea chemical dispersants will be applied if the Operational NEBA indicates the potential harm of dispersed oil and dispersants is less than leaving the oil untreated by dispersants; and if the implementation of the dispersant response strategy would provide a net environmental benefit to prevent/minimise environmental impacts to sensitive shorelines and shoreline receptors.The application of dispersants will also be evaluated based on the time of year of the spill. For example, should the spill occur during peak turtle nesting season (species-dependent, but generally occurs between September and March) or seabird nesting (peak October to January), consideration of implementing the dispersant response strategy in combination with other response strategies to maximise the reduction of surface oil and minimise the volume of oil reaching sensitive shorelines. Likewise, should the spill occur during peak coral spawning events (March-April), then the implementation of alternative response strategies other than dispersant application would be more likely, in order to minimise the concentration of dispersed oil (and dispersants) in the water column.			**PS RS3.2** and **PS RS3.5**
	Poor situational awareness and understanding of oil spill trajectory prior to dispersant application (i.e. oil could be heading out to sea).	Oil spill modelling contract in place to provide predictions of dispersed crude oil trajectory to be undertaken to support the Operational NEBA and activated within 2 hours of notification.	Used as tool to gain situational awareness through real-time spill trajectory modelling to enable evaluation of which sensitive receptors require priority protection.	N/A	N/A	0-2 hours	Minor	H	H	H	H	H	Positive environmental benefit gained as dispersant may not necessarily be applied to released oil that is heading offshore and away from sensitive receptors. Likewise dispersant will not be applied to oil in sensitive areas such as the Ningaloo and Muiron Islands Marine Park or their boundaries, or shallow water habitats around islands or within the Exmouth Gulf. Oil spill trajectory modelling will assist in the effective use of dispersant by directing dispersant to target areas, and will also enable real-time evaluation of which			**PS RS3.4** and **PS RS3.6**

Risk Assessment				ALARP Assessment												Performance Standard
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (Days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Analysis	Practicability Analysis	ALARP Summary	
													sensitive receptors require priority protection.			
	Poor undersatanding of the effectiveness of the dispersant application and its impact on the environment.	Environmental monitoring (refer to Section 9.3.8).	Environmental monitoring to evaluate the concentration of entrained hydrocarbons; the effectiveness of applied dispersant; and the impact of hydrocarbons and dispersant on marine and shoreline habitats.	N/A	N/A	Immediately and on-going	Minor	H	H	H	H	H	Positive environmental benefit gained from adopting this control measure. Allows evaluation of the effectiveness of applied dispersant which feeds into on-going decision-making in relation to dispersant application (i.e. altering volumes of dispersant/ continue/ halt dispersant application).			PS RS3.15
	Poor undersatanding of the effectiveness of the dispersant application and its impact on the environment.	Dispersant efficacy testing of chemical dispersant/s.	Dispersant quick effectiveness test (efficacy testing including test spray) to confirm the use and viability of the dispersant available on site prior to application.	N/A	N/A	0-1	Minor	H	H	H	H	H	Positive environmental benefit gained from implementation of this control measure. Enables justification that dispersant stocks are viable and useful in dispersing hydrocarbons released in Level 3 spill and will provide an indication that there will be a net environmental benefit of using dispersant.			PS RS3.12
	Poor 'hit rate' when spraying dispersant from aircraft.	Implementation of air attack supervision as part of dispersant application.	Spotter aircraft will be deployed to inform the dispersant spray crew when they are on target.	N/A	N/A	0-1	Minor	H	H	H	H	H	Positive environmental benefit gained from implementation of this control measure. Directs dispersant spray crew to target areas, avoiding sensitive areas (such as the Ningaloo and Muiron Islands Marine Park, within the Exmouth Gulf and shallow water habitats around islands), and allows real-time evaluation of the effectiveness of applied dispersant which feeds into on-going decision-making in relation to dispersant application. Also assists in real-time evaluation of which sensitive receptors require priority protection.			PS RS3.7
	Poor undersatanding of the effectiveness of the dispersant application and its impact on the environment	Chemical dispersant/s confirmed to be acceptable for use in the marine environment.	Only dispersants approved under the Australian Government National Plan arrangements on the OSCA Register or transitional list or otherwise approved through BHP chemical selection procedure.	N/A	N/A	N/A	Minor	H	N/A	H	H	H	Positive environmental benefit gained from the implementation of this control measure. The dispersants used will be approved under the Australian Government National Plan arrangements as listed on the Oil Spill Control Agents (OSCA) register or the transitional list or otherwise approved through BHP chemical selection procedure. Dispersant stocks held by BHP, AMOSC and the National Plan are listed on the OSCA Register and are therefore considered to have met the standard for acceptable practice for use within the National Plan.			PS RS3.9

Risk Assessment				ALARP Assessment												
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (Days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Analysis	Practicability Analysis	ALARP Summary	Performance Standard
	Dispersant use in impacting state waters without permission.	Permission for dispersant application in or around State waters will be obtained prior to application.	In State waters, chemical dispersant must not be applied without consent from appropriate HMA (DoT).	N/A	N/A	N/A	Minor	H	H	H	H	H	Control is a request from WA Department of Transport (DoT).			PS RS3.3
	Dispersant use volumes unknown.	Volumes of dispersants applied will be recorded.	All dispersant will be logged and reported to Incident Commander.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit gained by determination of the correct dosage of chemical dispersant prior to application and through the continual monitoring and adjustment of the dosage during application. Adopting this control measure will aid in reducing the potential impact of dispersant on sensitive receptors through the controlled and 'measured' application of dispersant.			PS RS3.16
	Dispersant use ceases early or continues with negative environmental impact.	Response strategy activities continued until termination criteria met.	Ensures that the dispersant application response strategy continues until the performance outcome has been achieved.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit gained from ensuring that the dispersant application response strategy continues until the performance outcome has been achieved.			PS RS3.17
Current Capability																
Administrate	Insufficient access to dispersant.	Access to dispersant stockpiles owned by BHP / AMOSC (in Exmouth, Fremantle, Dampier and Geelong) and equipment through Mutual Aid MOU.	Mobilisation of AMOSC owned dispersant stockpile and equipment through Mutual Aid MOU from Exmouth / Fremantle / Geelong, and BHP stock from Dampier.	Large	238 m^3	0-1	Minor	H	H	H	H	H	Positive environmental benefit gained from implementation of this control measure. The objective of dispersant application is to increase the surface area of the released oil by making the oil droplets smaller thereby increasing the potential for bacterial biodegradation to breakdown the hydrocarbons faster. In addition, dispersant application is intended to reduce concentrations of oil to below thresholds of concern faster than with natural weathering alone.	The response capacity is large and the control effectiveness is generally high (cf. potential for weather downtime). BHP has access to this capability through contractual arrangements with AMOSC / OSRL. Control has minor cost implications for the operation.	Accept: Controls are practicable and the cost sacrifice is not grossly disproportionate to the environmental benefit gained.	PS RS3.7
	Insufficient access to dispersant.	Access to Global Dispersant Stockpile via OSRL.	Mobilisation of OSRL dispersant stockpile from Singapore and other countries.	Large	5000 m^3	< 24 hours to mobilise; onsite > 7 days	Minor	L (due to time to mobilise)	H	H	H	H				PS RS3.7
	Insufficient resources available to assist in the application of dispersant (vessels, aircraft)	Access to support vessels (BHP, mutual aid, local charter).	BHP Marine Fleet, Mutual aid MOU's (Santos/ Woodside) and vessels of opportunity available on the local spot charter market in Exmouth. Vessels already on contract or readily obtained through	Small	3-4	0-1	Moderate	H	H	H	H	L	The environmental benefit associated with vessel and aerial dispersant is considered to be significant.	The response capacity is small for vessel operations but the control effectiveness is generally high (vessel operations are only possible during daylight hours, and SIMOPS in the same area with aerial operations is not	Accept: Controls are practicable and the cost sacrifice is not grossly disproportionate to the environmental benefit gained.	PS RS3.7

Risk Assessment				ALARP Assessment												Performance Standard
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (Days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Analysis	Practicability Analysis	ALARP Summary	
			MoU's, no additional standby cost.											possible) and the cost of using all available BHP marine vessels, those available through Mutual Aid and on the local spot-charter market in Exmouth / Dampier / Broome has minor cost implications. Cost during activation would be moderate.		
		Access to Fixed Wing Aerial Dispersant Contract (FWADC) includes provision of ground crew and air attack supervisors.	Activation of FWADC through AMOSC/AMSA. BHP is a participant member of AMOSC and therefore has access to this capability.	Large	1-2	0-1	Moderate	H	H	H	H	L		BHP is a full member of AMOSC and this service is available through AMOSC membership and can be called on if required.		PS RS3.7
		Access to OSRL Hercules C130.	Mobilisation of OSRL aircraft from overseas.	Large	1	5	Moderate	L (due to time to mobilise)	H	H	H	L		BHP is a full member of OSRL and this service is available through OSRL membership and can be called on if required.		
Scalable Options																
Administrate	Insufficient resources available to assist in the application of dispersant (vessels, aircraft)	Support vessels (Australia, SE Asia).	Acquisition of charter vessels on the spot-market from around Australia and/or SE Asia.	Medium	As required	3-8	Minor	H	H	H	H	H	The environmental benefit associated with vessel and aerial dispersant is considered to be significant.	The response capacity is small for vessel operations but the control effectiveness is generally high (vessel operations are only possible during daylight hours, and SIMOPS in the same area with aerial operations is not possible) and the cost of using marine vessels available as required through the spot-charter market around Australia and SE Asia has minor cost implications. Cost during activation would be high.	**Accept**: Controls are practicable and the cost sacrifice is not grossly disproportionate to the environmental benefit gained.	PS RS3.7

Risk Assessment				ALARP Assessment												Performance Standard
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (Days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Analysis	Practicability Analysis	ALARP Summary	
		Fixed Wing Aerial Dispersant Contract (FWADC).	Activation of all air tractors available under the FWADC through AMOSC/AMSA. BHP is a participant member of AMOSC and therefore has access to this capability.	Large	6	1-4	Major	H	H	H	H	H	Scalable options for vessel and aerial dispersant operations involves accessing more vessels from around the regions, and all air tractors (AT802) and ground support staff available through the FWADC,.	The response capacity is large aerial operations and the control effectiveness is generally high (cf. less potential for weather downtime), but aerial operations are only possible during daylight hours, and SIMOPS in the same area with vessel operations is not possible). BHP is has access to this capability through contractual arrangements with AMOSC. Cost during activation would be moderate to high.		**PS RS3.7**
		Other Hercules C130 / Boeing equivalent aircraft.	Acquisition of charter aircraft.	Large	1	15-20	Major	H	H	H	H	H	Scalable options for aircraft include other Hercules C130 or equivalent aircraft such as the Boeing 727 available in the region.	BHP is has access to this capability through contractual arrangements with OSRL. Cost during activation would be moderate to high.		**PS RS3.7**
	Insufficient access to dispersant.	Obtain and locate additional dispersant stockpiles that could be applied while the oil is most amenable to dispersant application.	As at May 2020, the dispersant stockpile at Exmouth is 75 m^3 and managed as part of the AMOSC stockpile.	Small	>75 m^3	0-1	Moderate $10K / m^3	H	H	H	H	H	75 m^3 dispersant locally available in Exmouth will allow speed in implementing response strategy. Additional dispersant if required exists in stockpile in Fremantle and Geelong.	As at May 2020, the dispersant stockpile at Exmouth is 75 m^3 and managed as part of the AMOSC stockpile. Logistics supply chain indicates that sufficient volumes can be delivered to the location to meet application needs. On notification of a Level 3 spill, the Incident Commander would authorise the manufacture of Just-in-Time Dispersant within 24 hours of notification of the spill and arrange logistics of its transportation to site.		**PS RS3.7**

Risk Assessment				ALARP Assessment												
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (Days)	Cost	Effectiveness (High / Low): Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Analysis	Practicability Analysis	ALARP Summary	Performance Standard
	Insufficient resources available to assist in the application of dispersant (vessels, aircraft)	Dedicated OSV vessel on standby at Pyrenees Facility.	On standby 24/7 during operations to expedite initiation of vessel dispersant application.	Small	1	0-1	Major $35K/day x 14 days = >$500Kr	H	H	L	H	L no SIMOPS with aerial applic'n	The environmental benefit associated with vessels on standby for dispersant application is considered to be substantial and unnecessary given the LWI vessel has capability for immediate subsea dispersant application.	Dedicated standby vessels and aircraft has substantial costs, that would be incurred for the duration of the activity.	**Reject**: These controls have high costs that are disproportionate to the potential environmental benefit that might be gained particularly taking into consideration the small increment of added dispersant volume (application that would be added to the logistics of a first strike response considering the short response time for mobilisation to site of the AT802 air tractors from the WA base near Perth, i.e. <12 hours. An AT802 has a capacity of $3m^3$. If an additional 4 sorties were conducted on day 1 (due to having the aircraft on site) this would result in an additional $12m^3$ applied, potentially treating $144m^3$ of surface oil	-
		Dedicated OSV vessel on standby at Dampier Supply Base.	On standby 24/7 during operations to expedite initiation of vessel dispersant application.	Small	1	0-1	Major $35K/day x 14 days = >$500K	H	H	L	L	L no SIMOPS with aerial applic'n				-
		Dedicated FWADC air tractor on standby at Exmouth.	On standby 24/7 during operations to expedite initiation of aerial dispersant application.	Large	1	0-1	Major $312K/yr includes ground suporpt	H	H	H	H	L no SIMOPS with aerial applic'n		Negative sacrifice versus benefit gained when viewed in context of having the existing service available through AMOSC / AMSA and given the short response time for mobilisation to site of the AT802 air tractors from the WA base in Perth, i.e. < 12 hours, which allows for vessel and aerial dispersant application to commence on Day 1, i.e. within the first 24 hours of a loss of containment.		-
		Dedicated Hercules C130 on standby at Exmouth.	On standby 24/7 during operations to expedite initiation of aerial dispersant application.	Large	1	0-1	Major	H	H	H	H	L				-

Table 4: RS4 Marine Recovery Response Strategy risk assessment including evaluation of effectiveness of controls, environmental benefit gained compared with practicability and ALARP summary

Risk Assessment				ALARP Assessment												Performance Standard
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (Days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	
Eliminate	Negative environmental impact from the execution of this response strategy.	No marine recovery.	Do nothing option.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No environment benefit would be gained from this option; experience from past oil spills suggests that volumes of oil ashore are reduced when marine recovery operations are activated. Removing oil from the surface will assist in effort to reduce the volume of oil making shoreline contact, hence enabling prevention of contact with sensitive environmental receptors.	There may be occasions when marine recovery is not implemented, e.g. during poor weather, or when operations are temporarily ceased such as, for example, due to the presence of migratory EPBC Act Listed species occurring within the area of operations, but in general, the 'do nothing' option is not considered within the external context (e.g. stakeholder views) to be a viable option.	Reject: Marine recovery using booms and skimmers is a recognised strategy for the mitigation of oil spill impacts.	-
Separate	Response executed use when EPBC Act listed migratory are in the area.	Operational control to prevent impacts on EPBC Act Listed migratory species and sites of cultural heritage.	If EPBC Act Listed migratory species such as humpback whales or whale sharks are observed in the immediate vicinity of marine recovery operations as determined from situational awareness reports from the 'monitor and evaluate' response strategy and/ or from the vessel platforms, marine recovery operations would cease until the animal has moved out of the area and has not been sighted for 30 minutes.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environment benefit gained by reducing the potential impacts, e.g. entrapment, entanglement, associated with implementing marine recovery operations in areas where EPBC Act Listed migratory species have been observed, as determined from situational awareness reports. Operations would cease until the animal has moved out of the area and has not been sighted for 30 minutes to reduce the potential of interaction with booms.	Controls have high effectiveness; are available, functional and reliable and in general are survivable and compatible with other control measures. Controls have minor cost implications for operations.	Accept: Controls are practicable and the cost sacrifice is not disproportionate to the environmental benefit gained.	PS RS4.4 and PS RS4.10

Risk Assessment				ALARP Assessment													Performance Standard
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (Days)	Cost	Effectiveness (High / Low)					Environmental Benefit Gained	Practicability	ALARP Summary		
								Availability	Functionality	Reliability	Survivability	Independence / Compatibility					
	Response use during periods of important windows of ecological sensitivity, e.g. coral spawning; turtle nesting season; migratory shorebirds arriving /departing the region and during migrations of EPBC Act Listed species.	Temporal / seasonal windows of ecological sensitivity to be considered in Operational NEBA.	Marine recovery is a key response strategy to facilitate the protection of sensitive shorelines and adjacent shallow water habitats particularly those occurring within the NMP. However, marine recovery during periods of important windows of ecological sensitivity, e.g. coral spawning; turtle nesting season; and during migrations of EPBC Act Listed species such as whales and whale sharks (as described in Section 4; will be a key component of the Operational NEBA and will be subject to operational constraints.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environment benefit gained by reducing the potential impacts associated with marine recovery operations during windows of important ecological sensitivity, as described in Section 4. For example, boom containment and recovery operations would not be applied in areas with visible coral spawning slicks.				**PS RS4.11**
Administrate	Response strategy executed adhoc with no real planning process.	Marine recovery operations reviewed and managed by IMT through Incident Action Plan (IAP) process.	Within the first 24 hours, the BHP IMT will develop IAPs.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit from identification of the most effective response strategies with the least detrimental impacts. The review/ evaluation of marine recovery operations will take place almost immediately in the event of a Level 3 spill. The marine recovery operations would be adapted	Controls have high effectiveness; are available, functional and reliable and in general are survivable and compatible with other control measures. Controls have minor cost implications for operations.	**Accept**: Controls are practicable and the cost sacrifice is not disproportionate to the environmental benefit gained.		**PS RS4.1, PS RS4.3, PS RS4.8 and PS RS4.9**

Risk Assessment				ALARP Assessment												Performance Standard
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (Days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	
													based on real-time information regarding the spill incident: determine if sea state and weather conditions are conducive to operations and applicability with other response strategies.			
	Response activites not considered in preparedness planning thereforenot allowing for input into the NEBA.	Operational NEBA to include evaluation of requirement for implementation of marine recovery operations.	The marine recovery response strategy will be activated if Operational NEBA indicates the implementation would provide a net environmental benefit to prevent environmental impacts to sensitive environmental receptors.	N/A	N/A	0-2 hours	Minor	H	H	H	H	H	Positive environmental benefit from identification of the most effective response strategies with the least detrimental impacts. The Operational NEBA will be completed based on specific circumstances of the spill incident, using real-time information (spill trajectory modelling, spill observations, weather and seastate conditions etc.) to confirm the appropriate response strategies to adopt for protection of priority locations and sensitive receptors. Marine recovery will be activated if the Operational NEBA indicates the potential harm of implementation is less than leaving the oil untreated on the surface; and if the implementation of the marine recovery response strategy would provide a net environmental benefit to			**PS RS4.2**

Risk Assessment				ALARP Assessment												Performance Standard
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (Days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	
													prevent/minimise environmental impacts to sensitive shorelines and shoreline receptors.			
	Poor situational awareness and understanding of oil spill trajectory prior to response execution (i.e. oil could be heading out to sea).	Modelling predictions of oil trajectory to be undertaken to support the Operational NEBA.	Used as tool to gain situational awareness through real-time spill trajectory modelling to enable direction of daily marine recovery operations.	N/A	N/A	0-2 hours	Minor	H	H	H	H	H	Positive environmental benefit gained as oil spill trajectory modelling will assist in the effective deployment of marine recovery vessels to areas where sensitive receptors require priority protection.			**PS RS4.2** and **PS RS4.9**
	Oil recovered not recorded to allow for effectiveness analysis and NEBA inputs.	Volumes of oil recovered will be recorded.	All recovered oil will be logged and reported to Incident Commander.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit gained by understanding the efficiency of marine recovery operations. Positive environmental benefit gained by implementation of Waste Management Plan.			**PS RS4.5**
	Weather impacting the response operations increasing safety and operational risk.	Marine recovery boom will not be deployed during periods of weather and sea state conditions that are not appropriate for successful marine recovery operations.	Safety considerations for marine crew and reduces potential for inefficient oil spill response operations when weather conditions are not conducive for recovery of oil.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit gained by reducing the potential for inefficient oil spill response operations when weather conditions are not conducive for recovery of oil.			**PS RS4.11**
	Incompetent personnel utilised during response operations.	Trained operators to supervise boom deployment and marine recovery operations.	Use of skilled personnel to supervise Roboom deployment and oil skimming operations will increase	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit gained by using skilled personnel to supervise Roboom deployment and oil skimming operations			**PS RS4.6** and **PS RS 4.8**

Risk Assessment				ALARP Assessment												Performance Standard
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (Days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	
			efficiency of marine recovery efforts.										to increase efficiency of marine recovery efforts, increases the potential that impacts to sensitive receptors will be prevented and reduces the possibility that mistakes are made that magnify the severity of the situation.			
	Response continues with no end point or is removed early.	Response strategy activities continued until termination criteria met.	Ensures that the marine recovery response strategy continues until the performance outcome has been achieved.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit gained from ensuring that the marine recovery response strategy continues until the performance outcome has been achieved.			**PS RS4.12**
Current Capability																
Administrate	Marine recovery resources (equipment) not available to respond when required.	Access to marine recovery equipment, e.g. Roboom, skimmers, power packs, storage containers owned by AMOSC (in Exmouth, Fremantle, Dampier and Geelong).	Mobilisation of AMOSC owned marine recovery equipment from Exmouth / Fremantle / Geelong, and BHP stock from Dampier.	Small	AMOSC	0-1	Minor	H	H	H	H	H	Positive environmental benefit gained from implementation of this control measure. The objective of marine recovery is to contain the oil on the surface and then recover it using skimming equipment. This reduces the volume of oil that has the potential to make shoreline contact and have negative consequences on sensitive shoreline receptors.	The response capacity is small but the control effectiveness is generally high (cf. potential for weather downtime). BHP has access to this capability through contractual arrangements with AMOSC / OSRL. Control has minor cost implications for operations.	<u>Accept</u>: Controls are practicable and the cost sacrifice is not grossly disproportionate to the environmental benefit gained.	**PS RS4.3 and PS RS4.6**
	Marine recovery resources (equipment) not available to respond when required.	Access to marine recovery equipment, e.g. Roboom, skimmers, power packs, storage containers owned by OSRL.	Mobilisation of OSRL marine recovery from Singapore and other countries.	Small	OSRL	< 24 hours to mobilise; onsite > 7 days	Minor	Low (due to time to mobilise)	H	H	H	H				**PS RS4.6**
	Marine resources (Vessels) not available to respond when required.	Access to support vessels (Pyrenees Facility, support vessel, Mutual Aid, local charter).	BHP Marine Fleet (Mermaid Cove), Mutual Aid MOU's (Santos / Woodside) and vessels of opportunity available on the local spot charter	Small	3	0-1	Minor	H	H	H	H	H	The environmental benefit associated with marine recovery is potentially significant, which has the potential to reduce the environmental severity from a	The response capacity is small for vessel operations but the control effectiveness is generally high (vessel operations are only possible during daylight	<u>Accept</u>: Controls are practicable and the cost sacrifice is not grossly disproportionate to the environmental benefit gained.	**PS RS4.7**

Risk Assessment				ALARP Assessment												Performance Standard
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (Days)	Cost	Effectiveness (High / Low): Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	
			market in Exmouth.										Material Risk rating of 5 (serious or extensive impacts <20 years) to a Non-Material Risk rating of 4 (major impacts <5 years).	hours, and SIMOPS in the same area with aerial operations is not possible) and the cost of using all available BHP marine vessels, those available through Mutual Aid and on the local spot-charter market in Exmouth / Dampier / Broome has minor cost implications. Cost during activation would be moderate.		
	Marine resources (Vessels) not available to respond when required.		Vessels already on contract or readily obtained through MoU's, no additional standby cost.													
Scalable Options																
Administrate	Marine resources (vessels) not available to respond when required.	Support vessels (Australia, SE Asia).	Acquisition of more support vessels via charter on the spot-market from around Australia and/or SE Asia.	Medium	As required	3-8	Moderate	H	H	H	H	H	Marine recovery units on standby during event – Scaling up a fleet of vessels/equipment during an event to be on standby during the response would enable increased collection of surface hydrocarbons. These vessels could then be deployed to areas where hydrocarbons are amenable to collection or if high shoreline sensitivities are predicted to be impacted. These vessels may work at a low efficiency rate (< $35m^3$/day). Although the environmental benefit is low compared to the overall spill volume, a higher environmental benefit may be obtained by reducing hydrocarbons impacting shorelines. The environmental	The response capacity is small for vessel operations but the control effectiveness is generally high (vessel operations are only possible during daylight hours, and SIMOPS in the same area with aerial operations is not possible) and the cost of using marine vessels available as required through the spot-charter market around Australia and SE Asia has minor cost implications. The costs of having the vessels and equipment on standby during an event are moderate and acceptable to BHP and therefore this will be implemented during a Level 3 response.	**Accept**: Controls are practicable and the cost sacrifice is not grossly disproportionate to the environmental benefit gained.	**PS RS4.6**

Risk Assessment				ALARP Assessment												Performance Standard
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (Days)	Cost	Effectiveness (High / Low) Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	
													benefit associated with marine recovery is considered to be significant, which has the potential to reduce the environmental severity from a Material Risk rating of 5 (serious or extensive impacts <20 years) to a Non-Material Risk rating of 4 (major impacts <5 years).			
	Marine recovery resources (equipment) not available to respond when required.	Obtain and locate additional marine recovery equipment.	Acquisition of more marine recovery equipment to be on standby during the campaign.	Medium	As required	3-8	Moderate	H	H	H	H	H	Scalable options for marine recovery operations involve accessing more vessels from around Australia and the broader region including SE Asia.	Suitable stockpiles of marine recovery resources (equipment) exist within AMOSC and AMSA inventory.		**PS RS4.6**
	Marine recovery resources (equipment) not available to respond when required.	Dedicated marine recovery vessels with recovery equipment (e.g. Roboom, skimmers, etc.) on standby at Pyrenees Facility or Dampier Supply Base.	On standby 24/7 during operations to expedite initiation of marine recovery operations.	Small	As required	0-1	Major $35K/day x 14 days = > $500Kr	H	H	L	H	H	The environmental benefit associated with a dedicated marine recovery vessels on standby is considered to be significant, which has the potential to reduce the environmental severity from a Material Risk rating of 5 (serious or extensive impacts <20 years) to a Non-Material Risk rating of 4 (major impacts <5 years). Scalable options for marine recovery operations involve having dedicated vessels on standby with marine recovery equipment on board in the unlikely event of a hydrocarbon spill. Having 4 vessels on	Dedicated standby vessels/equipment have substantial costs, during operations.	**Reject**: These controls have high costs that are disproportionate to the potential environmental benefit that might be gained particularly taking into consideration the small increment of oil volume that would be recovered prior to activation of the IMT response, which would occur on a time scale of 1-3 days.	-

Risk Assessment				ALARP Assessment												Performance Standard
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (Days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	
													standby in Exmouth and J-boom/skimmers located at site for the initial response may enable an extra 2 days of marine operations (if conditions were favourable). This would collect additional 100 m^3 oil which is low in terms of the overall oil budget that may reach shore. Improved reliability in open ocean recovery – Expanding the stockpile of the NOFI current buster type of boom would increase operational window for marine recovery activities. Single unit costs in the order of $600K and units could be sourced from the supplier during the spill event. Each unit would increase the daily recovery rate by 50 m^3 which is low in terms of the overall oil budget that may reach shore.			

Risk Assessment				ALARP Assessment												Performance Standard
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (Days)	Cost	Effectiveness (High / Low)					Environmental Benefit Gained	Practicability	ALARP Summary	
								Availability	Functionality	Reliability	Survivability	Independence / Compatibility				
	Insufficent number of trained personnel.	Additional number of trained marine recovery specialists.	Additional number of marine crew trained in the use of the equipment prior to mobilisation.	Small	As required	0-1	Moderate, includes standby crew	H	H	L	H	H	Training of marine crews in the use of the equipment can be done prior to mobilisation to the field in half a day with a small complement of AMOSC or OSRL specialists. This could be included in the mobilisation schedule given the likelihood of weather downtime in the use of this oil response strategy.	Providing training prior to the event, surplus to the existing trained AMOSC core group etc, has limited benefit as the training on site/on the job would not significantly impact (<4 hrs) the timeframe to operation of marine recovery. Controls have disproportionate cost/effort relative to environmental benefit gain.	**Reject**: These controls have costs/ effort sacrifice that are disproportionate to the potential environmental benefit that might be gained particularly taking into consideration the short timeframe for training (<4 hrs).	-

Table 5: RS5 Shoreline Protection Response Strategy risk assessment including evaluation of effectiveness of controls, environmental benefit gained compared with practicability and ALARP summary

Risk Assessment				ALARP Assessment												Performance Standard
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	
Eliminate	Negative environmental impact from the execution of this response strategy.	No shoreline response.	Do nothing option.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No environment benefit would be gained from this option; experience from past oil spills suggests that environmental sensitivities can be protected effectively when shoreline protection operations are activated.	There may be occasions when shoreline protection is not implemented, e.g. during poor weather, or when operations are temporarily ceased such as, for example, due to the presence of migratory EPBC listed species occurring within the area of operations, but in general, the 'do nothing' option is not considered within the external context (e.g. stakeholder views) to be a viable option.	<u>Reject</u>: Shoreline protection using booms is a recognised strategy for the mitigation of oil spill impacts.	-
Separate	Response executed when EPBC Act listed migratory are in the area.	Operational control to prevent impacts on EPBC Act Listed migratory species.	If EPBC Act Listed migratory species such as humpback whales or whale sharks are observed in the immediate vicinity of shoreline protection operations as determined from situational awareness reports from the 'monitor and evaluate' response strategy and/or from the vessel platforms, shoreline protection operations would cease until the animal has moved out of the area and has not been sighted for 30 minutes.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environment benefit gained by reducing the potential impacts, e.g. entrapment, entanglement, associated with implementing shoreline protection operations in areas where EPBC Act Listed threatened/migratory species have been observed, as determined from situational awareness reports. Operations would cease until the animal has moved out of the area and has not been sighted for 30 minutes to reduce the potential of interaction with booms.	Controls have high effectiveness; are available, functional and reliable and in general are survivable and compatible with other control measures. Controls have minor cost implications for operations.	<u>Accept</u>: Controls are practicable and the cost sacrifice is not disproportionate to the environmental benefit gained.	<u>PS RS5.12</u>

Risk Assessment				ALARP Assessment													
								Effectiveness (High / Low)									
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	Performance Standard
	Response use during periods of important windows of ecological sensitivity, e.g. coral spawning; turtle nesting season; migratory shorebirds arriving /departing the region and during migrations of EPBC Act Listed species.	Temporal / seasonal windows of ecological sensitivity to be considered in Operational NEBA.	Shoreline protection is a key response strategy to facilitate the protection of sensitive shorelines and adjacent shallow water habitats particularly those occurring within the NMP. However, shoreline protection during periods of important windows of ecological sensitivity, e.g. coral spawning; turtle nesting season; and during migrations of EPBC Act Listed species such as whales and whale sharks (as described in Section 4); will be a key component of the Operational NEBA and will be subject to operational constraints.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environment benefit gained by reducing the potential impacts associated with shoreline protection operations during windows of important ecological sensitivity, as described in Section 4. For example, shoreline protection operations would not be applied in areas with visible coral spawning slicks.			**PS RS5.13**
	Response strategy not executed effectively through planning or fast enough to prevent impact highly sensitive areas impacted.	Pre-deployment of shoreline protection boom at identified 'Extreme' and 'High Priority' sensitivities along the Ningaloo Coast during operations.	Pre-deployment of shoreline protection boom at identified 'Extreme' and 'High Priority' sensitivities along the Ningaloo Coast would reduce the time to deployment following the loss of hydrocarbons thereby increasing the potential for protection of environmental sensitivities.	N/A	N/A	N/A	Major; 2 people $1000 / day x 14 days = $28K	H	H	H	Low	H	Positive environment benefit gained by pre-deploying shoreline protection boom such as beach guardian at identified 'Extreme' and 'High Priority' sensitivities along the Ningaloo Coast, and Thevenard and Muiron Islands during operations.	This control would have low survivability and major costs associated with standby rates for the field crew to monitor the condition of the boom.	**Reject**: Pre-deployment of shoreline boom has high costs that are disproportionate to the potential environmental benefit that might be gained particularly taking into consideration that sufficient booms are located in Exmouth and mobilisation timeframes are considered to be acceptable for rapid deployment.	-
Administrate	Response strategy not executed effectively through planning or fast enough to prevent impact highly sensitive areas impacted.	Shoreline protection operations to be reviewed and managed by IMT through Incident Action Plan (IAP) process.	Within the first 24 hours, the BHP IMT will develop IAPs.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit from identification of the most effective response strategies with the least detrimental impacts. The review/evaluation of shoreline protection operations will take place almost immediately in the event of a Level 3 spill. The shoreline protection operations would be adapted based on real-	Controls have high effectiveness; are available, functional and reliable and in general are serviceable and compatible with other control measures. Controls have minor cost implications for operations.	**Accept**: Controls are practicable and the cost sacrifice is not disproportionate to the environmental benefit gained.	**PS RS5.1**

Risk Assessment				ALARP Assessment													
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (days)	Cost	Effectiveness (High / Low) Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	Performance Standard
													time information regarding the spill incident: determine if seastate and weather conditions are conducive to operations and applicability with other response strategies.			
	Response activites not considered in preparedness planning thereforenot allowing for input into the NEBA.	Operational NEBA to include evaluation of requirement for implementation of shoreline protection operations.	The shoreline protection response strategy will be activated if Operational NEBA indicates the implementation would provide a net environmental benefit to prevent environmental impacts to sensitive environmental receptors.	N/A	N/A	0-2 hours	Minor	H	H	H	H	H	Positive environmental benefit from identification of the most effective response strategies with the least detrimental impacts. The Operational NEBA will be completed based on specific circumstances of the spill incident, using real-time information (spill trajectory modelling, spill observations, weather and seastate conditions etc.) to confirm the appropriate response strategies to adopt for protection of priority locations and sensitive receptors. Shoreline protection will be activated if the Operational NEBA indicates the potential harm of implementation is less than leaving the oil untreated on the surface; and if the implementation of the response strategy would provide a net environmental benefit to prevent/minimise environmental impacts to sensitive shorelines and shoreline receptors.			**PS RS5.2, PS RS5.3, PS RS5.7 and PS RS5.13**
	Predictive spill trajectory unknown when undertaking NEBA.	Oil spill modelling contract in place to provide predictions of dispersed crude oil trajectory to be undertaken to support the Operational	Used as tool to gain situational awareness through real-time spill trajectory modelling to enable direction of daily shoreline protection operations.	N/A	N/A	0-2 hours	Minor	H	H	H	H	H	Positive environmental benefit gained as oil spill trajectory modelling will assist in the effective deployment of shoreline protection boom to areas where sensitive receptors require priority protection.			**PS RS5.9**

Risk Assessment				ALARP Assessment												
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	Performance Standard
		NEBA and activated within 2 hours of notification.														
	Incompetent personnel utilised during response operations.	Trained operators to supervise boom deployment and shoreline protection operations.	Use of skilled personnel to supervise boom deployment and shoreline protection operations will increase efficiency of oil spill protection efforts.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit gained by using skilled personnel to supervise boom deployment and shoreline protection operations to increase efficiency of response efforts, increases the potential that impacts to sensitive receptors will be prevented and reduces the possibility that mistakes are made that magnify the severity of the situation.			PS RS5.10
	Shoreline response delayed due to poor understanding of impact area and specific operational response.	Deployment of boom and any laydown areas will follow pre-designated plans for establishing a works area, as described in North West Cape Sensitivity Mapping (AOHSE-ER-0036), to protect environmental sensitivities and including areas of cultural sensitivity.	Increases the potential that impacts to sensitive receptors will be prevented by avoiding areas with environmental and cultural sensitivity.	N/A	N/A	N/A	Minor	H	H	H	H	H				PS RS5.5
	Vessel selection limits the ability to deploy boom.	Vessels used to deploy boom will be flat-bottomed (where safe and practicable) and no anchoring of vessels or booms will occur on emergent reefs or other fragile / sensitive benthic habitats.	Increases the potential that impacts to sensitive receptors will be prevented by using plant and equipment that is fit-for-purpose.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit gained by using small marine craft that are fit for purpose in working in shallow water and not anchoring on emergent coral reefs or other sensitive benthic habitats.			PS RS5.3 and PS RS5.8
	Response impact (positive or negative) is not known or measured.	Environmental monitoring (refer to Section 9.3.2).	Environmental monitoring to evaluate the concentration of hydrocarbons; the effectiveness of shoreline protection; and the impact of hydrocarbons on marine and shoreline habitats.	N/A	N/A	Immediately and on-going	Minor	H	H	H	H	H	Positive environmental benefit gained from adopting this control measure. Allows evaluation of the effectiveness of shoreline protection techniques.			PS RS5.11
	Response continues with no end point or is removed early.	Response strategy activities continued until termination criteria met.	Ensures that the shoreline response strategy continues until the performance outcome has been achieved.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit gained from ensuring that the shoreline protection response strategy continues until the			PS RS5.14

Risk Assessment				ALARP Assessment												
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	Performance Standard
													performance outcome has been achieved.			
Current Capability																
Administrate	Response resources not available.	Access to shoreline protection equipment, e.g. beach guardian, fence boom, deployment kits, owned by AMOSC (in Exmouth, Fremantle, Dampier and Geelong).	Mobilisation of AMOSC owned shoreline protection equipment from Exmouth / Fremantle / Geelong, and BHP stock from Dampier.	Small	AMOSC	0-1	Minor	H	H	H	H	H	Positive environmental benefit gained from implementation of this control measure. The objective of shoreline protection is to separate the oil from shoreline sensitivities.	The response capacity is small but the control effectiveness is generally high. BHP has access to this capability through contractual arrangements with AMOSC / OSRL. Control has minor cost implications for operations.	**Accept**: Controls are practicable and the cost sacrifice is not grossly disproportionate to the environmental benefit gained.	**PS RS5.6**
	Shoreline response delayed due to poor understanding of impact area and specific operational response.	Shoreline tactical response plans for key sensitivities.	These plans outline the equipment and resources requirements for pre impact and post impact response.	N/A	N/A	0-1	Minor	H	H	H	H	H				**PS RS5.5**
	Response resources not available.	Access to shoreline protection equipment.	Mobilisation of OSRL shoreline protection equipment from Singapore and other countries.	Small	OSRL	< 24 hours to mobilise; onsite > 7 days	Minor	Low (due to time to mobilise)	H	H	H	H	These plans outline the equipment and resources requirements for pre impact and post impact response. Reduces time for response personnel to determine site requirements.	This control has high effectiveness; are available, functional and reliable and in general are survivable and compatible with other control measures. Control has minor cost implications for operations.	**Accept**: Controls are practicable and the cost sacrifice is not grossly disproportionate to the environmental benefit gained.	**PS RS5.3, PS RS5.6 and PS RS5.7**
	Response resources not available.	Access to small support vessels (AMOSC, local charter).	Mobilisation of AMOSC owned small craft from Geelong and / or vessels of opportunity available on the local spot charter market in Exmouth.	Small	4	7	Minor	H	H	H	H	H	The environmental benefit associated with shoreline protection is potentially significant, which has the potential to reduce the environmental severity from a Material Risk rating of 5 (serious or extensive impacts <20 years) to a Non-Material Risk rating of 4 (major impacts <5 years).	The response capacity is small for vessel operations but the control effectiveness is generally high (vessel operations are only possible during daylight hours) and the cost of using marine vessels	**Accept**: Controls are practicable and the cost sacrifice is not grossly disproportionate to the environmental benefit gained.	**PS RS5.3, PS RS5.6 and PS RS5.7**

Risk Assessment				ALARP Assessment													Performance Standard
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (days)	Cost	Effectiveness (High / Low): Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary		
														available through AMOSC and on the local spot-charter market in Exmouth / Dampier / Broome has minor cost implications.			
Scalable Options																	
Administrate	Response resources not available.	Support vessels (Perth / Australia).	Acquisition of more support vessels via charter on the spot-market from Perth and around Australia.	Small	As required	3-8	Moderate	H	H	H	H	H	The environmental benefit associated with shoreline protection is considered to be significant, which has the potential to reduce the environmental severity from a Material Risk rating of 5 (serious or extensive impacts <20 years) to a Non-Material Risk rating of 4 (major impacts <5 years).	The response capacity is small but the control effectiveness is generally high and the cost of acquiring small marine vessels and more equipment as required through the spot-charter market around Australia and SE Asia has minor cost implications. Cost during activation would be moderate.	**Accept**: Controls are practicable and the cost sacrifice is not grossly disproportionate to the environmental benefit gained.		**PS RS5.3, PS RS5.6 and PS RS5.7**
	Response resources not available.	Obtain and location additional marine shoreline protection equipment.	Acquisition of more shoreline protection equipment to be on standby.	Small	As required	< 24 hours to mobilise; onsite > 7 days	Minor	Low (due to time to mobilise)	H	H	H	H	Scalable options involve accessing more vessels and equipment from around Australia and the broader region including SE Asia.	Stockpiles of boom are sufficient to meets the needs of the initial areas at risk and current stockpiles held by AMOSC, AMSA, Mutual Aid and supplemented by OSRL international stocks can be mobilised prior to the need for areas that may be impacted in weeks 3 onwards where SCAT teams			**PS RS5.3, PS RS5.6 and PS RS5.7**

Risk Assessment				ALARP Assessment												Performance Standard
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	
														identify that these locations are amenable to protection.		
	Response resources not available.	Dedicated shoreline protection vessel with boom deployment equipment on standby at Exmouth/ Dampier Supply base.	On standby 24/7 during operations to expedite initiation of shoreline protection operations.	Small	1	0-1	Major $35K/day x 14 days = $500K	H	H	L	H	H	The environmental benefit associated with shoreline protection is considered to be significant, which has the potential to reduce the environmental severity from a Material Risk rating of 5 (serious or extensive impacts <20 years) to a Non-Material Risk rating of 4 (major impacts <5 years).	Dedicated standby vessels have substantial costs, in the order of $500K during operations.	**Reject**: These controls have high costs that are disproportionate to the potential environmental benefit that might be gained particularly taking into consideration the small increment of oil volume that would be recovered prior to activation of the IMT response, which would occur on a time scale of 1-3 days.	-
	Response resources not available	Pre-deployment of shoreline protection boom equipment (such as along the Ningaloo Coast) during operations.	On standby 24/7 during operations to expedite initiation of shoreline protection operations.	Small	1	0-1	Moderate, includes standby crew	H	H	L	L	H	The environmental benefit associated with the pre-deployment of shoreline protection boom along the Ningaloo Coast during operations to reduce the amount of time lost prior to the first contact of hydrocarbons on the shoreline is considered significant. This has the potential to reduce the environmental severity from a Material Risk rating of 5 (serious or extensive impacts <20 years) to a Non-Material Risk rating of 4 (major impacts <5 years).	The response capacity is small but the control effectiveness is moderate as the control would have a low survivability. Cost during activation would be high.	**Reject:** These controls have high costs that are disproportionate to the potential environmental benefit that might be gained. This control would have a low survivability (i.e. boom integrity may decrease with time in the period when no hydrocarbon is in the near-shore zone), and hence no potential increase in any environmental benefit. Sufficient equipment for Yardie Creek and Mangrove Bay are available in Exmouth, which is the closest oil spill	-

Risk Assessment				ALARP Assessment												Performance Standard
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	
															equipment storage location.	
	Response resources not available.	Improved access to equipment deployment location.	Expedite initiation of shoreline protection operations through improved shoreline access.	Small	1	0-1	Moderate, includes standby crew	H	H	L	H	H	The environmental benefit associated with widening access paths to the inlet at Mangrove bay to reduce the time to move equipment to the deployment location, however, this would affect natural vegetation and deemed to increase tourist impacts in areas with little current impact. This has the potential to reduce the environmental severity from a Material Risk rating of 5 (serious or extensive impacts <20 years) to a Non-Material Risk rating of 4 (major impacts <5 years).	The negative environmental benefit did not warrant the inconvenience of using wheelbarrows and using manual labour initially as timeframe for deployment before hydrocarbon arrival would still be met	**Reject:** This control is rejected due to the negative environmental impacts that would occur for a spill incident that has a very low likelihood.	-

Table 6: RS8 Shoreline Clean-up Response Strategy risk assessment including evaluation of effectiveness of controls, environmental benefit gained compared with practicability and ALARP summary

Risk Assessment				ALARP Assessment												
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	Performance Standard
Eliminate	Negative environmental impact from the execution of this response strategy	No shoreline clean-up	Do nothing option	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No environment benefit would be gained from this option; experience from past oil spills suggests that environmental sensitivities can be protected effectively when shoreline clean-up operations are activated.	There may be occasions when shoreline clean-up is not implemented, e.g. during poor weather, but in general, the do nothing option is not considered within the external context (e.g. stakeholder views) to be a viable option.	Reject: Shoreline clean-up is a recognised strategy for the mitigation of oil spill impacts.	-
Separate	Sensitive vegetation impacted by machinery	No machinery to be used in mangroves. No machinery to be used within 20 m of an identified turtle nest.	Separate the potential of impacts due to machinery on sensitive receptors.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit gained by separating the potential of impacts due to machinery on sensitive receptors.	Control has high effectiveness; are available, functional and reliable and in general are serviceable and compatible with other control measures. Control has no cost implications.	**Accept**: Control is practicable and the cost sacrifice is not disproportionate to the environmental benefit gained.	**PS RS8.12**
Administrate	Response strategy executed adhoc with no real planning	Shoreline clean-up operations reviewed and managed by IMT through Incident Action Plan (IAP) process.	Within the first 24 hours, the BHP IMT will develop IAPs.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit from identification of the most effective response strategies with the least detrimental impacts. The review/evaluation of shoreline clean-up operations will take place almost immediately in the event of a Level 3 spill. The shoreline clean-up operations would be adapted based on real-time information regarding the spill incident: determine if seastate and weather conditions are conducive to operations and applicability with other response strategies.	Controls have high effectiveness; are available, functional and reliable and in general are serviceable and compatible with other control measures. Controls have minor cost implications.	**Accept**: Controls are practicable and the cost sacrifice is not disproportionate to the environmental benefit gained.	**PS RS8.1, PS RS 8.2, PS RS8.7 and PS RS8.8**
	Response activites not considered in preparedness planning thereforenot allowing for input into the NEBA.	Operational NEBA to include evaluation of requirement for implementation of shoreline clean-up operations.	The shoreline clean-up response strategy will be activated if Operational NEBA indicates the implementation would provide a net environmental benefit to prevent environmental impacts to	N/A	N/A	0-2 hours	Minor	H	H	H	H	H	Positive environmental benefit from identification of the most effective response strategies with the least detrimental impacts. The Operational NEBA will be completed based on specific			**PS RS8.2**

Risk Assessment				ALARP Assessment												
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (days)	Cost	Effectiveness (High / Low) Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	Performance Standard
			sensitive environmental receptors.										circumstances of the spill incident, using real-time information (spill trajectory modelling, spill observations, weather and seastate conditions etc.) to confirm the appropriate response strategies to adopt for protection of priority locations and sensitive receptors.			
	Poor situational awareness and understanding of oil spill trajectory prior to response execution (i.e. oil could be heading out to sea).	Modelling predictions of oil trajectory to be undertaken to support the Operational NEBA.	Used as tool to gain situational awareness through real-time spill trajectory modelling to enable direction of daily shoreline clean-up operations.	N/A	N/A	0-2 hours	Minor	H	H	H	H	H	Shoreline clean-up will be activated if the Operational NEBA indicates the potential harm of implementation is less than leaving the oil untreated on the shoreline; and if the implementation of the response strategy would provide a net environmental benefit to prevent/minimise environmental impacts to sensitive shorelines and shoreline receptors.			
	Response strategy not executed effectively through planning or fast enough to prevent impact highly sensitive areas impacted	Implement shoreline clean-up response strategy in accordance with optional shoreline protection methods for different coastal types (refer to Table 8-44 to Table 8-45; and North West Cape Sensitivity Mapping (AOHSE-ER-0036).	Increases the potential that impacts to sensitive receptors will be prevented by avoiding areas with environmental sensitivity.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit gained by using established shoreline protection plans to increase efficiency of response efforts, increases the potential that impacts to sensitive receptors will be prevented and reduces the possibility that mistakes are made that magnify the severity of the situation.			PS RS8.3
	Deployment of resources ineffective due to poor understanding of impact area	Conduct observations/ surveys prior to deployment of equipment and personnel to develop a deployment/ operations plan, which includes avoidance of impacts to wildlife, organisation of ground disturbance, protection of sensitive areas, and	Increases the potential that impacts to sensitive receptors will be prevented by avoiding areas with environmental sensitivity.	N/A	N/A	N/A	Minor	H	H	H	H	H	Increases the potential that impacts to sensitive receptors will be prevented by avoiding areas with environmental sensitivity.			PS RS8.3

Risk Assessment				ALARP Assessment													Performance Standard
								Effectiveness (High / Low)									
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary		
		consultation with DBCA and local stakeholders.															
	Regulatory approval not in place prior to execution of shoreline cleanup activities	All necessary regulatory approvals in place prior to implementation of shoreline clean-up activities.	Ensures that shoreline clean-up activities are approved and subject to any conditions required of the State agencies.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit gained by ensuring that shoreline clean-up activities are approved and subject to any conditions required of the State agencies.				**PS RS8.4**
	Poor shoreline cleanup practices with remobilisation of oil in the marine environment	Prevent further surface water contamination by conducting all flushing clean-up activities to a contained area.	Ensures that shoreline accumulated oil is contained and that impacts are not spread across a wider area.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit gained by ensuring that shoreline accumulated oil is contained and that impacts are not spread across a wider area.				**PS RS8.10**
	Poor undersatanding of the effectiveness of shoreline cleanup and its impact on the environment	Implement environmental monitoring to determine the ongoing acceptability of the environmental risk associated with the application of shoreline clean-up methods.	Water, sediment and benthic infauna quality monitoring to evaluate the effectiveness of shoreline clean-up techniques.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit gained by understanding the effectiveness of shoreline clean-up techniques.				**PS RS8.11**
	Shoreline activities impacting areas of cultural significance	Shoreline clean-up operations will avoid cultural heritage sensitivities.	Increases the potential that impacts to sensitive receptors will be prevented by avoiding areas of known cultural significance.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit gained by taking into consideration any advice from State government agencies and spatial information to avoid impacts to sensitive cultural heritage sensitivities.				**PS RS8.5**
	Response continues with no end point or is removed early	Response strategy activities continued until termination criteria met.	Ensures that the shoreline response strategy continues until the performance outcome has been achieved.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit gained from ensuring that the shoreline clean-up response strategy continues until the performance outcome has been achieved.				**PS RS8.13**
Current Capability																	
Administrate	Response resources not available	Access to shoreline clean-up equipment owned by AMOSC (in Exmouth, Fremantle, Dampier and Geelong).	Mobilisation of AMOSC owned shoreline clean-up equipment from Exmouth / Fremantle / Geelong.	Small	AMOSC	0-1	Minor	H	H	H	H	H	Positive environmental benefit gained from implementation of this control measure. The objective of shoreline clean-up is to remove	The response capacity is small but the control effectiveness is generally high. BHP has access to this capability through contractual arrangements	**Accept**: Controls are practicable and the cost sacrifice is not grossly		**PS RS8.9**

Risk Assessment				ALARP Assessment												Performance Standard
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	
	Response resources not available	Access to shoreline clean-up equipment owned by OSRL	Mobilisation of OSRL shoreline clean-up equipment from Singapore and other countries.	Small	OSRL	< 24 hours to mobilise; onsite > 7 days	Minor	Low (due to time to mobilise)	H	H	H	H	the oil from shoreline sensitivities.	with AMOSC / OSRL. Control has minor cost implications.	disproportionate to the environmental benefit gained.	**PS RS8.9**
	Response resources not available	Access to small support vessels (AMOSC, local charter)	Mobilisation of AMOSC owned small craft from Geelong and / or vessels of opportunity available on the local spot charter market in Exmouth.	Small	4	7	Minor	H	H	H	H	H	The environmental benefit associated with shoreline clean-up is potentially significant, which has the potential to reduce the environmental severity from a Material Risk rating of 5 (serious or extensive impacts <20 years) to a Non-Material Risk rating of 4 (major impacts <5 years).	The response capacity is small for vessel operations but the control effectiveness is generally high (vessel operations are only possible during daylight hours) and the cost of using marine vessels available through AMOSC and on the local spot-charter market in Exmouth / Dampier / Broome has minor cost implications.	**Accept**: Controls are practicable and the cost sacrifice is not grossly disproportionate to the environmental benefit gained.	**PS RS8.9**
	Mobilisation of response personnel to impact location delayed	Mobilise First Strike Team to Exmouth within 24 hours following notification by IMT.	Mobilisation of BHP personnel from Perth to provide first-hand situational awareness to the IMT.	Small	BHP	0-1	Minor	H	H	H	H	H	Positive environmental benefit gained from implementation of this control measure. The objective is to provide first-hand situational awareness to the IMT.			**PS RS8.6**
	No arrangement with 3rd Party services leading to insufficient resourcing during response	AMOSC and OSRL contracts and other third party agreements for provision of resources for shoreline clean-up in place during operations.	Mobilisation of AMOSC / OSR: personnel to provide situational awareness and expert advice to the IMT on clean-up protection priorities.	Small	AMOSC / OSRL	0-4	Minor	H	H	H	H	H	Positive environmental benefit gained from mobilisation of AMOSC / OSRL personnel to provide situational awareness and expert advice to the IMT on clean-up protection priorities.			**PS RS8.9**
Scalable Options																
Administrate	Response resources not available	Support vessels (Perth / Australia).	Acquisition of more support vessels via charter on the spot-market from Perth and around Australia.	Small	As required	3	Moderate	H	H	H	H	H	The environmental benefit associated with shoreline protection is considered to be significant, which has the potential to reduce the environmental severity from a Material Risk rating of 5 (serious or extensive impacts <20 years) to a Non-Material Risk rating of 4 (major impacts <5 years).	The response capacity is small but the control effectiveness is generally high and the cost of acquiring small marine vessels and more equipment as required through the spot-charter market around Australia and SE Asia has minor cost implications. Cost during activation would be moderate.	**Accept**: Controls are practicable and the cost sacrifice is not grossly disproportionate to the environmental benefit gained.	**PS RS8.9**

Risk Assessment				ALARP Assessment												Performance Standard
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	
	Response resources not available	Access to more oil spill responders.	Acquisition of more oil spill responders (skilled and unskilled) from AMOSC / OSRL and resource labour companies (e.g. Hays) in Perth and around Australia.	Small	As required		Moderate	H	H	H	H	H	Scalable options involve accessing more vessels, equipment and resources from around Australia and the broader region including SE Asia.			**PS RS8.9**

Table 7: RS10 Environmental Monitoring Response Strategy risk assessment including evaluation of effectiveness of controls, environmental benefit gained compared with practicability and ALARP summary

Risk Assessment				ALARP Assessment												Performance Standard
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	
Eliminate	Negative environmental impact from the execution of this response strategy.	No environmental monitoring.	Do nothing option.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No environment benefit would be gained from this option; environmental data on any oil spill impacts will be required to understand recovery from any disturbance and to inform the effectiveness of the response strategies.	This control is practicable and not implementing it would not be satisfactory from a stakeholder perspective.	**Reject:** Environmental monitoring is a recognised strategy for understanding the effects of an oil spill on environmental sensitivities.	-
Administrate	Response strategy executed adhoc with no real planning leading ineffective response.	Environmental monitoring operations reviewed and managed by IMT through Incident Action Plan (IAP) process.	Within the first 24 hours, the BHP IMT will develop IAPs.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit from identification of the most effective response strategies with the least detrimental impacts. The review/evaluation of shoreline protection operations will take place almost immediately in the event of a Level 3 spill. The shoreline protection operations would be adapted based on real-time information regarding the spill incident: determine if seastate and weather conditions are conducive to operations and applicability with other response strategies.	Controls have high effectiveness; are available, functional and reliable and in general are serviceable and compatible with other control measures. Controls have minor cost implications.	**Accept**: Controls are practicable and the cost sacrifice is not disproportionate to the environmental benefit gained.	**PS RS10.1**

Risk Assessment				ALARP Assessment													
								Effectiveness (High / Low)									
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	Performance Standard
	Response activities not considered in preparedness planning therefore not allowing for input into the NEBA.	Operational NEBA to include evaluation of requirement for implementation of environmental monitoring operations, initiate mobilisation of resources within 24 hours notification by Incident Commander.	The environmental monitoring response strategy will be activated if Operational NEBA indicates the implementation would provide a net environmental benefit in understanding potential environmental impacts to sensitive environmental receptors.	N/A	N/A	0-1	Minor	H	H	H	H	H	Positive environmental benefit from identification of the most effective response strategies with the least detrimental impacts. The Operational NEBA will be completed based on specific circumstances of the spill incident, using real-time information (spill trajectory modelling, spill observations, weather and seastate conditions etc.) to confirm the appropriate response strategies to adopt for protection of priority locations and sensitive receptors. Environmental monitoring will be activated by the Operational NEBA to understand environmental impacts to sensitive receptors.			**PS RS10.2** and **PS RS10.3**
	Poor situational awareness and understanding of oil spill trajectory prior to response execution (i.e. oil could be heading out to sea).	Modelling predictions of oil trajectory to be undertaken to support the Operational NEBA.	Used as tool to gain situational awareness through real-time spill trajectory modelling to enable direction of daily environmental monitoring operations.	N/A	N/A	0-2 hours	Minor	H	H	H	H	H	Positive environmental benefit gained as oil spill trajectory modelling will assist in the effective deployment of environmental monitoring field teams to areas where sensitive receptors require priority protection.			**PS RS10.4**

Risk Assessment				ALARP Assessment												
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (days)	Cost	Effectiveness (High / Low) Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	Performance Standard
	Insufficient number of trained personnel.	Trained personnel to implement environmental monitoring operations.	Use of skilled personnel to implement environmental monitoring operations will increase efficiency of oil spill protection efforts.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit gained by using skilled personnel to implement environmental monitoring guidelines, which will increase efficiency of response efforts, increases the potential that impacts to sensitive receptors will be prevented and reduces the possibility that mistakes are made that magnify the severity of the situation.			**PS RS10.3**
	Poor understanding of the effectiveness of response strategies and their impact on the environment.	Activation of environmental monitoring guidelines will follow pre-designated plans for establishing works areas, as described in North West Cape Sensitivity Mapping (AOHSE-ER-0036), to protect environmental sensitivities.	Increases the potential that impacts to sensitive receptors will be prevented by avoiding areas with environmental sensitivity.	N/A	N/A	N/A	Minor	H	H	H	H	H				**PS RS10.5**
	Vessel selection and use may cause more impact than the benefit.	Vessels used to implement environmental monitoring will be fit-for-purpose and no anchoring of vessels will occur on emergent reefs or other fragile / sensitive benthic habitats [**see Note 1 at end of table**].	Increases the potential that impacts to sensitive receptors will be prevented by using plant and equipment that is fit-for-purpose.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit gained by using small marine craft that are fit for purpose in working in shallow water and not anchoring on emergent coral reefs or other sensitive benthic habitats.			**PS RS10.6**
	Monitoring activities impacting areas of cultural significance.	Environmental monitoring operations will avoid cultural heritage sensitivities.	Increases the potential that impacts to sensitive receptors will be prevented by avoiding areas of known cultural significance.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit gained by taking into consideration any advice from State government agencies and spatial information to avoid impacts to sensitive cultural heritage sensitivities.			**PS RS10.10**
	Response continues with no end point or is removed early.	Response strategy activities continued until termination criteria met.	Ensures that the environmental response strategy continues until the performance outcomes have been achieved.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit gained from ensuring that the environmental response strategy			**PS RS10.11**

Risk Assessment				ALARP Assessment												
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (days)	Cost	Effectiveness (High / Low)					Environmental Benefit Gained	Practicability	ALARP Summary	Performance Standard
								Availability	Functionality	Reliability	Survivability	Independence / Compatibility				
													continues until the performance outcomes have been achieved.			
Current Capability																
Administrate	Insufficient specialised personnel available – resourcing.	Access to first strike environmental monitoring responders for water quality, sediment quality and benthic infauna via 24/7 standby contract with analytical laboratory.	Mobilisation of standby emergency responders to Exmouth from Perth to collect water and sediment samples in the post-spill pre-impact period.	Small	SGS	0-1	Minor	H	H	H	H	H	Positive environmental benefit gained from implementation of this control measure. The objective of environmental monitoring is to collect data to understand the effect of an oil spill on environmental sensitivities.	The response capacity is small but the control effectiveness is generally high. BHP has access to this capability through contractual arrangements with preferred vendors. Control has minor cost implications	**Accept**: Controls are practicable and the cost sacrifice is not grossly disproportionate to the environmental benefit gained.	**PS RS10.7**
	Insufficient specialised personnel available – resourcing.	Access to scientific field sampling personnel.	Mobilisation of scientific field sampling personnel to Exmouth from Perth to collect environmental data (birds, marine mammals, megafauna, benthic habitats and benthic primary producers, marine reptiles, fisheries and fishes) following sampling designs and procedures outlined in the relevant environmental monitoring procedure.	Small	80	7	Minor	H	H	H	H	H				**PS RS10.7**
	Poor sampling techniques and plans leading to inadequate monitoring and poor quality data / results.	Sampling operations for marine water, sediment quality and benthic infauna to follow procedures outlined in AOHSE-ER-0037 to allow determination of any environmental impacts and inform effectiveness of response strategies. Laboratory analyses will follow: US EPA Method 8260 (volatile organic hydrocarbons); and US EPA Method 8015 (total petroleum hydrocarbons).	Standard procedures and methodologies (US EPA) are in place for laboratory analysis.	Small	N/A	N/A	Minor	H	H	H	H	H				**PS RS10.8**

Risk Assessment				ALARP Assessment												Performance Standard
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (days)	Cost	Effectiveness (High / Low)					Environmental Benefit Gained	Practicability	ALARP Summary	
								Availability	Functionality	Reliability	Survivability	Independence / Compatibility				
	Poor sampling techniques and plans leading to inadequate monitoring and poor quality data / results.	Sampling operations for marine mammals and megafauna, avifauna, shallow water benthic habitats, marine reptiles, commercial/ recreational fish species and mobile and site-attached fishes associated with coral reefs, seagrasses, macroalgal beds, deep-water sponge gardens and mangroves will follow procedures outlined in AOHSE-ER-0038, AOHSE-ER-0039, AOHSE-ER-0040, AOHSE-ER-0043, AOHSE-ER-0048 and AOHSE-ER-0051 to allow determination of any environmental impacts and inform effectiveness of response strategies.	Development of oil spill environmental monitoring appropriate to the nature and scale of the environmental risk to determine the extent, severity and duration of impact to relevant environmental receptors.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A				**PS RS10.9**
Scalable Options																
Administrate	Insufficient specialised personnel available – resourcing.	Access to more environmental monitoring responders.	Mobilisation of more scientific field sampling personnel to Exmouth from Perth to collect environmental data (birds, marine mammals, megafauna, benthic habitats and benthic primary producers, marine reptiles, fisheries and fishes) following sampling designs and procedures outlined in the relevant environmental monitoring procedure.	Small	50	14-21	Minor	H	H	H	H	H	Positive environmental benefit gained from implementation of this control measure. The objective of environmental monitoring is to collect data to understand the effect of an oil spill on environmental sensitivities.	The response capacity is small but the control effectiveness is generally high. BHP has access to this capability through contractual arrangements with preferred vendors. Control has minor cost implications.	**Accept**: Control is practicable and the cost sacrifice is not grossly disproportionate to the environmental benefit gained.	**PS RS10.7**
	Insufficient specialised personnel available – resourcing.	Dedicated environmental monitoring crew with sampling equipment on standby at Exmouth.	On standby 24/7 during operations to expedite initiation of environmental monitoring operations.	Small	1	0-1	Minor, >10 people at $1,000 / day by 14 days = from $196K	H	H	Low	H	H	The environmental benefit associated with environmental monitoring is considered to be significant, which has the potential to reduce the environmental severity from a	Dedicated standby field crews have substantial costs, in the order of >$196K that would be incurred for the duration of the operation.	**Reject**: This controls has high costs that are disproportionate to the potential environmental benefit that might be	-

Risk Assessment				ALARP Assessment												
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	Performance Standard
													Material Risk rating of 5 (serious or extensive impacts <20 years) to a Non-Material Risk rating of 4 (major impacts <5 years). Scalable options for marine recovery operations involve having dedicated vessels on standby with marine recovery equipment on board in the unlikely event of loss of hydrocarbons.		gained particularly taking into consideration the availability of first strike responders who are contracted to be on 24/7 standby during the activity and can be onsite with 'next flight' status.	

[1] For the purpose of this control, deploying remote video cameras onto sensitive and fragile habitats will not be considered 'anchoring'.

Table 8: RS11 Oiled Wildlife Response Response Strategy risk assessment including evaluation of effectiveness of controls, environmental benefit gained compared with practicability and ALARP summary

Risk Assessment				ALARP Assessment												
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (days)	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	Performance Standard
Eliminate	Negative environmental impact from the execution of this response strategy	No oiled wildlife response	Do nothing option	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No environment benefit would be gained from this option.	This control is practicable and not implementing it would not be satisfactory from a stakeholder perspective.	Reject: Oiled wildlife response is a recognised strategy for preventing impacts of an oil spill on environmental sensitivities.	-
Administrate	Response strategy executed adhoc with no real planning leading to ineffective response	Oiled wildlife response operations will be reviewed and managed by IMT through Incident Action Plan (IAP) process.	Within the first 24 hours, the BHP IMT will develop IAPs.	N/A	N/A	0-1	Minor	H	H	H	H	H	Positive environmental benefit from identification of the most effective response strategies with the least detrimental impacts. The review/evaluation of oiled wildlife operations will take place almost immediately in the event of a Level 3 spill. The oiled wildlife operations would be adapted based on real-time information (situational awareness / OSTM) regarding the spill incident to inform collection of wildlife.	Controls have high effectiveness; are available, functional and reliable and in general are serviceable and compatible with other control measures. Controls have minor cost implications.	**Accept**: Controls are practicable and the cost sacrifice is not disproportionate to the environmental benefit gained.	**PS RS11.1**
	Response activites not considered in preparedness planning therefore not allowing for input into the NEBA.	Operational NEBA to include evaluation of requirement for implementation of oiled wildlife response.	The oiled wildlife response strategy will be activated if Operational NEBA indicates the implementation would provide a net environmental benefit in preventing impacts to sensitive receptors.	N/A	N/A	0-1	Minor	H	H	H	H	H	Positive environmental benefit from identification of the most effective response strategies with the least detrimental impacts. The Operational NEBA will be completed based on specific circumstances of the spill incident, using real-time information (spill trajectory modelling, spill observations, weather and seastate conditions etc.) to confirm the appropriate response strategies to adopt for protection of priority locations and sensitive receptors. Oiled wildlife response will be activated by the Operational NEBA to prevent impacts to sensitive receptors.			**PS RS11.2**
	Unsuitably qualified personnel	Lead response personnel are trained and experienced for the activities to which they are assigned.	Use of skilled personnel to implement oiled wildlife response will increase efficiency of oil spill protection efforts.	N/A	N/A	5	Minor	H	H	H	H	H	Positive environmental benefit gained by using skilled personnel to implement oiled wildlife response following Industry and WA State Government drafted guidelines, which will increase efficiency of response efforts, increases the potential that impacts to sensitive receptors will be prevented and reduces the possibility that mistakes are made that magnify the severity of the situation.			**PS RS11.3**

Risk Assessment				ALARP Assessment												
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (days)	Cost	Effectiveness (High / Low) Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	Performance Standard
	Response strategy executed adhoc with no real planning leading to ineffective response	Activation and implementation of oiled wildlife response will follow pre-designated plans for establishing works areas, as described in Western Australian Oiled Wildlife Response plan (WAOWRP); and Pilbara Region Oiled Wildlife Response Plan (PROWRP).	Increases the potential that impacts to sensitive receptors will be prevented by avoiding areas with environmental sensitivity.	N/A	N/A	5	Minor	H	H	H	H	H				PS RS11.8
	Response activities impacting areas of cultural significance	Oiled wildlife response operations will avoid cultural heritage sensitivities.	Increases the potential that impacts to sensitive receptors will be prevented by avoiding areas of known cultural significance.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit gained by taking into consideration any advice from State government agencies and spatial information to avoid impacts to sensitive cultural heritage sensitivities.			PS RS11.10
	Response continues with no end point or is removed early.	Response strategy activities continued until termination criteria met.	Ensures that the oiled wildlife response strategy continues until the performance outcome has been achieved.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit gained from ensuring that the oiled wildlife response strategy continues until the performance outcome has been achieved.			PS RS11.9 and PS RS11.11
Current Capability																
Administrate	No access to suitable specialised equipment in reasonable timeframes.	Access to containerised oiled wildlife wash facility (via AMOSC contract) and trained responders, mobilisation within 24 h of notification by Incident Commander, facility ready to take oiled wildlife within 72 hours of reaching site.	Contract with AMOSC for mobilisation to Exmouth and access to resources and equipment.	N/A	N/A	5	Minor	H	H	H	H	H	Positive environmental benefit gained from implementation of this control measure. The objective of oiled wildlife response is to prevent effects of an oil spill on environmental sensitivities.	The response capacity is small but the control effectiveness is generally high. BHP has access to this capability through contractual arrangements with AMOSC. Control has minor cost implications.	Accept: Controls are practicable and the cost sacrifice is not grossly disproportionate to the environmental benefit gained.	RS11.4, RS11.5 and RS11.6
Scalable Options																

Risk Assessment				ALARP Assessment													
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time (days)	Cost	Effectiveness (High / Low)					Environmental Benefit Gained	Practicability	ALARP Summary	Performance Standard
								Availability	Functionality	Reliability	Survivability	Independence / Compatibility				
Administrate	Insufficient specialised personnel available – resourcing.	Access to more oiled wildlife responders.	Mobilise more oiled wildlife responders from around Australia and SE Asia.	N/A	N/A	14-21	Minor	H	H	H	H	H	Positive environmental benefit gained from implementation of this control measure. The objective of oiled wildlife response strategy is to prevent effects of an oil spill on environmental sensitivities.	The response capacity is small but the control effectiveness is generally high. BHP has access to this capability through contractual arrangements with AMOSC. Control has minor cost implications.	**Accept**: Controls are practicable and the cost sacrifice is not grossly disproportionate to the environmental benefit gained.	**PS RS11.3, PS RS11.5 and PS RS11.6**
	No access to suitable specialised equipment in reasonable timeframes.	Pre-deployment of oiled wildlife container on standby at Exmouth during operations.	On standby 24/7 during operations to expedite initiation of environmental monitoring operations.	Small	1	0-1	Moderate	H	H	Low	H	H	The environmental benefit associated with oiled wildlife response strategy is considered to be significant, which has the potential to reduce the environmental severity from a Material Risk rating of 5 (serious or extensive impacts <20 years) to a Non-Material Risk rating of 4 (major impacts <5 years). Scalable options for oiled wildlife response involve a pre-deployment and establishment of the oiled wildlife facility to be on standby, fully functional and capable of receiving oiled wildlife on Day 1 of an incident.	Dedicated standby oiled wildlife crews have substantial cost.	**Reject**: This control has moderate costs that are disproportionate to the potential environmental benefit that might be gained particularly taking into consideration the availability and mobility of the containerised oiled wildlife wash facility operated by AMOSC and available in Perth, i.e. 36 hours by road freight once activated by the BHP IMT.	-

Table 9: RS13 Waste Management Response Strategy Risk assessment including evaluation of effectiveness of controls, environmental benefit gained compared with practicability and ALARP summary

Risk Assessment				ALARP Assessment												Performance Standard
								Effectiveness (High / Low)								
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time	Cost	Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	
Eliminate	Negative environmental impact from the execution of this response strategy.	No waste management	Do nothing option	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No environmental benefit would be gained from this option; experience from past oil spills suggests that environmental sensitivities can be protected effectively when waste management operations are activated.	Waste management is practicable and the do nothing option is not considered within the external context (e.g. stakeholder views) to be a viable option.	**Reject:** Waste management is a recognised strategy for the mitigation of oil spill impacts.	-
Administrate	Response strategy executed adhoc with no real planning leading to ineffective response.	Waste management operations reviewed and managed by IMT through Incident Action Plan (IAP) process.	Within the first 24 hours, the BHP IMT will develop IAPs.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit from identification of the most effective response strategies with the least detrimental impacts. The review/evaluation of waste management operations will take place almost immediately in the event of a Level 3 spill. The waste management operations would be adapted based on real-time information regarding the spill incident.	Controls have effectiveness; are available, functional and reliable and in general are serviceable and compatible with other control measures. Controls have minor cost implications.	**Accept**: Controls are practicable and the cost sacrifice is not disproportionate to the environmental benefit gained.	**PS RS13.1**
	Response activites not considered in preparedness planning therefore not allowing for input into the NEBA.	Operational NEBA to include evaluation of requirement for implementation of waste management operations.	The waste management response strategy will be activated to prevent environmental impacts to sensitive environmental receptors.	N/A	N/A	0-2 hours	Minor	H	H	H	H	H	Positive environmental benefit from identification of the most effective response strategies with the least detrimental impacts. The Operational NEBA will be completed based on specific circumstances of the spill incident, using real-time information (spill trajectory modelling, spill			**PS RS13.2**

Risk Assessment				ALARP Assessment													Performance Standard
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time	Cost	Effectiveness (High / Low): Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary		
													observations, weather and seastate conditions etc.) to confirm the appropriate response strategies to adopt for protection of priority locations and sensitive receptors. Waste management will be activated to prevent/minimise environmental impacts to sensitive shorelines and shoreline receptors.				
	No access to suitable specialised equipment in reasonable timeframes.	Mobilisation of equipment and personnel to conduct waste management response within 24 hours of notification by IMT following outcomes of first IAP and maintained regularly in IAP outcomes.	Timely implementation of waste management plan and contractor.	N/A	N/A	0-2 hours	Minor	H	H	H	H	H	Positive environmental benefit gained from rapid response of waste management plant, equipment and resources from Dampier / Karratha.				**PS RS13.2 and PS RS13.3**
	Recovered waste is not handled or managed effectively or efficiently further impacting the environment.	Crude oil waste retrieved to be managed in accordance with the Waste Management Plan.	Ensures waste management policies and procedures are being followed.	N/A	N/A	0-2 hours	Minor	H	H	H	H	H	Positive environmental benefit gained from rapid response of waste management plant, equipment and resources from Dampier / Karratha.				**PS RS13.5**
	Poor undersatanding of the effectiveness of waste management and its impact on the environment.	Implement environmental monitoring to determine the ongoing acceptability of the environmental risk associated with waste management methods.	Environmental monitoring will be used to determine the effectiveness of waste management controls and techniques for removing waste oil from site.	N/A	N/A	0-2 hours	Minor	H	H	H	H	H	Positive environmental benefit gained from environmental monitoring in understanding the effectiveness of waste management controls and techniques for removing waste oil from site. Outcomes of environmental monitoring will be used to inform				**PS RS13.6**

Risk Assessment				ALARP Assessment												
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time	Cost	Effectiveness (High / Low) Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	Performance Standard
													waste management response strategy through the IAP's.			
	Response activities impacting areas of cultural significance.	Waste management operations will avoid cultural heritage sensitivities.	Increases the potential that impacts to sensitive receptors will be prevented by avoiding areas of known cultural heritage significance.	N/A	N/A	N/A	Minor	H	H	H	H	H	Positive environmental benefit gained by taking into consideration any advice from State government agencies and spatial information to avoid impacts to cultural heritage sensitivities.			**PS RS13.7**
	Response continues with no end point or is removed early.	Response strategy activities continued until termination criteria met.	The waste management response strategy will continue to prevent environmental impacts to sensitive environmental receptors until the performance outcome has been achieved.	N/A	N/A	0-2 hours	Minor	H	H	H	H	H	Positive environmental benefit gained from ensuring that the waste management response strategy continues until the performance outcome has been achieved.			**PS RS13.8**
Current Capability																
Administrate	No access to suitable specialised equipment in reasonable timeframes.	Access to waste management plant and equipment in place during operations.	Enables rapid response of waste management resources from Dampier / Karratha.	Large	Veolia / NWWA	0-1	Moderate	H	H	H	H	H	Positive environmental benefit gained from implementation of this control measure. The objective of waste management is to prevent impacts to sensitive receptors by the removal of oiled waste from site.	Control has High effectiveness; are available, functional and reliable and in general are serviceable and compatible with other control measures. Controls have minor cost implications for operations but moderate to major costs if implemented.	**Accept**: Control is practicable and the cost sacrifice is not grossly disproportionate to the environmental benefit gained.	**PS RS13.4**
Scalable Options																

Risk Assessment				ALARP Assessment													Performance Standard
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time	Cost	Effectiveness (High / Low): Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary		
Administrate	No access to suitable specialised equipment in reasonable timeframes.	Access to more waste management plant and equipment.	Acquisition of more waste management plant and equipment from Perth and around Australia.	Small	As required	10	Moderate	H	H	H	H	H	The environmental benefit associated with waste management is considered to be significant, which has the potential to reduce the environmental severity from a Material Risk rating of 5 (serious or extensive impacts <20 years) to a Non-Material Risk rating of 4 (major impacts <5 years). Scalable options involve accessing more plant and equipment from Perth and if needed around Australia.	This control is effective and the cost of acquiring more plant equipment from Perth and around Australia would potentially have moderate cost implications. Cost during activation would be major.	**Accept**: Controls are practicable and the cost sacrifice is not grossly disproportionate to the environmental benefit gained.		**PS RS13.4**
	Response strategy executed adhoc with no real planning leading to ineffective response.	Pre-position temporary waste storage locations along most likely area for oil to come ashore (Cape Range National Park).	Build temporary waste storage locations along Cape Range National park to enable rapid collection of oil following shoreline contact.	Large	Veolia / NWWA, Transpacific and Toxfree (if required)	Up to 35	Moderate	H	L	L	H	H	The environment benefit gained with temporary storage is once oily waste is collected it allows effective waste management to continue and not hinder recovery operations because the necessary permits/approvals are in place for temporary storage, treatment and disposal of oily waste. The only limitation is logistics such as traffic, waste collection and processing time associated with temporary storage/treatment and final disposal options. However, with spill contact location spanning the	Temporary storage disposal locations will vary depending on the concentrations of contaminates and location ashore. The control has High availability. BHP has equipment/resources in place for project managing the selection, construction and operation temporary storage sites, however, significant resource requirements is required for the following activities to be complete: - Ground truth the information in OSRA from the potential temporary storage layer using Appendix C – Temporary Storage Site Suitability Assessment – and advice from the Local Council/WALGA and DER. - Select most suitable sites. - Obtain site owner approval and necessary licensing requirements and permits. - Construct site with engineer contractor and waste contractor - Select storage options,	**Reject:** Construction of temporary storage area prior to spill event is not a recognised strategy for the mitigation of oil spill impacts. Worst possible volumes ashore and associated waste volumes can be managed with existing infrastructure and arrangements.		-

Risk Assessment				ALARP Assessment												Performance Standard
Function	Risk	Control Measure	Rationale	Response Capacity	Units	Implementation Time	Cost	Effectiveness (High / Low) Availability	Functionality	Reliability	Survivability	Independence / Compatibility	Environmental Benefit Gained	Practicability	ALARP Summary	
													Ningaloo Coast, the selection and construction of a temporary waste storage facility prior to a spill event could preclude the response from making most of more suitable (closer) temporary or existing storage locations, place unnecessary pressure on regional infrastructure/ roads and clean-up logistics from waste recovery to temporary disposal location, and is unable to make most of IAP process and accepted Administrative Control Measure. Cost to build and operate would be Moderate to Major.	implement traffic management, set up waste reception area; - Establish system to track types, quantities and movements of waste into and out of temporary storage site including volumes recovered and type, segregation streams, storage locations, transport and disposal. - Create bunded areas for waste lay down and method to control capacity of the bunds (pumps, valves) - Construct truck transfer designated area (hard stand or bunded area) Implement appropriate decontamination procedures for personnel and equipment before leaving work area The control has low functionality and low reliability; implementation of the control measure does not greatly reduce the risk/impact of oil on shore, and the control has not been tried and tested in Australian waters for another oil and gas project. The control has High survivability and High independence/compatibility; implementation has a High operating timeframe and will not need to be replaced regularly; the control can be implemented in unison with accepted Administrative Control Measures.		