SapuraOMV Upstream (Western Australia) Pty Ltd.

SapuraOMV Kanga-1 Exploration Well Environment Plan

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SapuraOMV Upstream (WA) Pty Ltd
Level 2, 251 St Georges Terrace
Perth, WA 6000
T: +61 8 6118 4990 www.sapura-omv.com
ACN 629 043 518

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2	23/04/2021	GHD Pty Ltd	MC	RB	ZZ	Update following NOPSEMA OMR 22/12/2021

Table of contents

Table index

Figure index

Appendices

Environment Plan Summary

This Kanga-1 Exploration Well Environment Plan (EP) summary has been prepared from material provided in this EP. The summary consists of the following as required by regulation 11(4) of the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS(E)R):

EP Summary Material Requirement	Relevant EP Section
Details of the titleholder's nominated liaison person for the activity	**Section 1.4**
The location of the activity	**Section 3.1.1 and 3.1.2**
A description of the activity	**Section 3**
A description of the receiving environment	**Section 4 and Appendix D**
Consultation already undertaken and plans for ongoing consultation	**Section 5**
Details of the environmental impacts and risks	**Section 7 and 8**
The control measures for the activity	**Section 7 and 8**
The arrangements for ongoing monitoring of the titleholder's environmental performance	**Section 9.4**
Response arrangements in the oil pollution emergency plan	**Refer to OPEPs (Appendix F)**

List of Acronyms

Abbreviation	Description
ABARES	Australian Bureau of Agricultural and Resource Economics
ACN	Australian Company Number
ADMP	Accidental Discharge Management Plan
AFMA	Australian Fisheries Management Authority
AFZ	Australian Fishing Zone
AHO	Australian Hydrographic Office
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
AMOSC	Australian Marine Oil Spill Centre
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
API	American Petroleum Institute
APPEA	Australian Petroleum Production and Exploration Association
ASBTIA	Australian Southern Bluefin Tuna Industry Association
AUV	Autonomous Underwater Vehicle
BIA	Biologically Important Area
BoD	Basis of Design
BoM	Bureau of Meteorology
BOP	Blow-out Preventer
BWMC	Ballast Water Management Certificate
BWMP	Ballast Water Management Plan
BWMS	Ballast Water Management System
CCP	Cyclone Contingency Plan
CFA	Commonwealth Fisheries Association
CH_4	Methane
CHARM	Chemical Hazard and Risk Management
CMID	Common Marine Inspection Document
CMR	Commonwealth Marine Reserve
CO_2	Carbon Dioxide
COLREGS	Convention on the International Regulations for Preventing Collisions at Sea
CSA	Cetacean Sightings Application
DAWE	Department of Agriculture, Water and the Environment
dB	Decibel
DBCA	Department of Biodiversity, Conservation and Attractions
DDR	Daily Drilling Report
DFAT	Department of Foreign Affairs and Trade
DMIRS	Department of Mines, Industry Regulation and Safety
DNP	Director of National Parks

Abbreviation	Description
DNV	Det Norske Veritas
DoT	Department of Transport
DP	Dynamic Positioning
DPaW	Department of Parks and Wildlife (now DBCA)
DPIRD	Department of Primary Industries and Regional Development
ECR	Environmental Commitments Register
EEZ	Exclusive Economic Zone
EMBA	Environment that May be Affected
ENVID	Environmental Impact Identification
EP	Environment Plan
EPR	Environmental Performance Report
EPBC	Environment Protection and Biodiversity Conservation
EPO	Environmental Performance Outcome
EPS	Environmental Performance Standard
ESD	Ecologically Sustainable Development
FDA	Food and Drug Administration
FWADC	Fixed Wing Aerial Dispersant Capability
GHG	Greenhouse Gases
GPS	Global Positioning System
HEZ	High Exposure Zone
HF	High-frequency
HFO	Heavy Fuel Oil
HMCS	Harmonised Mandatory Control Scheme
HQ	Hazard Quotient
Hrs	Hours
HSE	Health, Safety and Environment
HSEMS	Health, Safety and Environmental Management System
IAPP	International Air Pollution Prevention
IFAW	International Fund for Animal Welfare
IFO	Intermediate Fuel Oil
IMCRA	Integrated Marine and Coastal Regionalisation of Australia
IMO	International Maritime Organisation
IMS	Invasive Marine Species
IMT	Incident Management Team
INMARSAT	International Maritime Satellite
IOPP	International Oil Pollution Prevention
ISO	The International Organisation for Standardization
ISPP	International Sewage Pollution Prevention
IUCN	International Union for Conservation of Nature
JRCC	Joint Rescue Coordination Centre
JSA	Job Safety Analysis
KCl	Potassium Chloride

Abbreviation	Description
KEF	Key Ecological Feature
KM	Kilometre
LCM	Lost Circulation Material
LF	Low-frequency
LOWC	Loss of Well Control
LWD	Logging While Drilling
MAH	Monocyclic Aromatic Hydrocarbons
MARPOL	International Convention for the Prevention of Pollution from Ships
MARS	Maritime Arrivals Reporting System
MDO	Marine Diesel Oil
MEE	Marine Environmental Emergencies
MEZ	Moderate Exposure Zone
MF	Mid-frequency
MFO	Marine Fauna Observer
MGO	Marine Gas Oil
MMA	Marine Management Area
MMSI	Maritime Mobile Service Identity
MNES	Matter of National Environmental Significance
MoC	Management of Change
MODU	Mobile Offshore Drilling Unit
MoU	Memorandum of Understanding
MP	Marine Park
NatPlan	National Plan for Environmental Emergencies
NEBA	Net Environmental Benefit Analysis
NEC	No Effect Concentration
nm	Nautical Mile
N_2O	Nitrous Oxide
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOPTA	National Offshore Petroleum Titles Administrator
NO_x	Nitrogen Oxides
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 Substances
OGUK	Oil and Gas United Kingdom
OIM	Offshore Installation Manager
OPEP	Oil Pollution Emergency Plan
OPPGGSA	*Offshore Petroleum and Greenhouse Gas Storage Act 2006*

Abbreviation	Description
OPGGS(E)R	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
OPRC	International Convention on Oil Pollution Preparedness, Response and Co-operation
OPRC-HNS	Protocol on Preparedness, Response and Co-operation to pollution Incidents by Hazardous and Noxious Substances
OSCA	Oil Spill Control Agent
OSMP	Operational Scientific Monitoring Plan
OSMIP	Operational Scientific Monitoring Implementation Plan
OSPAR	Convention for the Protection of the Marine Environment of the North East Atlantic (Oslo Paris Convention)
OVID	Offshore Vessel Inspection Database
OWM	Oil Weathering Model
OWR	Oiled Wildlife Response
OWRP	Oiled Wildlife Response Plan
OWS	Oily Water Separator
P&A	Plug and Abandon
PAH	Polycyclic Aromatic Hydrocarbons
PEC	Predicted Effect Concentration
PHG	Pre-hydrated Gel
PLONOR	Pose Little or No Risk to the Environment
PMS	Planned Maintenance System
PMST	Protected Matters Search Tool
PPA	Pearl Producers Association
ppb	Parts per billion
PSZ	Petroleum Safety Zone
PTS	Permanent Threshold Shift
PTW	Permit to Work
Q3	Quarter 3
Q4	Quarter 4
RMS	Root Mean Square Sound Pressure Level
ROV	Remotely Operated Vehicle
SA	South Australia
SapuraOMV	SapuraOMV Upstream (Western Australia) Pty Ltd
SBM	Synthetic Based Muds
SCE	Solids Control Equipment
SDA	Surface Dispersant Application
SDS	Safety Data Sheet
SEL	Sounds Exposure Level
SMPEP	Shipboard Marine Pollution Emergency Plan
SO_x	Sulphur Oxides
SOLAS	Safety of Life at Sea
SOPEP	Shipboard Oil Pollution Emergency Plan

Abbreviation	Description
SPL	Sound Pressure Level
SPRAT	Species Profile and Threats
SSDI	Subsea Dispersant Application/Injection
SSE	South Southeast
STP	Sewage Treatment Plant
SWMR	South-West Marine Region
t	tonne
TD	Total Depth
TOC	Total Organic Carbon
TSS	Total Suspended Solids
TTS	Temporary Threshold Shift
UK	United Kingdom
UKOOA	United Kingdom Offshore Operators Association
U.S.	United States
VLA	Vertically Loaded Anchor
VOC	Volatile Organic Compounds
VSP	Vertical Seismic Profiling
WA	Western Australia
WAFIC	Western Australian Fishing Industry Council
WAOWRP	Western Australian Oiled Wildlife Response Plan
WBM	Water-based Mud
WCP	Well Containment Plan
WOMP	Well Operations Management Plan
WSW	West South West

1. Introduction

1.1 Activity Overview

SapuraOMV Upstream (Western Australia) Pty Ltd (SapuraOMV) proposes to undertake a single exploration well drilling campaign (Kanga-1 well) in permit area WA-412-P, located in the Dampier sub-basin (Northern Carnarvon Basin). The permit area is wholly within offshore Commonwealth waters, and the operational area is approximately 163 km north northwest of Karratha, Western Australia (WA), in water depths of approximately 147 m (**Figure 1-1**).

The Activity will be deemed complete once the well has been plugged and abandoned (P&A) and the permit area vacated.

This Environment Plan (EP) has been prepared in accordance with the requirements of the Commonwealth Offshore Petroleum and Greenhouse Gas Storage Act 2006 and the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS(E)R), for acceptance by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).

1.2 Purpose

The purpose of this EP is to demonstrate that:

- The environmental impacts and risks (planned and unplanned) associated with the Activity are identified;
- Appropriate management controls are identified and implemented; and
- Environmental impacts and risks will be reduced to as low as reasonably practicable (ALARP) and to an acceptable level.

This EP defines activity-specific environmental performance outcomes, standards and measurement criteria and provides an implementation strategy that will be used to measure and report on environmental performance during planned activities and unplanned events. This EP also documents and considers all relevant stakeholder consultation performed during the planning of the Activity.

1.3 Scope

This EP covers exploration drilling and associated activities that have not been included within a plan previously submitted to, or accepted by, NOPSEMA. The scope of this EP does not cover planned activities outside of the operational area, including transit of the mobile offshore drilling unit (MODU), vessels and helicopters, and therefore these activities are not addressed within this EP. These activities will be undertaken in accordance with other relevant maritime and aviation legislation; notably the Commonwealth *Navigation Act 2012* and *Civil Aviation Act 1988*.

The primary objective of the exploration drilling Activity at Kanga-1 is to explore for oil within the Late Jurassic sandstones. The drilling campaign will be carried out with a semi-submersible MODU with auxiliary activities including support vessels and helicopters.

In accordance with Regulation 19 of the OPGGS(E)R, this EP remains valid from NOPSEMA acceptance for a period of five years or until NOPSEMA has accepted an end-of-activity notification under Regulation 25A of the OPGGS(E)R or SapuraOMV revises this EP.

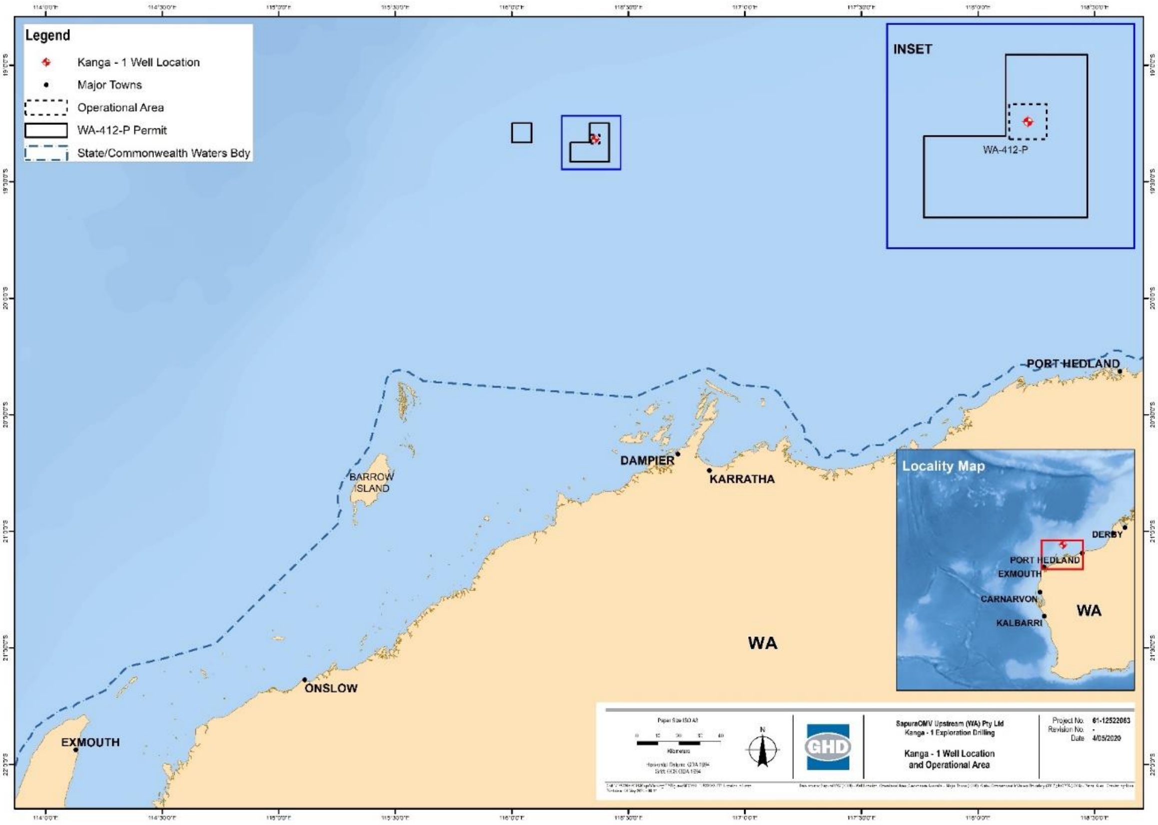


Figure 1-1 Kanga-1 well location and operational area

1.4 Titleholder Details

The participating interests in WA-412-P are presented in **Table 1-1** and the liaison person is provided in **Table 1-2**. If there is a change in the titleholder, the titleholder's nominated liaison person or the contact details for the titleholder or liaison person, SapuraOMV will notify NOPSEMA in accordance with Regulation 15(3) of the OPGGS(E)R. Specifically, a written notification including any changes will be provided to NOPSEMA as soon as practicable after the change occurs.

Table 1-1 Titleholder participating interests and operatorship

Title	Titleholder	Titleholder for Activity
WA-412-P	SapuraOMV 70% (ACN 37 629 043 518)	SapuraOMV
	Finder No 9 Pty Ltd 30% (ACN 150236445)	

Table 1-2 Titleholder nominated liaison person

Nominated Liaison Person	
Name	Zamin Zawawi
Position	Country Manager
Business address	SapuraOMV Upstream (WA) Pty Ltd Level 2, 251 St Georges Terrace Perth, WA 6000
Telephone number	+61 8 6118 4990
Email address	kanga.australia@sapura-omv.com

2. Environmental Management Framework

2.1 Environmental Management Policy

The Activity will be conducted in accordance with SapuraOMV's Health, Safety and Environment (HSE) Policy (**Appendix A**), inclusive of the relevant EP sections where the legislation may prescribe or control how an activity is undertaken.

SapuraOMV's HSE Policy sets the direction and minimum expectations for environmental performance, and is implemented through the standards and procedures of the Health, Safety and Environmental Management System (HSEMS) (HSE-MM-MAN-0001). This system and policy are further described in **Section 9** in accordance with Regulation 16(a) of the OPGGS(E)R.

2.2 Legislative Framework

In accordance with regulation 13(4) of the OPGGS(E)R, this Section describes the requirements including Commonwealth and State legislation, international agreements and other relevant guidelines and codes of practice. Applicable legislation is summarised in **Appendix B.**

2.2.1 Commonwealth Legislation

Appendix B presents a comprehensive list of Commonwealth legislation (including legislation adopting international conventions) relevant to the environmental management of the project.

2.2.2 State Legislation

The Activity is located entirely in Commonwealth waters; however, Western Australia (WA) legislation relevant to emergency response and the environmental values of areas that may be affected by unplanned events is presented in **Appendix B**.

2.2.3 International Agreements

Australia is a signatory to several international environmental protection agreements and conventions that are relevant to the region, which include conventions for protecting migratory birds and other marine fauna (e.g. Japan–Australia Migratory Birds Agreement; China–Australia Migratory Birds Agreement; Republic of Korea and Australia Migratory Birds Agreement), wetlands (Ramsar) and environmental values (International Convention for the Prevention of Pollution from Ships (MARPOL)).

2.3 Environmental Emergencies

A brief description of the National Plan and State oil spill response plans is provided below with further details in this Activity's Oil Pollution Emergency Plans (OPEPs; **Appendix F**) for marine diesel oil (MDO) (AU-HSE-KG1-EX-PLN-039) and crude oil (AU-HSE-KG1-EX-PLN-037) spill incidents.

2.3.1 National Plan

The National Plan for Maritime Environmental Emergencies 2017 (NatPlan) is managed by the Australian Maritime Safety Authority (AMSA) and sets out national arrangements, policies and principles for the management of maritime environmental emergencies. It gives administrative effect to Australia's emergency response obligations relating to the:

- International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990 (OPRC);
- Protocol on Preparedness, Response and Co-operation to Pollution Incidents by Hazardous and Noxious Substances, 2000 (OPRC-HNS Protocol);
- International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, 1969 (Intervention Convention); and
- Articles 198 and 221 of the United Nations Convention on the Law of the Sea, 1982.

2.3.2 State Spill Response Plan

State emergency management plans are largely based on NatPlan and set out local arrangements, policies and principles for the management of maritime environmental emergencies in State waters. Relevant to the Activity is the WA Sate Hazard Plan – Marine Environmental Emergencies (MEE).

3. Activity Description

3.1 Location and Timing

3.1.1 Activity Location

This EP provides for exploration drilling and associated activities (as described in **Section 3.2**) of a single exploration well in Commonwealth permit area WA-412-P that is offshore of WA (**Figure 1-1**).

The proposed well is located in Commonwealth waters with a water depth of approximately 147 m. Indicative coordinates for the proposed Kanga-1 well location are provided in **Table 3-1**. If a re-spud is required or the site survey identifies a more favourable location for MODU anchoring, the coordinates of the well will change within the operational area.

Table 3-1 Kanga-1 exploration well indicative coordinates

Latitude	Longitude	Approximate water depth
-19°19' 02.30" S	116° 21' 26.80" E	~147 m

The relative distances of key islands and mainland towns from the Kanga-1 operational area are provided in **Table 3-2**.

Table 3-2 Distances of key islands and mainland to the operational area

Islands / Mainland	Distance and Direction (approx.)
Legendre Island	122 km SSE
Rosemary Island	127 km SSE
Trimouille Island	142 km SW
North West Island	142 km SW
Karratha	163 km SSE
Barrow Island	175 km SW
Port Hedland	254 km ESE
Cunningham Island	324 km NE

3.1.2 Operational Area

The operational area defines the spatial boundary of the proposed Activity. For the purposes of this EP, the operational area is set as the polygon bounded by the coordinates in **Table 3-3** for the planned well coordinates, measuring approximately 4 km by 4 km (16 km^2). This area is defined to encompass both the 500 m petroleum safety zone around the MODU, and to account for support vessels on standby and for potential movement in the well location (e.g. re-spud if required). Marine users are permitted within the 4.6 km (2.5 nm) radius cautionary area (centred around the MODU), so long as they approach and operate with caution, however only authorised vessels are permitted in the petroleum safety zone.

Table 3-3 Operational area planned coordinates

Latitude	Longitude
-19° 20' 07.27" S	116° 20' 18.28" E
-19° 17' 57.06" S	116° 20' 18.28" E
-19° 17' 57.06" S	116° 22' 35.31" E
-19° 20' 07.27" S	116° 22' 35.31" E

3.1.3 Activity Timing

To account for potential delays or schedule changes, the environmental assessment encompasses petroleum activities at any time of the year. Thus, the Activity may commence any time between Q1 2022 and the end of Q4 2022.

Drilling activities are estimated to take ~40 days (excluding weather and operational delays) or up to ~80 days (if side-track drilling or re-spud is required). The drilling duration may be subject to change based on geological conditions and the potential for operational challenges.

Activities will be conducted 24 hours per day, seven days per week.

3.2 Drilling Activities

3.2.1 Drilling Phases

The following high-level phases describe the planned drilling activity:

- Move the MODU to location, position MODU;
- Drill top hole section without a riser in place (i.e. riserless drilling);
- Run and cement conductor casing;
- Drill surface hole;
- Run and cement surface casing and wellhead;
- Install blow-out preventer (BOP);
- Drill intermediate hole section;
- Run and cement production liner;
- Drill production hole to well total depth (TD) (the maximum anticipated well TD is 3,500 m);
- Run wireline evaluation program (which in a success case includes, formation pressures and samples, rotary side wall cores, imaging and acoustic downhole profiling [checkshot or vertical seismic profiling]);
- Plug and abandon (P&A) the well; and
- Demobilise MODU.

3.2.2 MODU Positioning

The Kanga-1 well will be drilled with a semi-submersible MODU. The MODU will be towed to location and anchored over the well site. The MODU will maintain position with an anchored mooring system. Up to 12 drag embedment anchors (~12-18 tonnes each) will be set in place by support vessels. Anchors may be pre-laid in advance of the MODU arriving at the well location. Anchors will be spread in a radial pattern extending from the MODU. Anchors will be attached to either wire, chain or a combination of both. The exact anchor spread will be dependent on the preliminary mooring analysis to be conducted during the planning phase of the drilling program, but will conform with the MODU Mooring in Australian Tropical Waters Guideline (APPEA, 2019). The mooring analysis will also incorporate the results from the geophysical and geotechnical survey obtained beforehand.

Mooring lines may be up to ~1,900 m in length (subject to mooring analysis and Safety Case), including as much as ~1,000 m of grounded chain. Retrieval of anchors will be the reverse of the deployment procedures.

3.2.3 Well Design

The well design will include the installation of a structural conductor, a surface casing string, and a production liner. The surface string and wellhead are installed to isolate shallower unconsolidated intervals, to allow drilling of deeper, overpressured formations. The production liner will isolate these overpressured formations to allow drilling of the deeper reservoir zone. Prior to drilling out the surface casing, BOPs will be installed and tested as a means of implementing secondary well control. Primary well control is achieved by maintaining a positive pressure differential (overbalance) between the drilling fluid column and pore pressure. The proposed TD is approximately 3,300 m, with a maximum potential TD of approximately 3,500 m TVD.

3.2.4 Drilling Fluids and Cuttings

Only water-based drilling fluids will be used for the well. The top hole (or interval) will be drilled using seawater and pre-hydrated gel (PHG) sweeps to clean the hole. This fluid will exit the well at the seabed while drilling the hole. The surface hole section may be drilled utilising this same seawater and pre-hydrated gel (PHG) sweeps with discharge at the seabed while drilling until surface casing and BOPs are installed. Once the surface casing and BOPs are installed, and a closed circulating system established, the remainder of the well will be drilled with a weighted shale inhibitive (e.g. KCL/polymer) WBM system. WBM will periodically be discharged from the MODU through a discharge line above the sea surface. Residual drilling fluids will be discharged overboard in a single event after completion of the drilling operations or when the quality of the material has been compromised and is below technical specifications. Drilling fluid properties will be maintained through the use of dilution and chemical additives to minimise the volume of discharge.

Similar to drilling fluids, cuttings for the top hole and surface sections will exit the wellbore at the seabed. Cuttings for the remaining hole sections to TD will be discharged from the rig after being removed from the WBM system through the solids control equipment (SCE). The SCE comprises shale shakers and desilters.

Aqueous based lost circulation material (LCM) and stuck-pipe freeing agents will be available to pump should downhole losses or stuck pipe occur.

3.2.5 Cement Operations

Cementing operations will be undertaken to maintain well control and structural support of the casing and to set permanent plugs to abandon the well. G class cement and high temperature blended cement (G + silica flour) will be used for the Kanga-1 well. Three primary casing cement jobs are planned for cementing the conductor, surface casing and production liner in place. The purpose of cementing is to provide additional zonal isolation between the different formations, and to provide structural support for the well. Any cement returns during the conductor and surface casing jobs will be to the seabed.

SapuraOMV require at least two permanent barriers to be installed to isolate any potential source of inflow or hydrocarbon bearing reservoirs. This philosophy aligns with NORSOK Standard D-

010, Rev 4, globally viewed as an industry best practice. The final abandonment program will ensure movable fluids (identified while drilling) are isolated as per the Kanga-1 Plug and Abandonment Program.

During cementing operations, surface cementing equipment and lines will need to be flushed, washed and cleaned with water to prevent cement from setting inside of the lines/surface equipment. The residual cement and wash water will be discharged to sea after each cementing job. At the completion of the exploration well drilling, some or all of the contingency volume of cement loaded to the MODU may remain. To the extent practicable, this volume will be reduced by optimising the length of the final wellbore integrity plug(s) and/or the excess cement will be transferred to the next MODU Operator. In the event that there is no subsequent Operator taking the MODU on contract, or the type of cement does not meet the requirements of the next Operator's drilling program, residual cement is unable to be backloaded and will be slurrified prior to discharge overboard at the sea surface.

3.2.6 Chemical Selection Process

Drilling fluids and cementing chemicals discharged during the exploration well campaign will be selected to meet both technical and environmental criteria, and will be evaluated with SapuraOMV's Chemical Risk Assessment Procedure (AU-HS-PRO-010-1.1). Chemicals associated with drilling operations (i.e. drilling fluids and cementing additives) are preferentially selected based on existing Offshore Chemical Notification Scheme (OCNS) risk rankings. The OCNS primarily uses the Chemical Hazard and Risk Management (CHARM) model for risk ranking of chemicals (CHARM, 2005). This model was adopted from the Harmonised Mandatory Control Scheme (HMCS) developed by the Convention for the Protection of the Marine Environment of the North-East Atlantic (the OSPAR Convention). The CHARM model uses the ratio of Predicted Effect Concentration (PEC) to No Effect Concentration (NEC) to assign a Hazard Quotient (HQ), which is then assigned a colour band ranking, with a gold ranking being the least hazardous to the environment.

For chemicals that do not fit the CHARM model, OCNS hazard groups are used to rank chemicals (generally inorganic substances) based on ecotoxicology, biodegradation and bioaccumulation data (OCNS, 2014). The final rankings range from A to E, with E being the least hazardous chemical.

Where possible, OCNS chemical products without a 'substitution warning' will be used in place of a product with a chemical carrying the warning. If a product containing the chemical with a warning is required to meet specific operational performances it must have a primary ranking of Gold/Silver or D/E, and its risk to the environment will be assessed. If the assessment results in a hazard ranking of D or E, the product is suitable for use in Australian waters. If the hazard ranking is C, B or A, then an Accidental Discharge Management Plan (ADMP) to minimise environmental risk from spillage is required, which will also include justification regarding its use (e.g. required specific technical properties).

3.2.7 Well Re-spud and Side-track Drilling

If drilling difficulties are experienced, meaning the well cannot progress, then contingency options exist to either cement up the existing hole above the trouble zone and side-track the well around the problem; or in extreme circumstances, P&A the existing wellbore, and re-drill the well at an offset location.

A re-spud may require a rig move within the operational area and would require additional time on location and an increase in the volume of cuttings, drilling fluids and cement consumed, compared to the planned activity.

A re-spud and/or side-track drilling would only be exercised if drilling difficulties are experienced, which are determined to be unmanageable and are not considered new stages of the Activity. If required, a re-spud would remain within the operational area in close proximity to the initial well location.

3.2.8 Well Evaluation

The well evaluation includes the following possible downhole formation assessments in the reservoir for a success case:

- Formation pressures (20 pre-tests) and up to 8 samples at 2 or 3 stations;
- 2 sample carriers with 6 samples per carrier;
- Rotary mechanical sidewall cores (20 plugs); and
- Acoustic downhole profiling (checkshots/Vertical Seismic Profiling [VSP]) from TD to shallowest possible point in the well.

A Gamma Ray-Resistivity-Neutron-Density-Sonic wireline log may also be run in all hole sections if the LWD data is not of sufficient quality.

The majority of these planned downhole formation evaluations are wholly contained within the wellbore and have negligible environmental impact. Checkshots/VSP uses a sound source suspended in the water column and recorders located down-hole to provide a high-resolution seismic image of the immediate vicinity of the well. Checkshots/VSP measurements are used primarily for correlation of geological characteristics downhole with existing seismic data. The sound source used for checkshots/VSP involves the release of compressed air to generate very short duration acoustic pulses.

3.2.9 Abandonment

The barriers will consist of isolating the open hole with cement from well TD up into cased hole, followed by setting of up to two mechanically supported cement plugs in the production liner and surface casing. The barriers will meet and be verified in accordance with NORSOK D-010, Rev 4 guidelines, widely accepted as industry best practice. Casing will be cut and the subsea wellhead retrieved to ensure nothing remains above the mud line. See **Section 3.2.5** for details of cementing operations involved.

3.2.10 Cyclone Response

Standard well suspension equipment will be available offshore to safely install temporary barriers should the MODU require evacuation for any reason. The standard well suspension equipment includes storm packers in order to temporarily isolate the wellbore from surface. Any suspension will be conducted in accordance with SapuraOMV's barrier philosophy, aligned with the NORSOK D-010 Rev 4 Standards globally viewed as an industry best practice.

The design and implementation of the mooring system of the MODU will be undertaken consistent with the requirements of the APPEA MODU Mooring in Australia Tropical Waters Guideline Revision 2 (2019), including if necessary due to timing of the activity, measures to address cyclonic extremes and ensure risk of losing station is ALARP.

3.2.11 Logistics and Support Activities

3.2.11.1 Support Vessels

Typically, only two support vessels will be required to assist the MODU; however, this EP accounts for up to four (used for towing, equipment and material transfers, standby operations and emergency response). The support vessels are yet to be confirmed, but are usually offshore multiple purpose or anchor handling vessels. The vessels will be fuelled with marine diesel oil (MDO) or marine gas oil (MGO), and will be either stationary or operating at slow speeds while undertaking activities within the operational area.

Equipment and material transfers may include, but are not limited to, crew supplies, hydrocarbons (e.g. MDO/MGO, engine oil, hydraulic fluids, grease), bulk drilling products, MODU and drilling equipment and parts, and waste. MODU cranes will be used for transfers between the MODU and support vessels.

Some bulk products will also be transferred via hose from the support vessels and the MODU. Such products may include drilling fluids and barite, bentonite, brine, drilling water, dry cement and fuel (e.g. MDO or MGO).

At least one support vessel will remain on standby for the MODU within the distance defined in the MODU's Safety Case (nominally three nautical miles). Support vessels will not anchor within 500 m of the MODU, but may anchor in the operational area during the Activity.

3.2.11.2 Remotely Operated Vehicle

A work-class remotely operated vehicle (ROV) will also be used to support drilling activities (e.g. equipment deployment, monitoring, blow-out preventer (BOP) activation under emergency conditions). Hydraulic systems on the ROVs are closed systems and are designed to not release hydraulic fluid. The ROV will be parked on the deck of the MODU when not in use.

3.2.11.3 Helicopters

Helicopters will be used primarily for crew change and medevac, and occasionally equipment and material transfers. Helicopter flights will occur approximately 3 times per week (on average), but up to 7 times per week, dependent on the progress of the drilling program and logistical constraints.

3.2.12 End of Activity

The Activity ends once the well has been P&A and the MODU and all support vessels have departed the operational area. The surface wellhead will be removed. No equipment will be left above the seabed.

4. Description of the Environment

4.1 Background

In accordance with Regulation 13(2) of the OPGGS(E)R, this Section provides a description of the physical, biological, socio-economic and cultural receptors of the environment that may be affected (EMBA) (**Figure 4-1**). In determining the spatial extent of the EMBA, SapuraOMV has considered the area potentially affected by planned activities and unplanned events, including emergency conditions.

The description of environmental values in this EP was sourced from peer reviewed journals, and government and industry reports. The key sources of information are from the Department of Agriculture, Water and the Environment (DAWE) resources and published literature. These resources were used to identify ecological, heritage, socio-economic and cultural environments, their associated values and sensitivities, and their presence in the operational area and the broader EMBA.

These key sources included, but are not limited to:

- An EPBC Act Protected Matters Database search was conducted to identify matters of national environmental significance (MNES) and other matters protected under the EPBC Act occurring in the operational area and EMBA (see **Appendix C**). Relevant DAWE websites, publications and peer-reviewed scientific publications were accessed for conservation values of these matters;
- DAWE Species Profile and Threats (SPRAT) Database, which includes information about species, ecological communities and key ecological features (KEFs) protected under the EPBC Act;
- National Conservation Values Atlas, which includes information on Biologically Important Areas (BIAs) for protected species under the EPBC Act;
- Species recovery plans, published conservation advice and peer-reviewed scientific publications; and
- State and Commonwealth online and published fisheries reports.

A comprehensive description of the environmental values and sensitivities of the existing environment in the operational area and an overview of values and sensitivities in the EMBA and moderate exposure zone (see below) are provided in this Section. Further detail of these environmental values is also provided in **Appendix D**.

4.2 Environment That May Be Affected

The outer boundary of the EMBA for the Activity has been defined on the basis of a maximum credible hydrocarbon spill event (**Section 8.1 -** hydrocarbon spill from the loss of well control (LOWC)). Stochastic spill modelling of this event used the 'NOPSEMA Bulletin #1 Oil Spill Modelling' (NOPSEMA, 2019a) low hydrocarbon contact thresholds of four oil phases (surface, dissolved, entrained, shoreline loads) that pose differing environmental risks to define the outer extent of the EMBA.

The EMBA has been used to identify the environmental receptors that may be contacted by surface and subsurface hydrocarbons in the highly unlikely event of a worst case oil spill (uncontrolled subsea blowout). Low contact thresholds that have been used to inform the extent of the EMBA (**Table 4-1**) are useful for establishing the spatial extent of scientific monitoring and identifying potential socio-economic impacts; however, it may not be ecologically significant

(NOPSEMA, 2019a). Therefore, in addition to the EMBA, a moderate exposure zone (MEZ) and high exposure zone (HEZ) have also been derived from the stochastic spill modelling by applying moderate and high hydrocarbon contact thresholds (NOPSEMA, 2019a) that have potential to cause impacts to receptors (**Table 4-1**).

The HEZ for surface, shoreline and dissolved oil components are illustrated in the overview of the stochastic oil spill modelling in **Sections 8.1** and **8.2** for informative purposes only. An overall integrated HEZ cannot be defined because there is no NOPSEMA (2019a) high instantaneous contact threshold for entrained oil (**Table 4-1**). Impact assessment from a large spill is provided on those values and sensitivities that are identified within the MEZ (**Appendix D**).

It is important to note that the MEZ and EMBA represent probabilistic areas of spill contact predicted from 120 stochastic simulations over a range of seasonal and interannual environmental conditions. The MEZ and EMBA shown in **Figure 4-1** encompass the area that modelling predicts to be contacted by very low concentrations of hydrocarbons in the event of 120 uncontrolled subsea blowouts, each continuing for almost four months (11 weeks). It is also important to note that the model reports 'contact' for a given grid cell even if hydrocarbon concentrations reach this very low threshold for only one time step (2 hours) within the entire 16 weeks that the model runs. As such, the actual area affected from any single spill event, even a worst case loss of well control, would be considerably smaller than represented by the MEZ or EMBA. The offshore spatial extent of both the MEZ and EMBA is primarily driven by total submerged oil (primarily entrained oil droplets) as described in **Section 8.1** with the extent of potential surface oil or dissolved hydrocarbon exposure much smaller (**Figure 4-1**). In addition, the oil spill modelling used to define the EMBA does not consider mitigation and response capabilities that would be applied in the highly unlikely event of a major spill to reduce volumes (e.g. successful capping stack after 28 days of LOWC) and/or prevent/reduce hydrocarbons from reaching sensitive areas (e.g. dispersant application).

Table 4-1 Oil spill thresholds to define the MEZ and EMBA (NOPSEMA, 2019a)

Oil Type	NOPSEMA Threshold	EP Area/Zone	NOPSEMA Description
Accumulated Shoreline	Low 10 g/m^2	EMBA	Predicts potential for some socio-economic impact.
	Medium 100 g/m^2	MEZ	Loading predicts area likely to require clean-up effort.
	High 1,000 g/m^2	HEZ	Loading predicts area likely to require intensive clean-up effort.
Instantaneous[1] Surface	Low 1 g/m^2	EMBA	Approximates range of socioeconomic effects and establishes planning area for scientific monitoring.
	Medium 10 g/m^2	MEZ	Approximates lower limit for harmful exposures to birds and marine mammals.
	High 50 g/m^2	HEZ	Approximates surface oil slick and informs response planning.
Instantaneous Dissolved	Low 10 ppb	EMBA	Establishes planning area for scientific monitoring based on potential for exceedance of water quality triggers.

[1] If the concentrations exceed these thresholds for 1 oil spill modelling time step (1 hour) across the 120 stochastic simulations of 100+ days duration at the horizontal location (also at any depth through the water column for dissolved and entrained thresholds), then an exceedance is triggered with these instantaneous contact thresholds. These are not exposure thresholds, which would consider both concentration and duration that receptors are exposed to oil.

Oil Type	NOPSEMA Threshold	EP Area/Zone	NOPSEMA Description
	Medium 50 ppb	MEZ	Approximates potential toxic effects, particularly sublethal effects to sensitive species.
	High 400 ppb	HEZ	Approximates toxic effects including lethal effects to sensitive species.
Instantaneous Entrained (Threshold for Total Submerged Oil in this EP)[2]	Low 10 ppb	EMBA	Establishes planning area for scientific monitoring based on potential for exceedance of water quality triggers.
	Medium[3] 100 ppb	MEZ	As appropriate given oil characteristics for informing risk evaluation.

[2] NOPSEMA (2019a) provides thresholds for entrained oil. The oil spill modelling used in this assessment simulates dissolved and total submerged oil. Total submerged oil is defined as the combination of dissolved and entrained oil.

[3] The high instantaneous contact threshold for entrained oil has been reallocated as medium instantaneous threshold as typically entrained oil concentations are greater than those of dissolved oil.

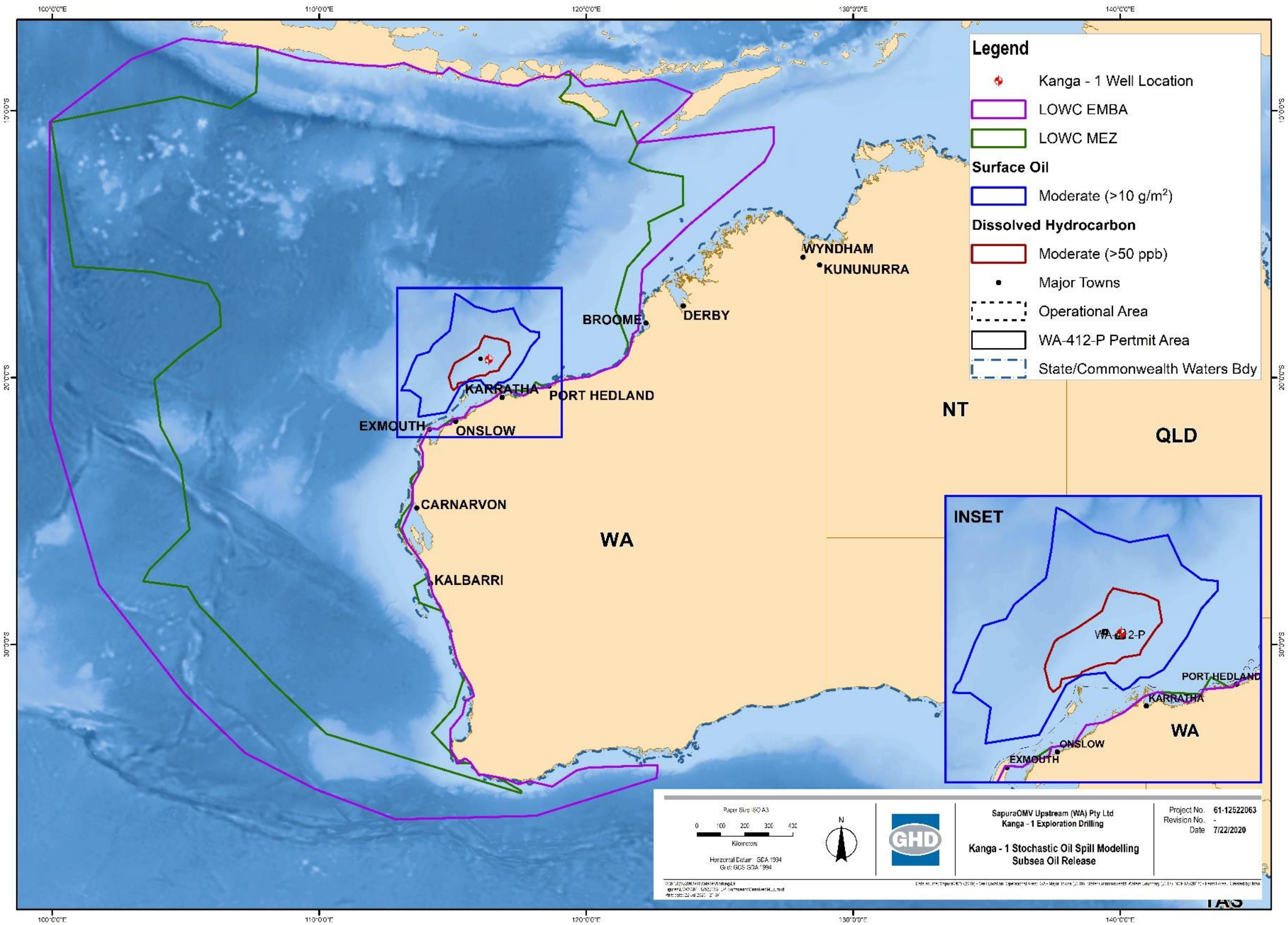


Figure 4-1 Kanga-1 exploration drilling MEZ and EMBA

4.3 Regional Overview

Australia's offshore waters have been divided into six broad marine bioregions in order to facilitate their management by the Australian Government under the EPBC Act. Marine Bioregional Plans describe the marine environment and conservation values of each marine region, set out broad biodiversity objectives, identify regional priorities and outline strategies and actions to address these priorities.

The operational area is located entirely within the North-West Marine Region (NWMR). The MEZ and EMBA intersect with the NWMR and the South-West Marine Region (SWMR).

Based on the Integrated Marine and Coastal Regionalisation of Australia (IMCRA), Version 4.0 (CoA, 2006), the operational area is located within the Northwest Shelf Province. The MEZ and EMBA also overlap 14 other bioregions (see **Appendix D**).

The Bioregional Plans for the NWMR (DSEWPaC, 2012a) and SWMR (DSEWPaC, 2012b) have been used in conjunction with other relevant management plans, reports and published papers to inform the description of the existing environment in this Section and in **Appendix D**.

4.4 Physical Environment

The physical environment of the operational area is described in this Section. An overview of the EMBA and a comprehensive description of the existing environment in the MEZ are provided in **Appendix D**.

4.4.1 Climate and Meteorology

4.4.1.1 Air Temperature

Air temperatures at the Karratha aerodrome, the closest Bureau of Meteorology (BoM) climatological station to WA-412-P, follow seasonal trends (**Figure 4-2**) with elevated air temperatures from December-March (mean maximum air temperature peak of 36.2°C) and lower air temperatures from June-September (mean minimum temperature of 13.8 °C) (BoM, 2020a).

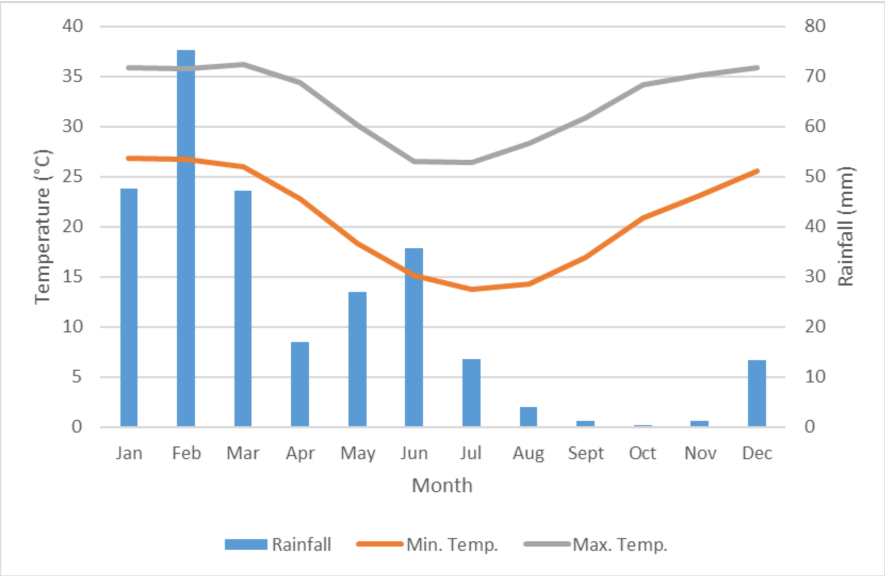


Figure 4-2 Mean monthly rainfall, and minimum and maximum average air temperatures at Karratha aerodrome (BoM, 2020a).

4.4.1.2 Rainfall

The region has a pronounced monsoon (wet) season between January and March and dry season from August to November. Historical rainfall data shows the highest mean monthly rainfall occurs from January to March (**Figure 4-2**) (BoM, 2020a).

4.4.1.3 Winds

Winds typically vary seasonally, with a tendency for south-westerly winds during September–March and south-easterly from May–July (**Figure 4-3**, Condie et al. 2006). Transitional wind periods, during which either pattern may predominate, can be experienced in April–May and September of each year. September–March winds are more variable and are driven by high pressure cells that pass from west to east over the Australian continent. During May–July the relative position of the high pressure cells moves further north, leading to prevailing easterly winds blowing from the mainland (Pearce et al. 2003).

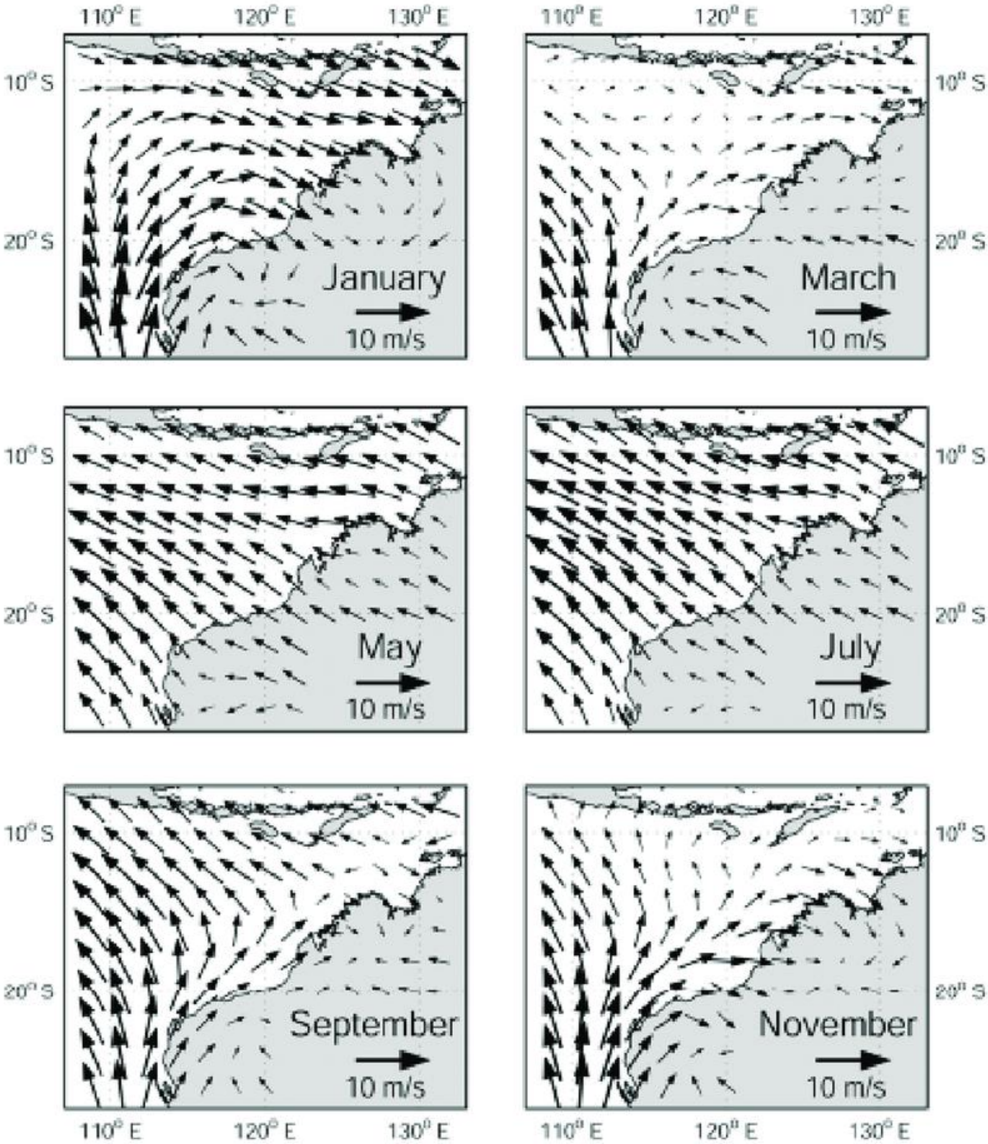


Figure 4-3 Monthly averaged wind patterns across north-west Australia (Condie et al. 2006)

4.4.1.4 Tropical Cyclones

Tropical cyclones are low pressure systems that form over warm tropical waters and have well defined wind circulations of at least gale force strength (sustained winds of 63 km/h or greater with gusts in excess of 90 km/h) (BoM, 2020b). The Australian cyclone season officially runs from November to April, although very few have occurred in November. Tropical cyclones in the Australian region are influenced by several factors, and in particular variations in the El Niño – Southern Oscillation. In general, more tropical cyclones cross the coast during La Niña years and fewer during El Niño years. On average about eleven cyclones form in the Australian region (90-160° E) each cyclone season (BoM, 2020b). **Figure 4-4** shows the average number of tropical cyclones through the Australian region and surrounding waters over a 48-year period from the 1969/70 to 2017/18 tropical cyclone seasons.

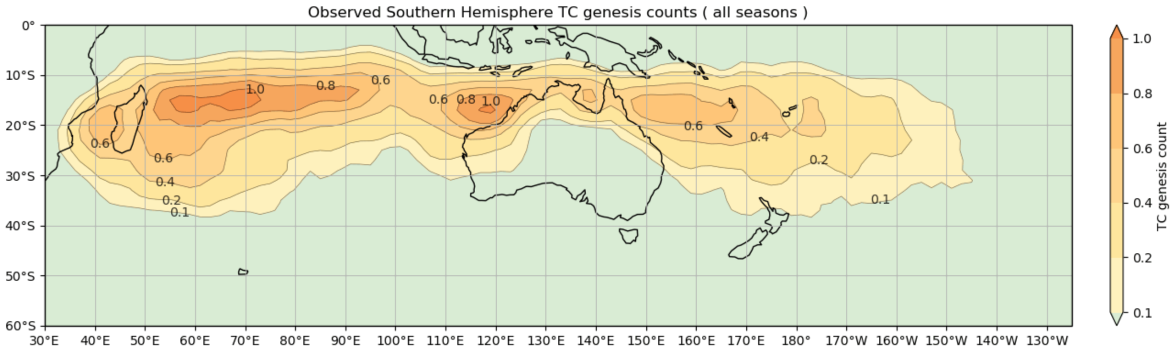


Figure 4-4 Average number of tropical cyclones in Australia from 1969 to 2018 (BoM, 2020b)

4.4.1.5 Air Quality

The operational area is offshore and remote from urbanisation. Therefore, local air quality is expected to be very good. Localised and temporary reductions in air quality may be associated with transient anthropogenic emission sources such as shipping and oil and gas activities.

4.4.2 Oceanography

The NWS bioregion is a dynamic oceanographic environment that is influenced by strong tides, cyclonic storms, long-period swells and internal tides (DEWHA, 2008a).

4.4.2.1 Currents

The NWMR is influenced by a complex system of ocean currents that vary between seasons and years, which generally result in warm, nutrient-poor and low salinity surface waters (DEWHA, 2008a). Two ocean and coastal currents in the WA region are significant in shaping marine environmental conditions and climate. Forming on the NWS, the Leeuwin Current exerts a major influence on the distribution of marine life and WA's weather. The Indonesian Throughflow is a system of currents that carries water westward from the Pacific to the Indian Ocean through the deep passages and straits of the Indonesian Archipelago. This is the only place in the world where warm, equatorial waters flow from one ocean to another, and this warm tropical water influences the character of the Leeuwin Current (CSIRO, 2020). **Figure 4-5** represents key patterns of ocean currents around Australia.

Currents within the shallow nearshore waters are primarily driven by the prevailing wind regime, resulting in almost exclusively northward flow between October and February, as a result of the dominant southerly winds prevailing during the summer months, and dominantly southward in winter (DEWHA, 2008a).

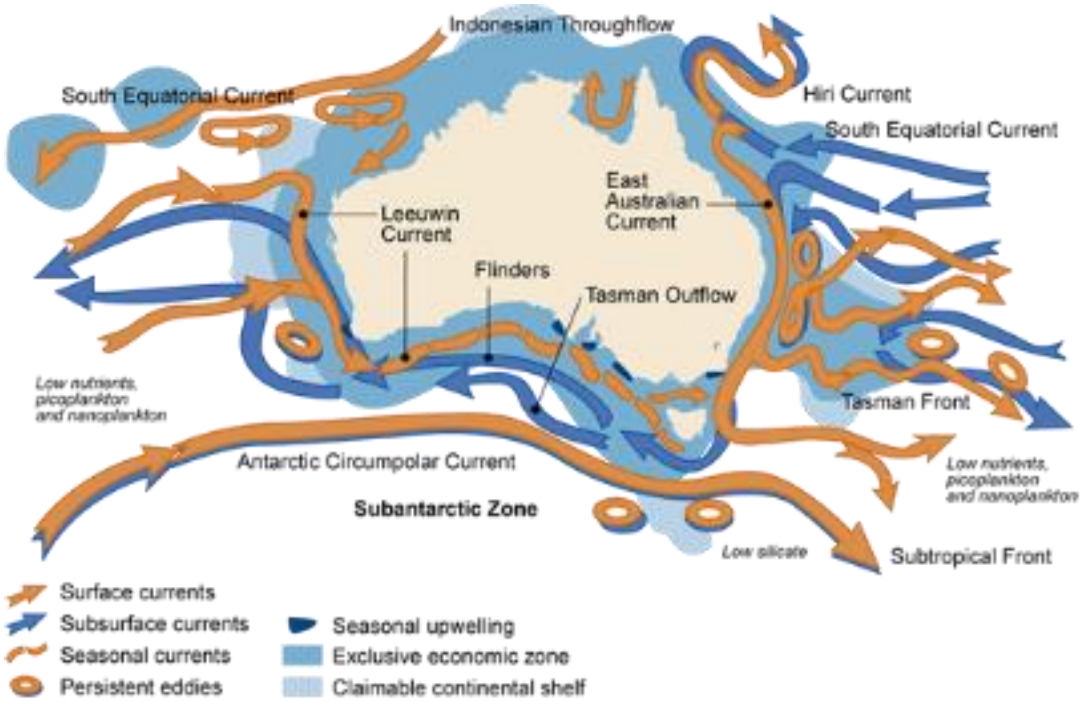


Figure 4-5 Ocean currents surrounding Australia (CoA, 2013)

4.4.2.2 Tides and Waves

The tides of the region are mixed and predominantly semi-diurnal (two high tides and two low tides per day) with well-developed spring to neap tidal variation (DEWHA, 2008a). The NWMR has some of the largest tides in Australia with an increase in amplitude from south to north, which corresponds with the increasing width of the shelf (Holloway, 1983). Tides and winds strongly influence water flow in the coastal zone and over the inner to mid-shelf, whereas flows over the outer-shelf, slope, rise and deeper waters are influenced by large scale regional circulation (DEWHA, 2008a).

Perhaps one of the most unique features of the NWMR is the occurrence of internal waves. Internal waves are dynamic, episodic events that are strongly influenced by topography and generated by internal tides (DEWHA, 2008a). Internal tides occur at the thermocline where the warm, low salinity waters of the Indonesian Throughflow overlay colder, more saline, deeper ocean waters. Internal tides are large in scale, frequently occurring across an ocean basin and forced by the gravitational pull of the moon and sun (DEWHA, 2008a).

Waves within the NWMR reflect the direction of the synoptic winds. They flow predominantly from the south-west in the summer and from the east in winter (Pearce et al. 2003). Only 10% of significant wave heights off Dampier exceed 1.2 m with an average wave height of 0.7 m (Pearce et al. 2003).

4.4.3 Water Quality

The NWMR is an oligotrophic environment (Holloway et al. 1985). Nutrient enrichment of the shelf occurs through river runoff, tidal mixing, internal tides, low frequency circulation, upwelling, and tropical cyclones that induce oceanic mixing and further upwelling (Holloway et al. 1985). The Leeuwin current maintains warm sea surface temperatures that inhibit the establishment of macrophyte communities that compete with reef building organisms (Hatcher, 1991) and contribute to the transportation of reef larvae and propagules down the west coast of Australia.

4.4.4 Bathymetry and Geomorphology

The NWMR is divided into four physiographic regions: the inner shelf; middle shelf; outer shelf/slope; and abyssal plain/deep ocean floor. These divisions are on the basis of water depth and the geomorphic provinces. The Kanga -1 operational area lies in the middle shelf, which is defined as the region between 30 and 200 m water depths (Baker et al. 2008). The middle shelf environment covers the majority of shelf regions within the NWMR. Prominent geomorphic features of the region include terraces, deeps/holes/valleys, ridges, plateaus and pinnacles. However, available data indicates that the seabed of the Rowley/Northwest Shelf, where the operational area is located, is gentle and smooth (Baker et al. 2008).

4.4.5 Sedimentology

Sediments of the NWMR comprise bio-clastic, calcareous and organogenic sediments that were deposited by relatively slow and uniform sedimentation rates. Sediments of the middle shelf, where the operational area is located, are dominated by sand with accumulations of coral and gravel deposits (Baker et al. 2008). According to the CAMRIS Marine Benthic Substrate Database – Marsed (Lucieer et al. 2017), the benthic substrate within the operational area is primarily made up of mud and calcareous clay with the south-east corner made up of calcareous gravel, sand and silt.

Major contributors to sediment mobilisation in the NWMR include storm events (including tropical cyclones), internal tides and ocean currents (including the Leeuwin current) (Baker et al. 2008). Sediments of the middle shelf region are predominantly influenced by tidal processes (Baker et al. 2008).

4.5 Biological Environment

4.5.1 Benthic Habitat and Communities

As the operational area is dominated by soft sediments, benthic fauna may include animals living within the sediments (infauna) and those living on or above the seabed (sessile and mobile epifauna). This fauna comprises predominantly mobile burrowing species including molluscs, crustaceans (crabs, shrimps and smaller related species), polychaetes, sipunculid and platyhelminth worms, asteroids (sea stars), echinoids (sea urchins), and other small animals. Given the water depth within the operational area is ~147 m, benthic primary producer habitat (e.g. seagrass, macroalgae and hard corals) is unlikely to be present due to insufficient light availability.

4.5.2 Pelagic Environment

Modelling of nutrient cycling and primary production on the NWS suggests that nutrients are primarily carried into the system by horizontal currents before diffusing upward into the photic layer (NWSJEMS, 2007).

Plankton communities comprise phytoplankton and zooplankton, including fish eggs and larvae. Phytoplankton and zooplankton are a source of primary and secondary productivity, and key food sources for other organisms in the oceans (Brewer et al. 2007). Plankton is widespread throughout oceanic environments and is expected to occur in the operational area.

Plankton abundance and distribution is patchy, dynamic and strongly linked to localised and seasonal productivity (Evans et al. 2016). Biological productivity in the NWMR follows boom and bust cycles, is sporadic and significantly geographically dispersed (DEWHA, 2008a). The spatial distribution and seasonal cycles of biological productivity in the NWS are poorly understood, but higher productivity is likely to be associated with topographic features such as escarpments along the Ancient Coastline and the Glomar Shoals (DEWHA, 2008a).

4.6 Conservation Values and Sensitivities

4.6.1 Matters of National Environmental Significance

4.6.1.1 Listed Threatened and Migratory Species

An EPBC Protected Matters Search Tool (PMST) report identified 14 listed threatened species and 30 listed migratory species as having the potential to occur within the operational area (**Table 4-2**, **Appendix C**). The distribution, migratory movements and preferred habitat of these species are described in **Appendix D**. An additional 40 threatened and 67 migratory species were identified as having the potential to occur in the MEZ, and a further 4 migratory species identified in the EMBA. The distribution, migratory movements and preferred habitat of these species are also described in **Appendix D**.

Table 4-2 Threatened and/or migratory marine species potentially occurring within the operational area

Common Name	Species Name	EPBC Act Status	
		Threatened	Migratory
Marine Mammals			
Sei whale	*Balaenoptera borealis*	Vulnerable	Migratory
Blue whale	*Balaenoptera musculus*	Endangered	Migratory
Fin whale	*Balaenoptera physalus*	Vulnerable	Migratory
Humpback whale	*Megaptera novaeangliae*	Vulnerable	Migratory
Bryde's whale	*Balaenoptera edeni*		Migratory
Killer whale	*Orcinus orca*		Migratory
Sperm whale	*Physeter macrocephalus*		Migratory
Spotted bottlenose dolphin (Arafura/Timor Sea)	*Tursiops aduncus*		Migratory
Marine Reptiles			
Loggerhead turtle	*Caretta caretta*	Endangered	Migratory
Green turtle	*Chelonia mydas*	Vulnerable	Migratory
Leatherback turtle	*Dermochelys coriacea*	Endangered	Migratory
Hawksbill turtle	*Eretmochelys imbricata*	Vulnerable	Migratory
Flatback turtle	*Natator depressus*	Vulnerable	Migratory
Sharks, Rays and Fish			
Great white shark	*Carcharodon carcharias*	Vulnerable	Migratory
Green sawfish	*Pristis zijsron*	Vulnerable	Migratory
Whale shark	*Rhincodon typus*	Vulnerable	Migratory
Narrow sawfish	*Anoxypristis cupidata*		Migratory
Shortfin mako	*Isurus oxyrinchus*		Migratory
Longfin mako	*Isurus paucus*		Migratory
Grey nurse shark (west coast)	*Carcharias taurus*	Vulnerable	
Reef manta ray	*Manta alfredi*		Migratory
Giant manta ray	*Manta birostris*		Migratory

Common Name	Species Name	EPBC Act Status	
		Threatened	Migratory
Marine Birds			
Red knot	*Calidris canutus*	Endangered	Migratory
Eastern curlew	*Numenius madagascariensis*	Critically Endangered	Migratory
Common noddy	*Anous stolidus*		Migratory
Streaked shearwater	*Calonectris leucomelas*		Migratory
Lesser frigatebird	*Fregata ariel*		Migratory
Great frigatebird	*Fregata minor*		Migratory
Common sandpiper	*Actitis hypoleucos*		Migratory
Sharp-tailed sandpiper	*Calidris acuminata*		Migratory
Pectoral sandpiper	*Calidris melanotos*		Migratory

Recovery Plans, Management Plans and Conservation Advice

Recovery Plans set out research and management actions necessary to stop the decline of and support the recovery of listed threatened species. Conservation Advice provides guidance on immediate recovery and threat abatement activities that can be performed to facilitate the conservation of a listed species or ecological community. **Table 4-3** summarises the Recovery Plans and Conservation Advices relevant to those species identified by the EPBC Protected Matters searches (**Appendix C**) as potentially occurring within or using habitat in the operational area. Recovery Plans and Conservation Advices relevant to those species that may occur in the MEZ and EMBA are detailed in **Appendix D**. Species that occur in the MEZ/EMBA only may be affected by marine pollution (from unplanned hydrocarbon release); however, species that occur in the operational area have the potential to be impacted by planned activities (e.g. noise emissions) and unplanned events (e.g. vessel strike).

Table 4-3 Threatened species Recovery Plans, Management Plans and Conservation Advice relevant to the Activity's operational area for planned impacts

Receptor	Recovery Plan, Management Plan or Conservation Advice	Threats Identified as Relevant to the Activity	Relevant EP Section
All vertebrate fauna	Threat Abatement Plan for Impacts of Marine Debris on Vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018)	Marine debris	**Section 8.5**
Marine Mammals			
Sei whale	Approved Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015a)	Anthropogenic noise and acoustic disturbance	**Section 7.4**
		Habitat degradation including pollution	**Sections 7.6, 7.7**
Blue whale	Blue Whale Conservation Management Plan 2015 - 2025 (DoE, 2015a)	Noise interference	**Section 7.4**
Fin whale	Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015b)	Anthropogenic noise and acoustic disturbance	**Section 7.4**
		Habitat degradation including pollution	**Sections 7.6, 7.7**
Humpback whale	Approved Conservation Advice for *Megaptera novaeangliae* (humpback whale) (TSSC, 2015c)	Noise interference	**Section 7.4**
Marine Reptiles			

Receptor	Recovery Plan, Management Plan or Conservation Advice	Threats Identified as Relevant to the Activity	Relevant EP Section
All Marine Turtles	National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (DoEE, 2020)	Light pollution	**Section 7.3**
Loggerhead turtle Green turtle Leatherback turtle Hawksbill turtle Flatback turtle	Recovery Plan for Marine Turtles in Australia 2017 – 2027 (DoEE, 2017a)	Deteriorating water quality	**Sections 7.6, 7.7**
		Loss of habitat	**Sections7.2**
		Light pollution	**Section 7.3**
Sharks, Rays and Fish			
White shark	Recovery Plan for the White Shark (*Carcharodon carcharias*) (DSEWPaC, 2013b)	Ecosystem effects as a result of habitat modification	**Section 7.2**
Green sawfish	Commonwealth Conservation Advice on *Pristis zijsron* (green sawfish) (DEWHA, 2008c)	Habitat degradation and modification	**Sections 8.1, 8.2**
	Sawfish and River Sharks Multispecies Recovery Plan (DoE, 2015b)		
Whale shark	Approved Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015d)	Habitat disruption from mineral exploration, production and transportation	**Sections 7.4**
Grey nurse shark	Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (DoE, 2014a)	Ecosystem effects - habitat modification	**Section 7.2**
Marine Birds			
All Seabirds and Shorebirds	National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (DoEE, 2020)	Light pollution	**Section 7.3**
Red knot	Approved Conservation Advice *Calidris canutus* (Red Knot) (TSSC, 2016a)	Habitat loss, disturbance and modifications	**Section 8.1**
		Direct mortality (bird strike)	**Section 8.6**
Eastern curlew	Approved Conservation Advice for *Numenius madagascariensis* (Eastern Curlew) (DoE, 2015c)	Habitat loss and degradation from pollution	**Section 8.1**

Biologically Important Areas

Through the development of marine bioregional plans, biologically important areas (BIAs) have been identified for different species. BIAs are not defined under the EPBC Act, but they are areas that are particularly important for the conservation of protected species and where aggregations of individuals display biologically-important behaviour such as calving, foraging, resting or migration. BIAs have been identified using expert scientific knowledge about species' distribution abundance and behaviour (DoE, 2015a). BIAs were created to inform decision making under the EPBC Act, and have been identified for a selection of protected species only. These selected species were chosen based on their conservation status and the availability of reliable spatial and scientific information. The following BIAs overlap spatially with the operational area:

- Pygmy blue whale distribution (**Figure 4-6**); and
- Whale shark foraging northward from Ningaloo along the 200 m isobath (July-November) (**Figure 4-7**).

BIAs for numerous marine fauna species occur within or in the vicinity of the MEZ/EMBA and are described in **Appendix D**.

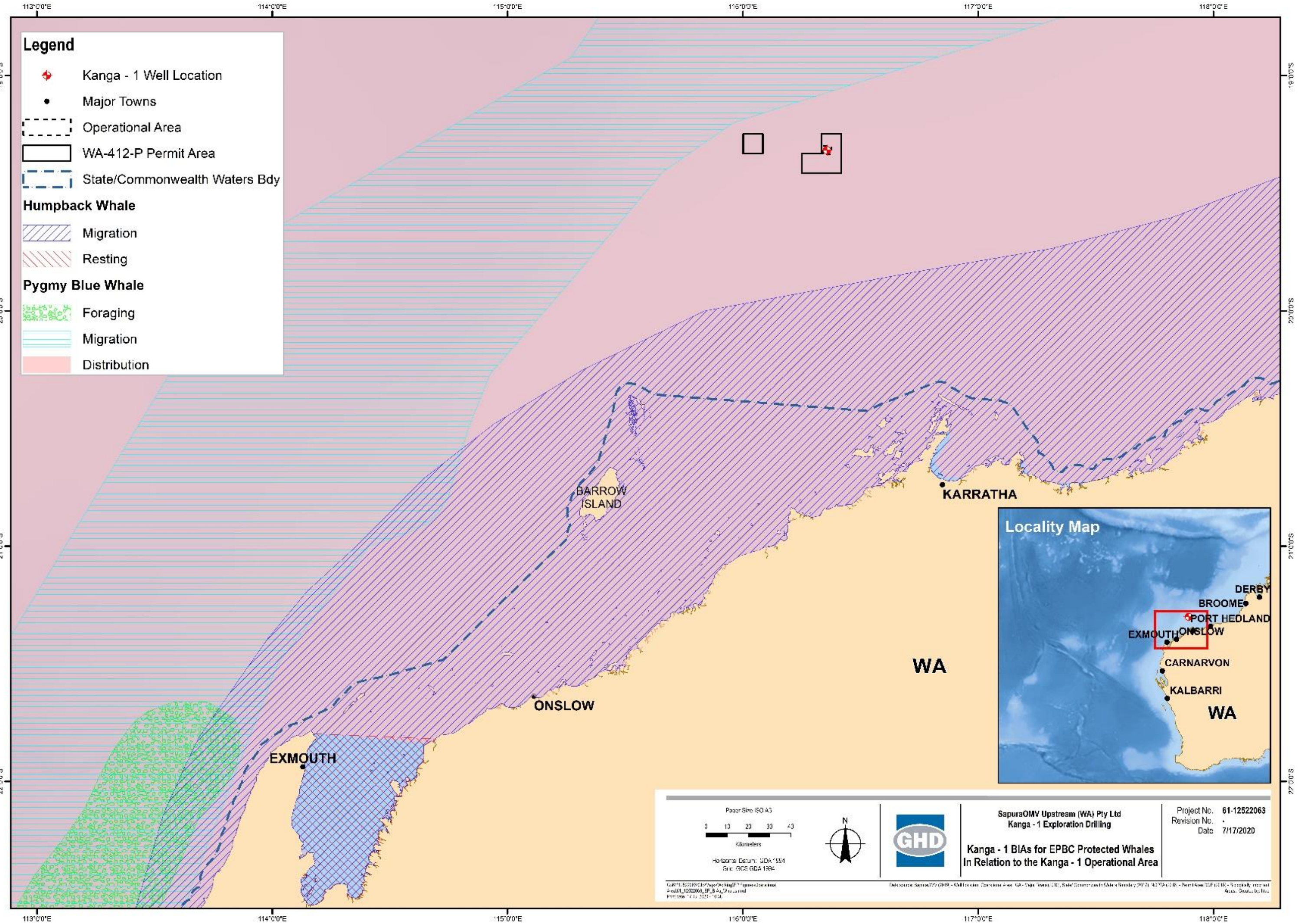


Figure 4-6 BIAs for whale species in the vicinity of the operational area

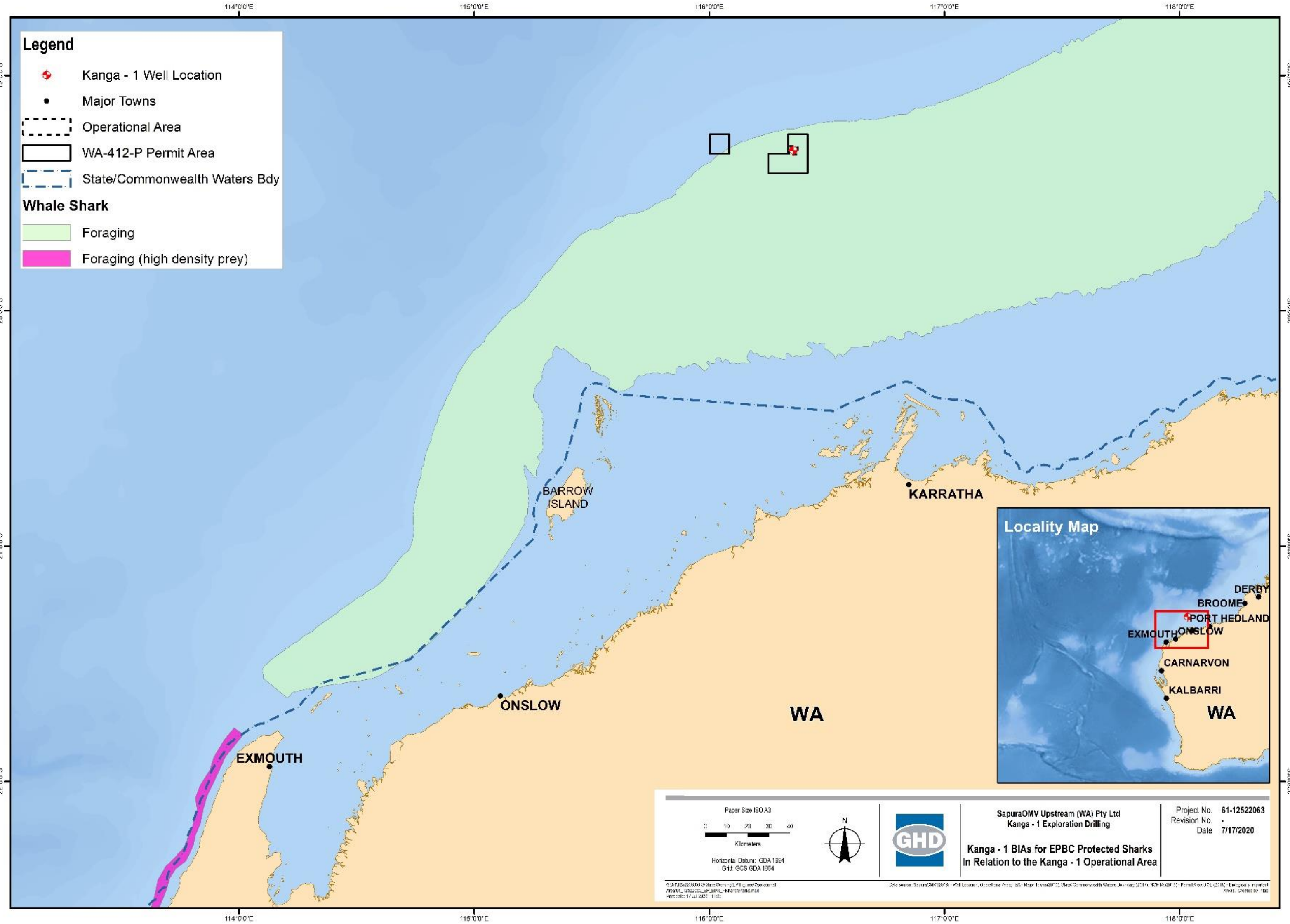


Figure 4-7 BIAs for sharks and fish in the vicinity of the operational area

4.6.1.2 World and National Heritage Properties

No World or National Heritage Properties overlap the operational area, with the closest located approximately 123 km to the south south-east (Dampier Archipelago (including Burrup Peninsula)).

Six National Heritage Properties (two of which are also listed as World Heritage) are listed as occurring within the MEZ and EMBA. These are described in detail in **Appendix D**.

4.6.1.3 Wetlands of International Importance (Ramsar)

No Ramsar wetlands overlap the operational area.

Four are listed as occurring in the MEZ and EMBA (**Appendix D**).

4.6.1.4 Threatened Ecological Communities

No threatened ecological communities (TEC) listed under the EPBC Act are known to occur within or in the vicinity of the operational area.

One TEC occurs in the MEZ and EMBA (**Appendix D**).

4.6.2 Other Matters Protected Under the EPBC Act

4.6.2.1 Commonwealth Heritage Places

No Commonwealth Heritage places overlap the operational area.

The four that overlap the MEZ and EMBA are described in **Appendix D**.

4.6.2.2 Wetlands of National Importance

No nationally important wetlands occur within the operational area.

Seven occur within the EMBA, of which six are in the MEZ (see **Appendix D**).

4.6.2.3 Australian Marine Parks

Australian Marine Parks (AMPs) (Commonwealth reserves proclaimed under the EPBC Act in 2007 and 2013) are located in Commonwealth waters between the outer edge of State and Territory waters (generally 3 nm or ~5.5 km from the shore) and the outer boundary of Australia's exclusive economic zone (EEZ) (200 nm or ~370 km) from the shore (DNP, 2018a).

No AMPs overlap or are in the vicinity of the operational area. The closest is the Montebello AMP, which is approximately 90 km to the south-east (**Figure 4-8**). The AMPs that overlap the MEZ and EMBA are described in **Appendix D**.

4.6.3 State Marine Parks, Reserves and Management Areas

State marine parks and reserves have been progressively established in WA since 1987. Marine parks and reserves managed by the Department of Biodiversity, Conservation and Attractions (DBCA) help to conserve marine biodiversity and provide special places for people to enjoy and appreciate.

There are no State marine parks, reserves or management areas that overlap or are located in the vicinity of the operational area.

Thirty-one WA State marine parks, reserves or management areas were identified to occur within the EMBA, of which 29 are within the MEZ. An overview and summary of their conservation values are provided in **Appendix D**.

4.6.4 Key Ecological Features

Key Ecological Features (KEFs) are elements of the Commonwealth marine environment that are considered to be of importance for either a region's biodiversity or its ecosystem function and integrity. No KEFs overlap the operational area. The nearest KEF is the Ancient coastline at 125 m depth contour, located ~2.6 km to the south of the operational area (**Figure 4-9**).

Twenty-five KEFs occur within the EMBA, of which 20 are in the MEZ. Their location, values and national/regional importance are further described in **Appendix D**.

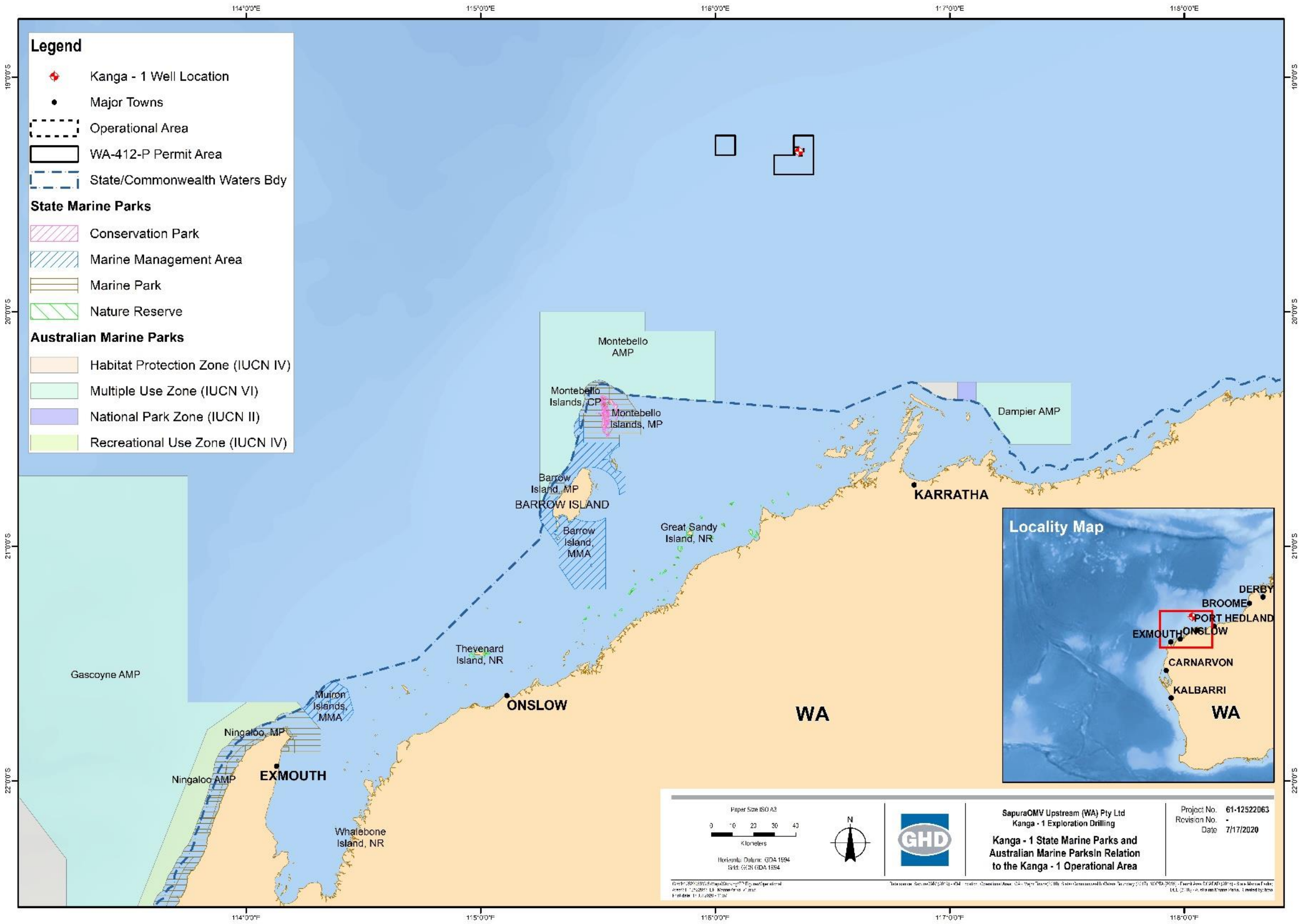


Figure 4-8 Australian and state marine parks, reserves and management areas in the vicinity of the operational area

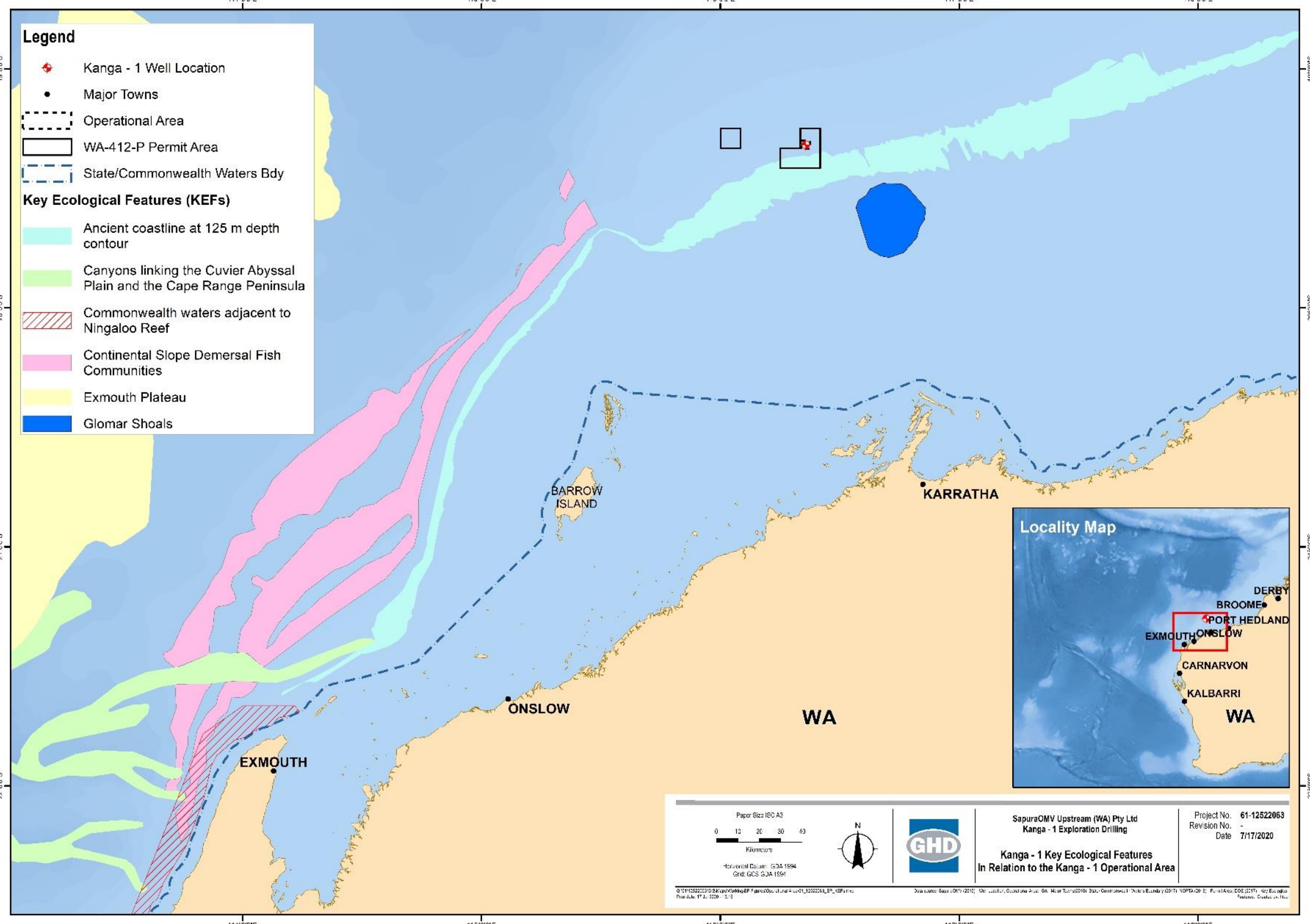


Figure 4-9 Key Ecological Features in the vicinity of the operational area

4.7 Socio-economic Environment

4.7.1 Defence Activities

The operational area does not overlap with any active defence areas.

Appendix D describes key defence areas that are present within the MEZ/EMBA.

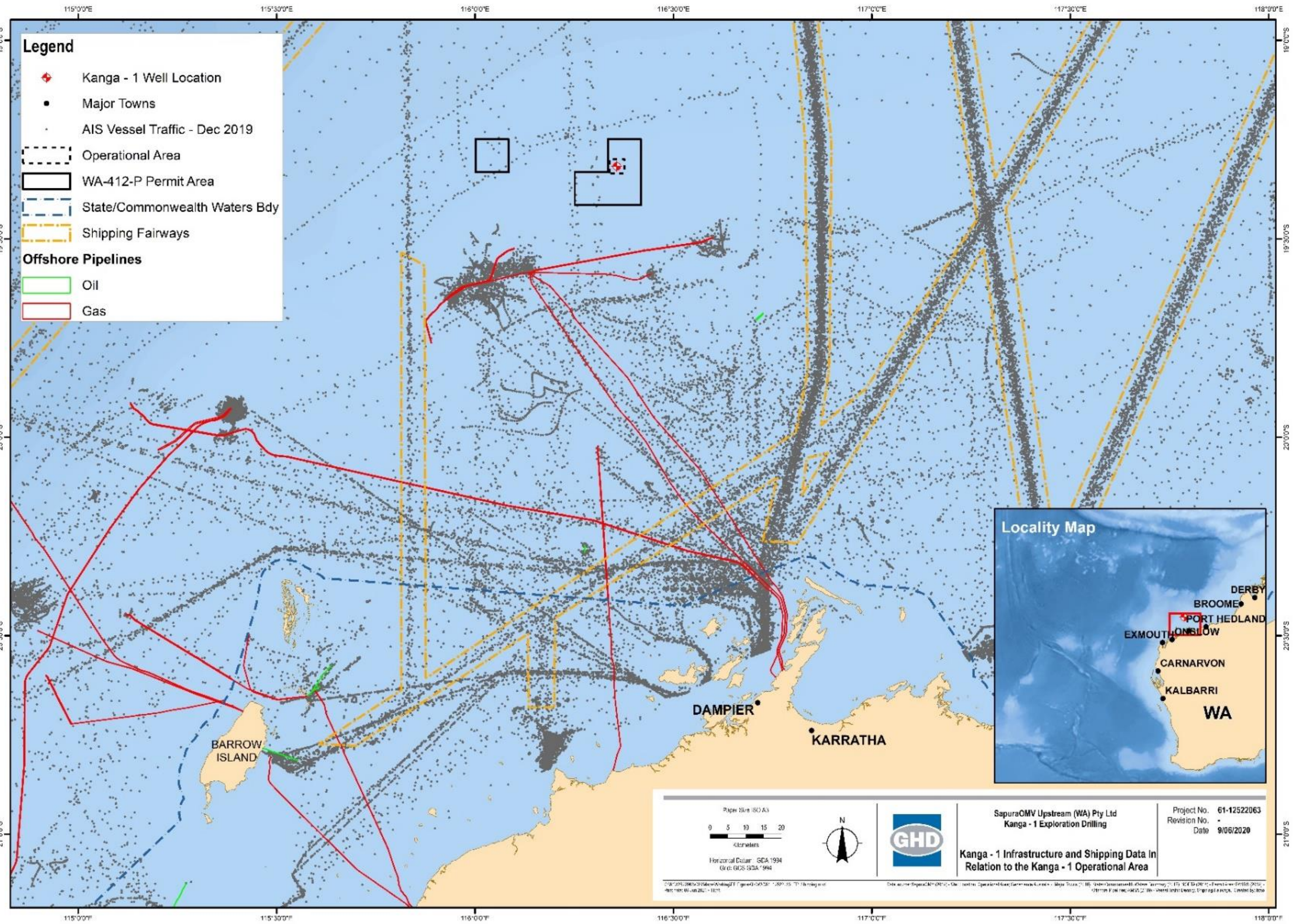


Figure 4-10 Existing petroleum infrastructure and vessel activity in the vicinity of the operational area

4.7.2 Commercial Fisheries

4.7.2.1 Commonwealth Managed Fisheries

Commonwealth fisheries are those within the 200 nm Australian Fishing Zone (AFZ), which are managed by the Australian Fisheries Management Authority (AFMA). The information on Commonwealth managed fisheries has been derived from the fisheries status ABARES reports (Patterson et al. 2019) and direct consultation with AFMA and the fishing industry (**Section 5**).

The management areas for three Commonwealth-managed fisheries overlap the operational area (**Table 4-4**; **Figure 4-11**). While these fisheries are authorised to operate in the area, consultation indicates the operational area is not of interest to these fisheries (**Section 5.8**) and no active fishing within the operational area has occurred for at least five years (**Table 4-4**). An additional five fisheries have management areas that overlap the EMBA, of which four are in the MEZ (see **Appendix D**).

Table 4-4 Commonwealth-managed commercial fisheries within the operational area

Fishery	Description	Fishing Effort
Southern Bluefin Tuna Fishery	Most of the Australian fishing effort for southern bluefin tuna is by purse-seine vessels in the Great Australian Bight and waters off South Australia (SA). The number of vessels in the purse-seine fishery has been fairly stable, ranging from five to eight since the 1994–95 fishing season. Since 2011, most fishing has occurred in the east of the Bight, closer to Port Lincoln. The number of longline vessels fishing for southern bluefin tuna off the east coast of Australia has been more variable, ranging from 11 to 24 vessels during the past 10 years. Southern bluefin tuna have been documented to spawn on the NWS between September and March, and larvae are seasonally abundant in surface waters during these months. There is no current fishing effort on the NWS (Patterson et al. 2019). **Activity:** There has been no active fishing in WA in recent years as fishing efforts are concentrated off New South Wales and SA (Patterson et al. 2019).	No
Western Skipjack Tuna Fishery	The Western Skipjack Tuna Fishery targets skipjack tuna (*Katsuwonus pelamis*) and is licensed to fish throughout WA waters. The fishery employs the purse seine, pole and line, and longline methods as its techniques. Historically, effort in has been low, and fishing effort has been focussed on southeast Australia. **Activity:** There has been no effort in this fishery since the 2008-09 fishing season, and in that season activity was concentrated off SA (Patterson et al. 2019).	No
Western Tuna and Billfish Fishery	The Western Tuna and Billfish Fishery boundary extends westward from Cape York Peninsula in Queensland, around WA, to the border between Victoria and SA. The fishery is primarily a longline fishery targeting bigeye tuna (*Thunnus obesus*), yellowfin tuna (*Thunnus albacares*), striped marlin (*Kajikia audax*) and swordfish (*Xiphias gladius*). The main fishing gear is pelagic longline with low levels of minor-line fishing. Since 2005, fewer than five vessels have been active in the fishery each year, with only 3 active in 2018 (Patterson et al. 2019). **Activity:** There has been no active commercial fishing in the operational area in the past years. This was confirmed in consultation with AFMA (**Section 5**).	No

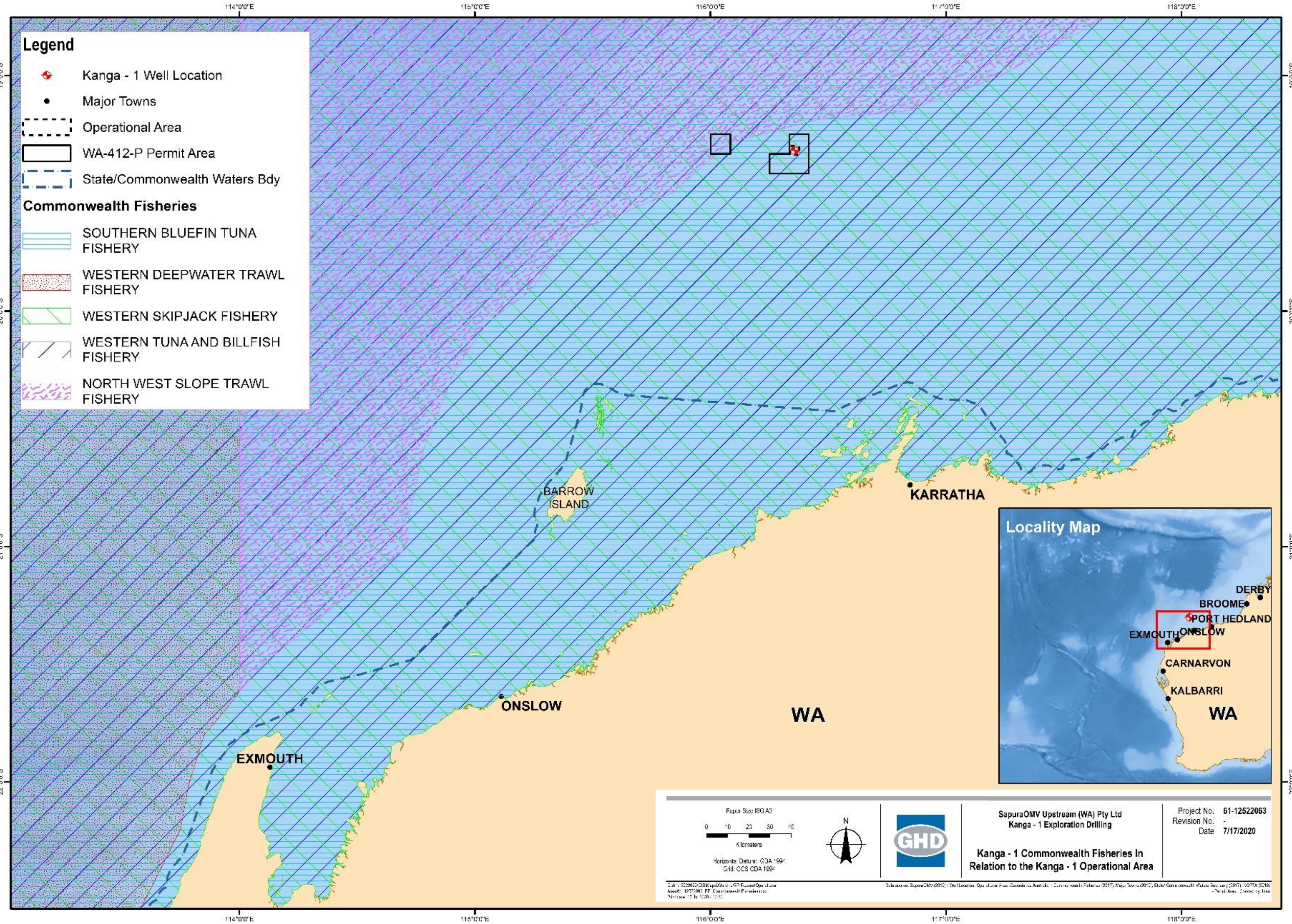


Figure 4-11 Commonwealth fisheries with management zones overlapping the operational area

4.7.2.1 State Managed Fisheries

State fisheries are managed by the Department of Primary Industries and Regional Development (DPIRD) with specific management plans, regulations and a variety of subsidiary regulatory instruments under the WA *Fish Resources Management Act 1994*. The information on State managed fisheries has been derived from the *State of Fisheries, Status Reports of the Fisheries and Aquatic Resources of Western Australia* (Gaughan et al. 2019) and direct consultation with DPIRD and the fishing industry (**Section 5**).

The management areas for 10 State managed fisheries overlap the operational area (**Table 4-5**, **Figure 4-12**). While these fisheries are authorised to operate in the operational area, no active fishing has occurred for at least five years (see **Table 4-5**).

A further 27 State managed fisheries overlap the EMBA, of which 26 are in the MEZ (**Appendix D**).

Table 4-5 State managed commercial fisheries within the operational area

Fishery	Description	Fishing Effort in Operational Area
Whole of State Fisheries		
Mackerel Managed Fishery	This fishery operates from Cape Leeuwin on the southwest coast to the WA-NT border, with most of the catch landed in the Kimberley and Pilbara regions. The fishery primarily targets Spanish mackerel (*Scomberomorus commerson*) by surface and mid-water trolling from vessels in coastal areas around reefs, shoals and headlands (WAFIC, 2020a). Jig fishing is also used to capture grey mackerel (*S. semifasciatus*). **Activity:** According to DPIRD and Fishcube data, there has been no recorded commercial fishing activity within the operational area from 2014-2019 (see **Section 5**).	No
Marine Aquarium Fish Managed Fishery	The fishery is licensed to operate on a state-wide basis throughout WA waters; however, licensees are not able to operate in any protected area. Operators are permitted to take up to 950 species of marine aquarium fishes, coral, live rock, algae, seagrass and invertebrates. The fishery operates by collection of marine aquarium species by hand, by wading or diving (scuba or hookah). This is a limited entry managed fishery with 12 licences (11 active) currently permitted to operate in WA (Newman et al. 2019a). **Activity:** The fishery is diver based, and due to the water depth of the operational area (~147 m), target species will not be present. In addition, there are special handling requirements for live fish; therefore, interaction with fishers are not expected during the Activity. According to DPIRD and Fishcube data, there has been no recorded commercial fishing activity within the operational area from 2014-2019 (see **Section 5**).	No
Specimen Shell Managed Fishery	The fishery occurs throughout coastal waters of WA based on the collection of shells for display, collection, cataloguing, sale and classification. 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. ROVs are currently being trialled under exemption instruments; these are limited to one per licence (Hart et al. 2019a). The fishery encompasses the entire WA coastline, but fishing effort is generally concentrated in areas adjacent to populated centres such as Broome, Exmouth, Perth, Mandurah and Albany (Hart et al. 2019a). The 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. Of the 31 licences in the fishery, 23 fished in 2017, and 9 licences recorded consistent activity (Hart et al. 2019a). **Activity:** Given the method by which the fishery operates, fishing activities are unlikely to occur within the operational area. According to DPIRD and	No

Fishery	Description	Fishing Effort in Operational Area
	Fishcube data, there has been no recorded commercial fishing activity within the operational area from 2014-2019 (see **Section 5**).	
North Coast Bioregion		
North Coast Shark Fishery	This fishery includes all WA waters off the north coast east of 114° 06 E longitude. **Activity:** This fishery is currently closed to protect the breeding grounds of the resource that support the two southern shark fisheries. No fishing effort since 2008/09.	No
Onslow Prawn Managed Fishery	The Onslow Prawn Managed Fishery is one of four northern prawn managed fisheries (Kimberley, Broom, Nickol Bay and Onslow) that operate in the North Coast Bioregion. Low opening otter trawl systems target western king prawns (*Penaeus latisulcatus*), brown tiger prawns (*P. esculentus*), and endeavour prawns (*Metapenaeus endeavouri*). High opening, otter trawl systems are also used when targeting banana prawns (*P. merguiensis*). The total landings in 2017 were negligible. Only 5 days of fishing effort was undertaken (one boat) in 2017 (Kangas et al*.* 2019a). **Activity:** Given the level of effort and catch in previous years, interaction with fishers are not expected during the Activity. According to DPIRD and Fishcube data, there has been no recorded commercial fishing activity within the operational area from 2014-2019 (see **Section 5**).	No
Pearl Oyster Managed Fishery	The Pearl Oyster Fishery licence area extends from 114° 10' E near Exmouth to the WA/NT border, and out to the edge of the Australian Fishing Zone (200 nm). The licence area is subdivided into four zones. Zone 1 extends from 114° 10' E to 119° 30' E. The principal fishing grounds, holding sites and pearl farms are in waters off Eighty Mile Beach and Broome. A single approved pearl farm lease is located near North Turtle Island and pearl diving activities have previously occurred in coastal waters near Port Hedland and the De Grey River mouth (Hart et al. 2019). **Activity:** Pearl oyster shell fishing has not been reported in Zone 1 since 2008 (Fletcher and Santoro, 2014), and Fishcube data confirms there has been no recorded commercial fishing activity within the operational area from 2014-2019 (see **Section 5**). Given the method by which the fishery operates, and the location of the main fishing grounds, fishing activities are not expected to occur within the operational area.	No
Pilbara Demersal Scalefish Fisheries (trap, line and trawl)	This fishery collectively use a combination of vessels, effort allocations (time), gear limits, plus spatial zones (including extensive trawl closures) as management measures. The main species landed in the Pilbara subregion are bluespotted emperor, red emperor and rankin cod (Newman et al., 2019c). It is estimated that ~10 fishers on 2 vessels were directly employed during 2017 in the trawl sector (Pilbara Fish Trawl (Interim) Managed Fishery), 8 fishers on 3 vessels in the trap sector (Pilbara Managed Trap Fishery) and at least ~15 fishers on 5 vessels in the line sector (Pilbara Line Fishery). Overall, at least ~33 people (e.g. 3-4 crew per vessel) were directly employed in this fishery. There has been no fish trawl effort allocation in Area 6 since 1998 (Newman et al. 2019b). Fishing vessels may occur around the operational area, but no fishing activity within the operational area has been recorded in recent years. The Pilbara Line Fishery fishing boat licensees are permitted to operate anywhere within "Pilbara waters", bounded by a line commencing at the intersection of 21°56' S latitude and the high water mark on the western side of the North West Cape on the mainland of WA; west along the parallel to the intersection of 21°56' S latitude and the boundary of the AFZ and north to longitude 120° E. In the 2018 season there were nine individual licences in the Pilbara Line Fishery, held by seven operators (Newman et al. 2019c).	No

Fishery	Description	Fishing Effort in Operational Area
	Activity: According to DPIRD and Fishcube data, there has been no recorded commercial fishing activity within the operational area from 2014-2019 (see **Section 5**).	
Gascoyne Coast Bioregion		
West Coast Deep Sea Crustacean Managed Fishery	The West Coast Deep Sea Crustacean resource consists primarily of Crystal (snow) (*Chaceon albus*), Champagne (spiny) (*Hypothalassia acerba*) and Giant (king) (*Pseudocarcinus gigas*) crabs. The fishery extends northward from Augusta throughout WA waters on the seaward side of the 150 m isobath out to the extent of the EEZ. It is a 'pot' fishery that uses baited pots in a long-line formation in the shelf edge waters (>150 m) of the West Coast and Gascoyne Bioregions (How and Orme, 2019a). In 2017 catches were dominated by crystal crabs. This fishery is considered to have low social amenity, and there is no recreational fishery. There were six vessels operating in 2017 (How and Orme, 2019a). Catch effort is concentrated in areas south of Exmouth. **Activity:** Given that fishing effort is concentrated south of Exmouth and in water depths greater than the operational area, interaction with fishers during the Activity is unlikely. According to DPIRD and Fishcube data, there has been no recorded commercial fishing activity within the operational area from 2014-2019 (see **Section 5**).	No
South Coast Bioregion		
Abalone Managed Fishery	The Abalone Managed Fishery includes the West Coast Roe's Abalone resource and the South Coast Greenlip / Brownlip Abalone resource. The fishery operates state-wide between the NT border and SA border. Abalone is a dive fishery and operates in shallow coastal waters (<20 m) along southern and western coasts of WA (Hart et al. 2017). **Activity:** No fishing effort or target species in the operational area, given the water depths and lack of suitable habitat. According to DPIRD and Fishcube data, there has been no recorded commercial fishing activity within the operational area from 2014-2019 (see **Section 5**).	No
South-West Coast Salmon Fishery	Commercial fishers in WA traditionally target salmon during the annual autumn 'salmon run' in March/April when large schools form nearshore and move around the coast to their spawning area on the lower west coast. Salmon fishers use a beach seine net to catch fish, however they may also be caught by rod and line from the beach. Fishers typically 'spot' large salmon schools and then use small boats to deploy nets around the schools before pulling them ashore (DPIRD, 2020b). There are currently six licences. Licensees are not restricted to specific beaches, but in practice only a few beaches are fished (DEH, 2004). In 2018 there were three active vessels in this fishery (Stewart et al. 2018). **Activity:** Given the methods of fishing and level of effort and catch in previous years, interaction with fishers are not expected during the Activity. According to DPIRD and Fishcube data, there has been no recorded commercial fishing activity within the operational area from 2014-2019 (see **Section 5**).	No

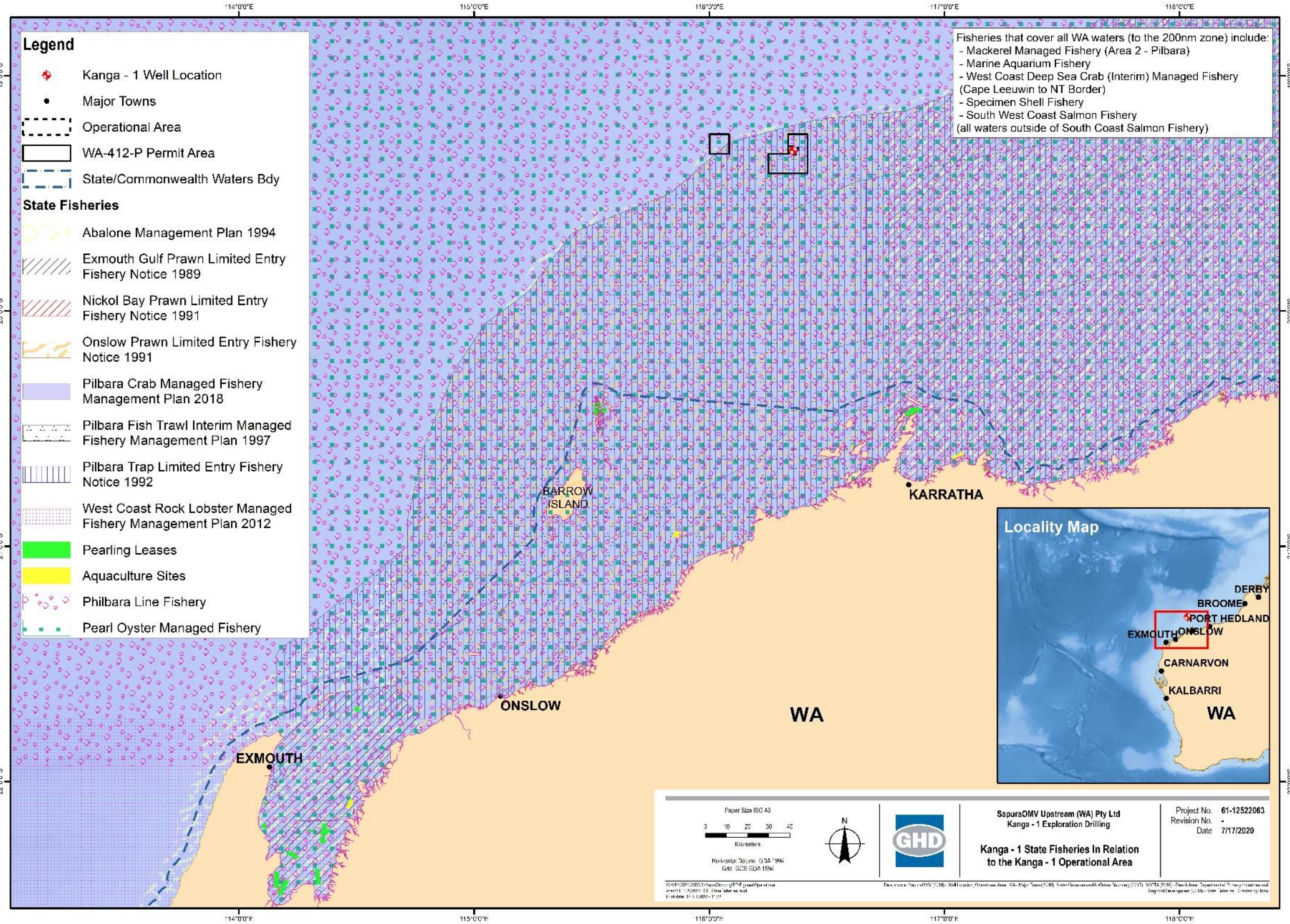


Figure 4-12 State fisheries with management zones overlapping the operational area

4.7.3 Marine Tourism and Recreation

Owing to the water depths of the operational area, distance from land and absence of seafloor features, it does not contain values for tourism or recreational fishing.

A wide range of tourism and recreation activities occur within the MEZ/EMBA, with a summary overview provided in **Appendix D**.

4.7.4 Cultural Heritage

4.7.4.1 Aboriginal Heritage Places

No known sites of aboriginal heritage significance occur within the operational area.

Multiple registered aboriginal heritage sites occur within the MEZ and EMBA. Aboriginal heritage sites in WA are protected under the *Aboriginal Heritage Act 1972*, whether or not they are registered with the Department of Planning, Lands and Heritage. **Appendix D** describes aboriginal heritage places within the MEZ/EMBA.

4.7.4.2 Underwater Cultural Heritage

There are no recorded shipwrecks in or in the vicinity of the operational area.

A description of the numerous shipwrecks listed as present in the MEZ/EMBA is provided in **Appendix D**.

4.7.5 Oil and Gas Industry

There is no active oil and gas (or any other industry) infrastructure within the operational area (**Figure 4-10**).

Various petroleum exploration and production activities and/or facilities occur within the broader MEZ/EMBA, particularly on the NWS. For example, Woodside is currently planning to undertake activities in the adjacent permit areas WA-5-L, WA-16-L and WA-3-L.

Appendix D provides an overview of the oil and gas industry in the MEZ and EMBA.

4.7.6 Shipping

AMSA has established a network of shipping fairways off the north-west coast of Australia to manage traffic patterns (AMSA, 2013). The closest recognised shipping fairway to the operational area is ~48 km to the east (**Figure 4-10**). Very little vessel traffic has been recorded in the operational area.

Appendix D describes shipping activity in the EMBA.

5. Stakeholder Consultation

SapuraOMV understands that retaining a social licence to operate depends on the development and maintenance of positive and constructive relationships with a comprehensive set of stakeholders in the community, government, non-government and business sectors.

SapuraOMV is committed to engaging with relevant persons, organisations and communities throughout the process of developing this EP and throughout the Activity in an open and honest manner. SapuraOMV strives to be transparent during consultation with relevant persons or organisations, sharing information freely to demonstrate a commitment to transparency. SapuraOMV has considered all feedback received from relevant persons or organisations for incorporation into this EP.

As required under Regulation 11A of the OPGGS(E)R, this Section demonstrates that sufficient information and an appropriate level of consultation was undertaken with relevant persons or organisations throughout the course of preparing this EP.

5.1 Regulatory Requirements and Guidelines

Regulation 11A (1) of the OPGGS(E)R identifies five groups of relevant persons who must be consulted in the course of preparing an EP:

1. Each department or agency of the Commonwealth to which the activities to be carried out under the EP, or the revision of the EP, may be relevant;
2. Each department or agency of a State or the Northern Territory (NT) to which the activities to be carried out under the EP, or the revision of the EP, may be relevant;
3. The department of the responsible State Minister, or the responsible NT Minister;
4. A person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the EP, or the revision of the EP; and
5. Any other person or organisation that the titleholder considers relevant.

In developing the EP and the stakeholder consultation process, SapuraOMV referred to guidance documents from NOPSEMA and other relevant stakeholders as follows:

- NOPSEMA
  - GN1488 – Oil pollution risk management – February 2018 (Rev2);
  - GN1785 - Petroleum activities and Australian marine parks – July 2018 (Rev0);
  - GN1344 – Environment plan content requirements– April 2019 (Rev4);
  - GL1721 – Environment plan decision making – November 2019 (Rev6);
  - NOPSEMA Bulletin #2 - Clarifying statutory requirements and good practice consultation – November 2019; and
  - GL1887 – Consultation with Commonwealth agencies with responsibilities in the Commonwealth marine area –December 2019 (Rev0).
- AFMA
  - Petroleum industry consultation with commercial fishing industry - https://www.afma.gov.au/sustainability-environment/petroleum-industry-consultation.
- DAWE
  - Fisheries and the Environment – Offshore Petroleum and Greenhouse Gas Act 2006 - https://www.agriculture.gov.au/fisheries/environment/opgga; and
  - Offshore Installation Biosecurity Guide – February 2019 (Rev1.3).
- DPIRD
  - Guidance statement for oil and gas industry consultation with the Department of Fisheries – Fisheries Occasional Publication No. 113, 2013.
- DoT
  - Offshore Petroleum Industry Guidance Note for Marine Oil Pollution: Response and Consultation Arrangements – Objective Number: A13836621 July 2020 (Rev5.0).
- DMIRS
  - Consultation Guidance Note (For the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009). Department of Mines and Petroleum. April 2012.

5.2 Consultation Approach

The following approach was used in the consultation process for this EP:

- Identification of relevant persons;
- Consultation with relevant persons;
- Assessing and managing relevant matters, objections and claims; and
- Ongoing consultation.

These elements are discussed further in the following Sections.

5.3 Identification of Relevant Persons

The relevant persons identification process commenced in January 2020. Identification of relevant persons was based on the collective experience of the project team together with desktop identification and analysis, with consideration of the proposed area of operations and potential impacts and risks. The list was also benchmarked with similar projects within close proximity of the operational area. This facilitated the development of a stakeholder register, which was further refined and continues to be reviewed and updated as the Activity planning progresses.

For the stakeholder consultation process for this EP, SapuraOMV refined the relevant persons list based on 'NOPSEMA Bulletin #2 Clarifying statutory requirements and good practice consultation' (NOPSEMA, 2019b). The stakeholder list for this EP was refined to include the following:

- Statutory agencies with responsibility or jurisdiction in the operational area or adjacent State waters that may be affected by the Activity;
- Marine user groups and interest groups active in the operational area (commercial fishers, other oil and gas producers, merchant shipping, etc); and
- Other stakeholders that may have an interest in the operational area.

The need to consult with fisheries licence holders was determined through review of catch data (e.g. FishCube) as well as consultation with AFMA, for Commonwealth managed fisheries, DPIRD, for WA State managed fisheries, and the relevant commercial fisher's industry associations.

It is acknowledged that the stakeholder environment can be dynamic. Therefore, new stakeholders may emerge and existing stakeholder concerns may change over the planning and implementation of the Activity. SapuraOMV's stakeholder register is updated as required, which allows for ongoing stakeholder identification and to support the management of stakeholder relationships regarding the Activity.

Currently identified stakeholders for this Activity and an assessment of their relevance under the OPGGS(E)R is provided in **Table 5-1**.

Table 5-1 Assessment of relevance of identified stakeholders for the Activity

Stakeholder	OPGGS(E)R Relevance	Relevance to the Activity
Commonwealth government departments/ agencies		
Australian Fisheries management Authority (AFMA)	Considered relevant person under Regulation 11A (1) (a)	Australian government agency responsible for managing Commonwealth fisheries. AFMA is a relevant agency where the Activity has the potential to impact fisheries resources. The operational area intersects with management areas for Commonwealth managed fisheries.

Stakeholder	OPGGS(E)R Relevance	Relevance to the Activity
Australian Hydrographic Office (AHO)	Considered relevant person under Regulation 11A (1) (a)	Australian government agency responsible for publishing and disseminating nautical charts and other information required for navigational safety, including the distribution of Notice to Mariners.
Australian Maritime Safety Authority (AMSA)	Considered relevant person under Regulation 11A (1) (a)	Statutory agency for maritime safety, protection of the marine environment and preventing and combatting ship-sourced pollution in the marine environment in Commonwealth waters. AMSA is a relevant agency when proposed offshore activities may impact on the safe navigation of commercial shipping in Australian waters.
Department of Agriculture, Water and the Environment (DAWE)	Considered relevant person under Regulation 11A (1) (a)	Responsible for implementing Commonwealth policies and programs for protecting and strengthening agriculture, water resources, the environment and Australia's heritage. DAWE is considered a relevant person because of its interest in protected marine fauna and biosecurity matters such as introduction of invasive marine species (IMS) that may be relevant to the Activity.
Department of Foreign Affairs and Trade (DFAT)	Considered relevant person under Regulation 11A (1) (a)	Responsible for promoting and protecting Australia's interest internationally. Responsible if the Activity poses oil spill risk that could impact international jurisdictions.
Department of Industry, Science, Energy and Resources (DISER)	Considered relevant person under Regulation 11A (1) (a)	Statutory authority responsible for providing policy advice on matters relating to exploration, investment, management and development of energy resources.
Director of National Parks (DNP)	Considered relevant person under Regulation 11A (1) (a)	Statutory authority for administration, management and control of Commonwealth marine reserves (CMR). Relevant person for: • An activity or part of the activity is within the boundaries of a proclaimed CMR. • Activities proposed to occur outside a reserve that may impact on the values within a CMR. • An environmental incident that occurs in Commonwealth waters surrounding a CMR and may impact on the values within the reserve.
National Offshore Petroleum Title Administrator (NOPTA)	Considered relevant person under Regulation 11A (1) (a)	Responsible for the day-to-day administration of petroleum and greenhouse gas titles in Commonwealth waters of Australia.
State government departments/ agencies		
Department of Biodiversity, Conservation and Attractions (DBCA)	Considered relevant person under Regulation 11A (1) (b)	Responsible for management of State marine parks and reserves and protected marine fauna and flora.
Department of Mines, Industry Regulation and Safety (DMIRS)	Considered relevant person under Regulation 11A (1) (c)	Responsible for the management of offshore petroleum activities in the adjacent State waters.
Department of Transport (DoT)	Considered relevant person under Regulation 11A (1) (b)	Responsible for oil pollution response in State waters. Oil spill modelling for the Activity predicts potential impacts to State waters from a loss of well control spill.
DPIRD	Considered relevant person under Regulation 11A (1) (b)	Responsible for managing State fisheries.
Commercial fisheries – Commonwealth managed		

Stakeholder	OPGGS(E)R Relevance	Relevance to the Activity
Southern Bluefin Tuna Fishery	Not considered relevant person under Regulations 11A (1)	Fishery management area overlaps with operational area, however consultation with AFMA, Western Australian Fishing Industry Council (WAFIC) and the Australian Southern Bluefin Tuna Industry Association (ASBTIA) confirmed that there is no fishing effort in the operational area.
Western Tuna and Billfish Fishery	Not considered relevant person under Regulations 11A (1)	Fishery management area overlaps with operational area, however consultation with AFMA, WAFIC and Tuna Australia confirmed that there is no fishing effort in the operational area.
Western Skipjack Fishery	Not considered relevant person under Regulation 11A (1)	Fishery management area overlaps with operational area, however consultation with AFMA and WAFIC confirmed that this fishery is inactive.
Commercial fisheries – State managed		
Abalone Managed Fishery	Not considered relevant person under Regulations 11A (1)	Fishery management area overlaps with operational area, however this fishery is diver based and operates in shallow coastal waters (<20 m). A review of DPIRD FishCube data and consultation with WAFIC confirmed that there is no fishing effort in the operational area.
Mackerel Managed Fishery (Area 2)	Not considered relevant person under Regulations 11A (1)	Fishery management area overlaps with operational area, however review of DPIRD FishCube data and consultation with WAFIC confirmed that there is no fishing effort in the operational area.
Marine Aquarium Fish Managed Fishery	Not considered relevant person under Regulations 11A (1)	Fishery management area overlaps with operational area, however this fishery is diver based and operates in shallow waters. A review of DPIRD FishCube data and consultation with WAFIC confirmed that there is no fishing effort in the operational area.
Onslow Prawn Managed Fishery	Not considered relevant person under Regulations 11A (1)	Fishery management area overlaps with operational area, however review of DPIRD FishCube data and consultation with WAFIC confirmed that there is no fishing effort in the operational area.
Pearl Oyster Managed Fishery	Not considered relevant person under Regulations 11A (1)	Fishery management area overlaps with operational area, however this fishery occurs predominantly in coastal waters. A review of DPIRD FishCube data and consultation with WAFIC confirmed that there is no fishing effort in the operational area.
Pilbara Demersal Scalefish Fisheries • Pilbara Fish Trawl (Interim) Managed Fishery • Pilbara Trap Managed Fishery • Pilbara Line Fishery	Not considered relevant person under Regulations 11A (1)	Fishery management area overlaps with operational area, however review of DPIRD FishCube data and consultation with WAFIC confirmed that there is no fishing effort in the operational area.
South West Coast Salmon Fishery	Not considered relevant person under Regulations 11A (1)	Fishery management area overlaps with operational area, however this fishery occurs around the coast. A review of DPIRD FishCube data and consultation with WAFIC confirmed that there is no fishing effort in the operational area.

Stakeholder	OPGGS(E)R Relevance	Relevance to the Activity
Specimen Shell Managed Fishery	Not considered relevant person under Regulations 11A (1)	Fishery management area overlaps with operational area, however this fishery occurs in coastal waters. A review of DPIRD FishCube data and consultation with WAFIC confirmed that there is no fishing effort in the operational area.
West Coast Deep Sea Crustacean Managed Fishery	Not considered relevant person under Regulations 11A (1)	Fishery management area overlaps with operational area, however this fishery is concentrated in water depths >150 m. A review of DPIRD FishCube data and consultation with WAFIC confirmed that there is no fishing effort in the operational area.
Industry representative bodies		
Australian Petroleum Production & Exploration Association (APPEA)	Considered relevant person under Regulation 11A (1) (e)	Representative body for oil and gas explorers and producers in Australia.
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	Considered relevant person under Regulation 11A (1) (e)	Represents the interest of the southern bluefin tuna industry.
Commonwealth Fisheries Association (CFA)	Considered relevant person under Regulation 11A (1) (e)	Representative body for Commonwealth fisheries. The operational area intersects with management areas for Commonwealth managed fisheries.
Pearl Producers Association (PPA)	Considered relevant person under Regulation 11A (1) (e)	Peak representative organisation of the Australian South Sea Pearling Industry.
Recfishwest	Not considered relevant person under Regulation 11A (1)	Represent interests of WA recreational fishers. No recreational fishing likely takes place in the operational area given the distance from shore.
Tuna Australia	Considered relevant person under Regulation 11A (1) (e)	Represents the interest of western tuna and billfish fishery.
Western Australian Fishing Industry Council (WAFIC)	Considered relevant person under Regulation 11A (1) (e)	Represents the interest of commercial fishers with licences to fish in State waters.
Adjacent permit operators		
BP Developments Australia Pty Ltd (BP)	Considered relevant person under Regulation 11A (1) (d)	Operator for permit WA-359-P.
Mobil Australia Resources Company Pty Ltd (Mobil)	Considered relevant person under Regulation 11A (1) (d)	Operator for permit WA-17-L.
Woodside Energy Limited (Woodside)	Considered relevant person under Regulation 11A (1) (d)	Operator for permits WA-28-P, WA-53-L and WA-16-L.
Other interested parties		
Charter Boat Operators	Not considered relevant person under Regulation 11A (1)	Given the distance of the operational area from shore, charter boats are not likely to be present or active in the operational area.
Conservation Council WA	Not considered relevant person under Regulation 11A (1)	Projects of concern are those occurring on land in WA and in State waters only.
International Fund for Animal Welfare (IFAW)	Considered relevant person under Regulation 11A (1) (e)	Actively involved in marine conservation and research projects including reducing impacts of noise from oil and gas operations on marine life.
The Wilderness Society	Considered relevant person under Regulation 11A (1) (e)	Actively involved in the protection of the WA's coastal waters.
Ningaloo Coast World Heritage Advisory Committee (NCWHAC)	Considered relevant person under Regulation 11A (1) (e)	Requested to be consulted for activities that may be of relevance to the Ningaloo Coast World Heritage Area.

5.4 Consultation with Relevant Persons for this EP

The consultation program developed as part of this EP has included provision of project information to, and seeking to enter into a dialogue with, all relevant stakeholders, to identify and understand how the proposed Activity may impact on their interests and to gain feedback and input to the assessment and management of potential impacts and risks. The consultation program for this EP included the following:

- Introductory project communications (including the Kanga-1 Project Fact Sheet – January 2020 and covering letter or email as appropriate) sent on 28 January 2020 to stakeholders initially identified through the stakeholder identification process. The communication materials sent out during this consultation included an overview of the proposed exploration drilling Activity and an invitation to provide input to the project risk assessment process.
- A follow-up project communication email (including the Kanga-1 Project Fact Sheet – June 2020) sent on 3 June 2020 to stakeholders initially identified in January 2020 and a few additional stakeholders identified as relevant to be consulted. The communication materials sent out during this consultation, provided updated details on the proposed exploration drilling Activity, associated impacts/risks and proposed management that were identified during the environmental impact identification (ENVID) workshop[4].
- Stakeholders were encouraged to provide feedback via a dedicated project email address and contact number. Consideration was given to all responses and feedback from stakeholders received prior to submission of the EP, with the provision of additional or clarifying information to stakeholders as needed.

The communications materials developed for this project, including the fact sheets, covering letters and emails, are presented in **Appendix E.** The contents of the fact sheets provided to relevant persons included:

- A summary of the background to the Activity, including SapuraOMV's role and the EP process;
- The location of the Activity, including coordinates and maps;
- A summary of the proposed Activity, including anticipated timing and duration;
- A summary of the key environmental considerations and the key management measures that SapuraOMV proposes to put in place to minimise potential impacts and risks; and
- Contact details to facilitate providing input and feedback, and to obtain further information.

All records of consultation with stakeholders are maintained by SapuraOMV in a stakeholder register.

5.5 Reasonable Time

To ensure relevant persons or organisations were allowed adequate opportunity to consider the information provided, the first fact sheet was sent out in January 2020 allowing over six months for relevant persons or organisations to respond prior to submission of the EP. All responses from stakeholders were promptly replied to. A follow up fact sheet was provided over six weeks prior to submission of the EP, and again any feedback replied to promptly. Several relevant persons or organisations did not reply to consultation attempts or replied only to acknowledge receipt of the project fact sheet(s) with no feedback on the Activity. Follow up emails and/or phone calls to select stakeholders were undertaken to confirm receipt of fact sheets and/or encourage

[4] Kanga-1 Project Fact Sheet – April 2020 was sent to stakeholders on 21 April 2020 and included details of the pre-drilling site survey Activity that was covered in a seperate EP and is therefore not discussed further here.

responses to information provided. SapuraOMV considers that a reasonable time period for consultation has been provided to all relevant persons and organisations.

5.6 Outcomes

SapuraOMV is satisfied that it has provided sufficient information, time and opportunity to allow relevant persons and organisations to make an informed assessment of the possible impacts and risks of the Kanga-1 exploration well Activity on their functions, interests or activities. In the context of the nature and scale of the Activity, the environmental sensitivities and values of the area (**Section 4** and **Appendix D**), and the outcomes of the impact and risk assessments in **Sections 7** and **8**, SapuraOMV is satisfied that no further attempts to contact relevant persons or organisations to the Activity who have not responded so far is required. Those stakeholders who have responded and wish to be kept informed during the ongoing consultation process, will receive update notifications at key milestones (e.g. clarification of mobilisation timing prior to commencement of operations, on completion of the Activity). Those who have not responded will be consulted with if they choose to contact SapuraOMV based on information provided through past notifications.

5.7 Managing Relevant Matters, Objections and Claims

During the stakeholder consultation process, all correspondence received from stakeholders was assessed by SapuraOMV for information that may be relevant to the Activity, or for objections or claims that may be of merit. The following categories were used in the assessment of merit/ relevance of objections or claims:

- Objection or claims with merit - An objection or claim raised that is relevant to both the planned Activity and the stakeholders function, activities or interest. The matter is considered to be of merit if there is a reasonable/ scientific basis for related effects or impacts likely to occur and/ or there is reasonable basis for the matter to be addressed in the EP;
- Objection or claims without merit - An objection or claim raised that may be relevant to the planned Activity or the stakeholders function, activities or interest, but with no credible or scientific basis;
- Relevant matter - A matter raised that does not fit the description for claims or concerns with/ without merit. However, it is considered a matter relevant to the planned Activity and comprises a request to SapuraOMV for further relevant information, or provides SapuraOMV with information that may be relevant to the Activity or the EP; and
- Irrelevant matter - A matter raised that does not relate to the planned Activity or the stakeholder's function, interest or activities being affected by the Activity. Irrelevant matters may also be general with no specific issues.

Relevant matters, objections or claims with merit are addressed by SapuraOMV in this EP. SapuraOMV also responded to all objection and claims via email and advised the stakeholder of how any issue raised was addressed in the EP. Stakeholders were also encouraged to provide further feedback on the Activity.

5.8 Consultation Results

A summary of all consultation undertaken with relevant persons or organisations, and the full assessment of relevance and merit of any feedback, are provided in **Table 5-2**. The actual record of correspondence is provided in a 'Sensitive Information Report' that is submitted to NOPSEMA separate to this EP.

Table 5-2 Consultation summary for Activity

Stakeholder	Summary of stakeholder and titleholder correspondence, and any objections and claims made	Assessment of stakeholder objections and claims
Commonwealth government departments/agencies		
AFMA	AFMA was contacted on 15 January 2020 with details on the Activity and operational area and to enquire if the following fisheries that overlap the operational area were active: • Southern Bluefin Tuna Fishery • Western Tuna and Billfish Fishery • Western Skipjack Fishery AFMA responded on 29 January 2020 confirming no active fishing in the operational area in the last 12 months. AFMA was provided the Kanga-1 Project Fact Sheet - January 2020 and a cover letter introducing SapuraOMV and the Activity via email on 28 January 2020. AFMA was provided the Kanga-1 Project Fact Sheet - April 2020 via email on 21 April 2020. AFMA responded on 22 April 2020 suggesting SapuraOMV consults with fishers licenced in the operational area either directly or via relevant fishing industry associations. SapuraOMV responded on 5 May 2020 confirming that the relevant fishing industry associations had been contacted. AFMA was contacted on 1 May 2020 to enquire if there has been any fishing in the operational area in the last 5 years. AFMA responded on 8 May 2020 advising of no fishing activity in the operational area in the last 5 years. AFMA was provided the Kanga-1 Project Fact Sheet - June 2020 via email on 3 June 2020.	Relevant matter – considered when deciding the level of consultation required for Commonwealth Fisheries. SapuraOMV consulted with relevant fishing industry associations.
AHO	AHO was provided the Kanga-1 Project Fact Sheet - January 2020 and a cover letter introducing SapuraOMV and the Activity via email on 28 January 2020. AHO acknowledged receipt of information on 7 February 2020. AHO was provided the Kanga-1 Project Fact Sheet - April 2020 via email on 21 April 2020. AHO acknowledged receipt of information on 22 April 2020. AHO was provided the Kanga-1 Project Fact Sheet - June 2020 via email on 3 June 2020. AHO acknowledged receipt of information on 4 June 2020.	No objections/ claims with merit raised. SapuraOMV considers the level of consultation to be adequate and will address any comments from this stakeholder should they arise in the future.
AMSA	AMSA was provided the Kanga-1 Project Fact Sheet - January 2020 and a cover letter introducing SapuraOMV and the Activity via email on 28 January 2020. AMSA responded on 29 January 2020 advising: • 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. JRCC will also need to be advised when operations start and end.	Relevant matter – AMSA notification included in **Section 7.1** of the EP. Vessel traffic map presented in **Figure 4-10**.

Stakeholder	Summary of stakeholder and titleholder correspondence, and any objections and claims made	Assessment of stakeholder objections and claims
	• SapuraOMV should contact the 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 activities. • To obtain a vessel traffic plot showing Automatic Identification System (AIS) traffic data for the area of interest, please visit AMSA's spatial data gateway and Spatial@AMSA portal to download digital data sets and maps. AMSA was provided the Kanga-1 Project Fact Sheet – April 2020 via email on 21 April 2020. AMSA was provided the Kanga-1 Project Fact Sheet – June 2020 via email on 3 June 2020.	
DAWE	DAWE was provided the Kanga-1 Project Fact Sheet - January 2020 and a cover letter introducing SapuraOMV and the Activity via email on 28 January 2020. DAWE was provided the Kanga-1 Project Fact Sheet – April 2020 via email on 21 April 2020. DAWE was provided the Kanga-1 Project Fact Sheet – June 2020 via email on 3 June 2020. DAWE responded on 4 June 2020 noting the information provided. DAWE requested to be informed of future developments relating to this Activity. DAWE also advised that AFMA and the relevant fishing associations operating in Commonwealth fisheries be consulted throughout the Activity. SapuraOMV responded on 8 June 2020 assuring DAWE that they will be informed on future developments relating to this Activity. SapuraOMV also confirmed that AFMA and the relevant fishing associations have been contacted.	Relevant matter – consultation with AFMA and fishing associations relevant to the Commonwealth fisheries overlapping the operational area was undertaken.
DFAT	DFAT was provided the Kanga-1 Project Fact Sheet - January 2020 and a cover letter introducing SapuraOMV and the Activity via email on 28 January 2020. DFAT was provided the Kanga-1 Project Fact Sheet – April 2020 via email on 21 April 2020. DFAT was provided the Kanga-1 Project Fact Sheet – June 2020 via email on 3 June 2020. No response received to date.	No objections/ claims with merit raised. SapuraOMV considers the level of consultation to be adequate and will address any comments from this stakeholder should they arise in the future.
DISER	DISER was provided the Kanga-1 Project Fact Sheet - January 2020 and a cover letter introducing SapuraOMV and the Activity via email on 28 January 2020. DISER was provided the Kanga-1 Project Fact Sheet – April 2020 via email on 21 April 2020. DISER was provided the Kanga-1 Project Fact Sheet – June 2020 via email on 3 June 2020. No response received to date.	No objections/ claims with merit raised. SapuraOMV considers the level of consultation to be adequate and will address any comments from this stakeholder should they arise in the future.
DNP	DNP was provided the Kanga-1 Project Fact Sheet - January 2020 and a cover letter introducing SapuraOMV and the Activity via email on 28 January 2020. DNP responded on 2 February 2020 advising that the planned activities do not overlap any AMPs and therefore there are no authorisation requirements from DNP. To assist in the preparation of an EP for petroleum activities that may affect AMPs, NOPSEMA and Parks Australia have developed and published a guidance note that outlines items to consider and evaluate. In preparing the EP, SapuraOMV is to consider the AMPs and their representativeness. SapuraOMV is to ensure that the EP:	Relevant matter – Australian marine parks and Management Plans relevant to the Activity are discussed in **Section 4.6.2.3** of the EP. Emergency response reporting requirements have been included in Section 3.2 of the Kanga-1 Exploration Well OPEP for a Crude

Stakeholder	Summary of stakeholder and titleholder correspondence, and any objections and claims made	Assessment of stakeholder objections and claims
	• Identifies and manages all impacts and risks on AMP values (including ecosystem values) to an acceptable level and considers all options to avoid or reduce them to ALARP. • Clearly demonstrates that the Activity will not be inconsistent with the management plan. DNP advised that: • The Northwest Marine Parks Network Management Plan 2018 came into effect on 1 July 2018 and provides further information on values for Cartier Island, Ashmore Reef and Kimberley marine parks. • AMP values are defined into four categories: natural (including ecosystems), cultural, heritage and socio-economic. • Information on the values for AMPs is located on the Australian Marine Parks Science Atlas. DNP confirmed that no further notification of progress made in relation to the Activity was required unless details regarding the Activity changes and results in an overlap with or new impact to an AMP, or for emergency response. In regards to emergency response, DNP advised: • They should be made aware of oil/ gas pollution incidents that occur within an AMP or are likely to impact on an AMP as soon as possible. • Notification should be provided to the 24 hour Marine Compliance Duty Officer and should include: – Titleholder details. – Time and location of the incident (including name of AMP likely to be affected). – Proposed response arrangements as per the Oil Pollution Emergency Plan (eg. dispersant, containment, etc.). – Confirmation of providing access to relevant monitoring and evaluation reports when available. – Contact details for response coordinator. SapuraOMV responded on 12 March 2020 thanking the DNP for confirming that no authorisation from the DNP is required to undertake the Activity and that no further notification of progress made in relation to the Activity is required, unless there is a change to the Activity that would result in an overlap with, or new impacts to a AMP or for emergency response purposes. DNP was provided the Kanga-1 Project Fact Sheet – April 2020 via email on 21 April 2020. DNP responded on 15 May 2020 in the same manner as 2 February 2020 with the additional comments: The Northwest Marine Parks Network Management Plan 2018 came into effect on 1 July 2018 and provides further information on values for Montebello Marine Park. SapuraOMV responded to thank DNP for providing the feedback on 18 May 2020. DNP was provided the Kanga-1 Project Fact Sheet – June 2020 via email on 3 June 2020. DNP responded on 10 June 2020 confirming that the advice provided on 15 May 2020 is still current and that they do not need further notification on the progress made in relation to the Activity unless details regarding the Activity change and result in an overlap with or new impact to a marine park, or for emergency responses.	Oil Spill (Doc No.: AU-HSE-KG1-EX-PLN-037) (**Appendix F**).

Stakeholder	Summary of stakeholder and titleholder correspondence, and any objections and claims made	Assessment of stakeholder objections and claims
NOPTA	NOPTA was provided the Kanga-1 Project Fact Sheet - January 2020 and a cover letter introducing SapuraOMV and the Activity via email on 28 January 2020. NOPTA was provided the Kanga-1 Project Fact Sheet – April 2020 via email on 21 April 2020. NOPTA was provided the Kanga-1 Project Fact Sheet – June 2020 via email on 3 June 2020. No response received to date.	No objections/ claims with merit raised. SapuraOMV considers the level of consultation to be adequate and will address any comments from this stakeholder should they arise in the future.
State government departments/agencies		
DBCA	DBCA was provided the Kanga-1 Project Fact Sheet - January 2020 and a cover letter introducing SapuraOMV and the Activity via email on 28 January 2020. DBCA responded on 3 February 2020 advising that DBCA has no comments in relation to its responsibilities under the *Biodiversity Conservation Act 2016* and the *Conservation and Land Management Act 1984*. DBCA advised SapuraOMV to continue to provide notifications to them. DBCA was provided the Kanga-1 Project Fact Sheet – April 2020 via email on 21 April 2020. SapuraOMV contacted the DBCA on 26 May 2020 via telephone to enquire if the DBCA had comments/ feedback about the Kanga-1 Activity based on the latest fact sheet. DBCA advised that they typically only respond to the first email from an operator and provide their comments/ feedback then. Follow-up emails or subsequent provision of information from an operator will usually not be responded to unless the DBCA wanted to raise a matter that was not raised in the initial email from them. DBCA was provided the Kanga-1 Project Fact Sheet – June 2020 via email on 3 June 2020.	No objections/ claims with merit raised. SapuraOMV considers the level of consultation to be adequate and will address any comments from this stakeholder should they arise in the future.
DMIRS	DMIRS was provided the Kanga-1 Project Fact Sheet - January 2020 and a cover letter introducing SapuraOMV and the Activity via email on 28 January 2020. DMIRS was provided the Kanga-1 Project Fact Sheet – April 2020 via email on 21 April 2020. DMIRS was provided the Kanga-1 Project Fact Sheet – June 2020 via email on 3 June 2020. No response received to date.	No objections/ claims with merit raised. SapuraOMV considers the level of consultation to be adequate and will address any comments from this stakeholder should they arise in the future.
DoT	DoT was provided the Kanga-1 Project Fact Sheet - January 2020 and a cover letter introducing SapuraOMV and the Activity via email on 28 January 2020. DoT responded on 5 February 2020 advising that if there is a risk of a spill impacting State waters, the DoT is to be consulted as outlined in the DoT Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (September 2018). DoT was provided the Kanga-1 Project Fact Sheet – April 2020 via email on 21 April 2020. DoT was provided the Kanga-1 Project Fact Sheet – June 2020 via email on 3 June 2020. DoT responded on 9 June 2020 advising they had no further comments than was already provided in February 2020. DoT provided with OPEP Rev0 on 2 July 2020. DoT responded with review comments on OPEP Rev0 on 12 August 2020.	Relevant matter – DoT consulted as per the DoT Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (September 2018; updated July 2020 during consultation).

Stakeholder	Summary of stakeholder and titleholder correspondence, and any objections and claims made	Assessment of stakeholder objections and claims
	DoT provided with response to address review comments on 24 August 2020. DoT responded on 1 September 2020 advising that they did not have futher queries and requested for a finalised version of the OPEP.	
DPIRD	DPIRD was contacted on 14 January 2020 to request FishCube data for 2015-2019. DPIRD responded on 15 January 2020 advising the following: • Data for 2019 is yet to be finalised and therefore DPIRD proposed providing FishCube data for 2014 – 2018 instead. • The data requested is quite specific (5 nm x 5 nm blocks and by the month). This will result in a lot of confidential data on weight of fish caught as the number of vessels active in the area per month is very low. DPIRD proposed providing data for the entire 5 years instead. • There isn't any fishing activity in the two 5 nm x 5 nm blocks selected, but some fisheries are active within the 60 nm x 60 nm blocks. It seems like the operational area is closed to fishing and therefore it is very unlikely for any fishing activities to occur there. SapuraOMV responded to DPIRD on 15 January 2020 advising: • Data from 2014 to 2018 was acceptable given that the 2019 data was yet to be finalised. • Annual (instead of monthly) data is sufficient. • If the area is closed for fishing does that mean that there is no data for the area requested? DPIRD responded on 15 January 2020 advising that they have no recorded commercial or tour operator fishing activity in the 5 nm x 5 nm blocks where the operational area is located for years 2014 – 2018. DPIRD was provided the Kanga-1 Project Fact Sheet - January 2020 and a cover letter introducing SapuraOMV and the Activity via email on 28 January 2020. DPIRD was provided the Kanga-1 Project Fact Sheet – April 2020 via email on 21 April 2020. SapuraOMV followed up with DPIRD on 21 April 2020 to enquire if the 2019 fisheries data had become available. DPIRD responded on 8 May 2020 advising that FishCube has been refreshed with 2019 commercial data. SapuraOMV responded on 8 May 2020 enquiring if there has been any fishing activity in the operational area in 2019. DPIRD responded on 11 May 2020 advising that they have no records of commercial or tour operator fishing activity in the operational area for the year 2019. DPIRD was provided the Kanga-1 Project Fact Sheet – June 2020 via email on 3 June 2020.	Relevant matter – considered when deciding if State fishers needed to be consulted. The absence of fishing in the operational area was discussed in **Section 4.7.2.1** of the EP. SapuraOMV considers the level of consultation to be adequate and will address any comments from this stakeholder should they arise in the future.
Industry representative bodies		
APPEA	APPEA was provided the Kanga-1 Project Fact Sheet - January 2020 and a cover letter introducing SapuraOMV and the Activity via email on 28 January 2020. APPEA was provided the Kanga-1 Project Fact Sheet – April 2020 via email on 21 April 2020.	No objections/ claims with merit raised. SapuraOMV considers the level of consultation to be adequate and will address

Stakeholder	Summary of stakeholder and titleholder correspondence, and any objections and claims made	Assessment of stakeholder objections and claims
	APPEA was provided the Kanga-1 Project Fact Sheet – June 2020 via email on 3 June 2020. No response received to date.	any comments from this stakeholder should they arise in the future.
ASBTIA	ASBTIA was provided the Kanga-1 Project Fact Sheet - January 2020 and a cover letter introducing SapuraOMV and the Activity via email on 28 January 2020. ASBTIA was provided the Kanga-1 Project Fact Sheet – April 2020 via email on 21 April 2020. SapuraOMV contacted ASBTIA on 29 April 2020 via telephone to enquire if they represented the Western Tuna and Billfish Fishery, as was suggested by an industry member. ASBTIA advised that Tuna Australia was the relevant association and that the Southern Bluefin Tuna Fishery does not have any fishing activity in the operational area. SapuraOMV contacted ASBTIA on 30 April 2020 via telephone to confirm they had no concerns about the Activity. ASBTIA confirmed that they did not have any concerns and that the Southern Bluefin Tuna Fishery does not have any fishing activity in the operational area. The ASBTIA followed this up with an email on 30 April 2020 and requested that they be removed from the stakeholder list.	No objections/ claims with merit raised. Stakeholder will not be consulted further and will be removed from the stakeholder list for this Activity.
CFA	CFA was provided the Kanga-1 Project Fact Sheet - January 2020 and a cover letter introducing SapuraOMV and the Activity via email on 28 January 2020. CFA was provided the Kanga-1 Project Fact Sheet – April 2020 via email on 21 April 2020. SapuraOMV contacted CFA on 1 May 2020 via telephone to enquire if CFA had any concerns about the Activity. CFA confirmed that they did not have any concerns and therefore did not require further consultation on the Activity. CFA enquired if SapuraOMV has contacted ASBTIA and Tuna Australia who are fishing industry associations who may have interest in the Activity. SapuraOMV confirmed existing consultation with ASBTIA and Tuna Australia. CFA followed this up with an email on 1 May 2020. CFA was provided the Kanga-1 Project Fact Sheet – June 2020 via email on 3 June 2020.	Relevant matter – request to consult with ASBTIA and Tuna Australia considered and undertaken. SapuraOMV considers the level of consultation to be adequate and will address any comments from this stakeholder should they arise in the future.
PPA	PPA was provided the Kanga-1 Project Fact Sheet - January 2020 and a cover letter introducing SapuraOMV and the Activity via email on 28 January 2020. PPA was provided the Kanga-1 Project Fact Sheet – April 2020 via email on 21 April 2020. PPA was provided the Kanga-1 Project Fact Sheet – June 2020 via email on 3 June 2020. No response received to date.	No objections/ claims with merit raised. SapuraOMV considers the level of consultation to be adequate and will address any comments from this stakeholder should they arise in the future.
Tuna Australia	SapuraOMV contacted Tuna Australia via email on 29 April 2020 to confirm whether they represented the Western Tuna and Billfish Fishery, to introduce the Activity and enquire if there was any planned fishing activity in the operational area. Tuna Australia confirmed they represented the fishery and requested further details so they could discuss any future fishing activity in the area with their members. Tuna Australia was provided with Kanga-1 Project Fact Sheet – January 2020 and Kanga-1 Project Fact Sheet – April 2020 via email on 30 April 2020. Tuna Australia responded that the area presented no issues for the fishery as important grounds are further south. Concern was raised that in the event of a loss of well control during drilling and currents would likely carry spilled oil south and expose tuna fisheries. Further detail on how a loss of well control incident would be managed was requested. SapuraOMV provided further information and committed to keeping Tuna Australia informed regarding the Activity.	Relevant matter – further information provided to Tuna Australia on how a loss of well control incident will be managed. Potential for loss of well control to affect commercial fisheries addressed in **Section 8.1**.

Stakeholder	Summary of stakeholder and titleholder correspondence, and any objections and claims made	Assessment of stakeholder objections and claims
	Tuna Australia was provided the Kanga-1 Project Fact Sheet – June 2020 via email on 3 June 2020.	
WAFIC	SapuraOMV contacted WAFIC on 14 April 2020 via email regarding the Activity and that AFMA and DPIRD advised of no commercial fishing activity in the operational area. WAFIC contacted SapuraOMV via telephone shortly after the email was sent to request for a map and copy of correspondence with DPIRD. The information was provided in a follow up email later that afternoon on the 14 April 2020. SapuraOMV contacted WAFIC on 22 April 2020 via email to determine if they had any comments on the Activity. WAFIC advised they were busy with COVID-19 initiatives and need more time to reply. SapuraOMV contacted WAFIC on 12 May 2020 to advise that DPIRD confirmed no commercial fishing activity in the operational area and CFA's request that they do not require additional consultation for the Activity. WAFIC responded on 13 May 2020 and acknowledged that there was no active State or Commonwealth fisheries in the operational area. WAFIC confirmed that no further consultation is required with the commercial fishing sector. WAFIC requested SapuraOMV's acknowledgement of the following and inclusion in the EP: • No recreational fishing from support/ commercial vessels. • Understanding of the difference between exclusion zones and cautionary zones amongst SapuraOMV's staff, contractors and sub-contractors. • Communication with all staff about protecting the rights of active commercial fishers on the waters. SapuraOMV responded to WAFIC on 15 May 2020 to confirm that no further consultation with the commercial fishing sector is required for the Kanga-1 project. SapuraOMV acknowledged the following: • There will be no recreational fishing from support/ commercial vessels - this will be reinforced in the EP. • SapuraOMV will have temporary exclusion zones and cautionary zones in place during drilling, per the AHP20 Mariner's Handbook for Australian Waters, Australian Hydrographic Office (April 2020). Commercial fishing is not expected in the operational area so it not likely to have any implications to the Activity. As professional mariners, vessel contractors are aware of the respective requirements. • Interaction with active commercial fishers is not expected in the operational area. Nevertheless, vessels are required to abide by Australian maritime law and AMSA guidelines at all times. WAFIC was provided the Kanga-1 Project Fact Sheet – June 2020 via email on 3 June 2020.	Relevant matter – matters raised that are relevant to the Activity included in **Section 7.1** of the EP. SapuraOMV considers the level of consultation to be adequate and will address any comments from this stakeholder should they arise in the future.
Adjacent permit operators		
BP	BP was provided the Kanga-1 Project Fact Sheet - April 2020 via email on 21 April 2020. BP was provided the Kanga-1 Project Fact Sheet – June 2020 via email on 3 June 2020. No response received to date.	No objections/ claims with merit raised. SapuraOMV considers the level of consultation to be adequate and will address any comments from this stakeholder should they arise in the future.
Mobil	Mobil was provided the Kanga-1 Project Fact Sheet - April 2020 via email on 21 April 2020.	No objections/ claims with merit raised.

Stakeholder	Summary of stakeholder and titleholder correspondence, and any objections and claims made	Assessment of stakeholder objections and claims
	Mobil was provided the Kanga-1 Project Fact Sheet – June 2020 via email on 3 June 2020. No response received to date.	SapuraOMV considers the level of consultation to be adequate and will address any comments from this stakeholder should they arise in the future.
Woodside	SapuraOMV received consultation material from Woodside on 27 February 2020 in regards to the Greater Western Flank Phase-3 and Lambert Deep Drilling and Subsea Installation project. SapuraOMV responded to Woodside on 20 March 2020 to inform them about the upcoming Kanga-1 project. Woodside was provided the Kanga-1 Project Fact Sheet - April 2020 via email on 21 April 2020. Woodside was provided the Kanga-1 Project Fact Sheet – June 2020 via email on 3 June 2020. No response received to date.	No objections/ claims with merit raised. SapuraOMV considers the level of consultation to be adequate and will address any comments from this stakeholder should they arise in the future.
Other interested parties		
IFAW	IFAW was provided the Kanga-1 Project Fact Sheet - January 2020 and a cover letter introducing SapuraOMV and the Activity via email on 28 January 2020. IFAW was provided the Kanga-1 Project Fact Sheet – April 2020 via email on 21 April 2020. IFAW responded on 24 April 2020 advising that they have no capacity to respond at present and will respond at a later date. SapuraOMV contacted IFAW on 1 May 2020 and 18 May 2020 requesting feedback by 19 May 2020 so it could be addressed during the EP development. SapuraOMV also advised that comments or feedback received at any time prior to or during the Activity are also welcomed and will be duly considered and responded to. IFAW was provided the Kanga-1 Project Fact Sheet – June 2020 via email on 3 June 2020. No response received to date.	No objections/ claims with merit raised. SapuraOMV considers the level of consultation to be adequate and will address any comments from this stakeholder should they arise in the future.
The Wilderness Society	The Wilderness Society was provided the Kanga-1 Project Fact Sheet - January 2020 and a cover letter introducing SapuraOMV and the Activity via email on 28 January 2020. The Wilderness Society was provided the Kanga-1 Project Fact Sheet – April 2020 via email on 21 April 2020. The Wilderness Society was provided the Kanga-1 Project Fact Sheet – June 2020 via email on 3 June 2020. No response received to date.	No objections/ claims with merit raised. SapuraOMV considers the level of consultation to be adequate and will address any comments from this stakeholder should they arise in the future.
NCWHAC	NCWHAC was provided the Kanga-1 Project Fact Sheet – January 2020 and Kanga-1 Project Fact Sheet – April 2020 via email on 28 April 2020. NCWHAC was provided the Kanga-1 Project Fact Sheet – June 2020 via email on 3 June 2020. No response received to date.	No objections/ claims with merit raised. SapuraOMV considers the level of consultation to be adequate and will address any comments from this stakeholder should they arise in the future.

5.9 Ongoing Consultation

Ongoing consultation allows for SapuraOMV to maintain a comprehensive view of stakeholder functions, interests and activities, and provide a forum for enquiries, objections and claims by relevant persons in the lead up to and during the conduct of the Activity. SapuraOMV has a process for ongoing stakeholder engagement and any concerns raised by stakeholders subsequent to this EP submission will be duly considered and addressed. The following will apply as part of the ongoing consultation process:

- SapuraOMV will maintain a dedicated email address to enable ongoing communication by stakeholders throughout the Activity (kanga.australia@sapura-omv.com).
- SapuraOMV will provide notifications to relevant persons at key project milestones in accordance with **Table 5-3**.
- If SapuraOMV becomes aware of a change in the potential to affect a relevant person or organisation's functions, interests or activities, or the control measures identified in this EP are found to be less adequate than currently understood, SapuraOMV will contact the relevant person(s) concerned and provide sufficient information regarding the change and provide reasonable time for responses and to address any new concerns that arise.
- If SapuraOMV becomes aware of the potential to affect a relevant person's functions, interests or activities at any time during the Activity that was not identified prior to commencing the Activity, SapuraOMV will immediately attempt to contact and consult with the relevant person(s).
- If ongoing consultation identifies a significant new environmental impact or risk, or a significant increase in an already identified impact or risk, the Management of Change process (**Section 9.4.7**) will be triggered.

SapuraOMV will provide updates and advise of any material changes to the Activity if they arise as planning and implementation processes progress. Notifications/consultations required for this Activity are outlined in **Table 5-3**.

Table 5-3 Notifications/ consultations required for the Activity

Stakeholder	Purpose of Notification/ Consultation	Notification/ Consultation Method	Timing
AMSA	Notify AMSA's Joint Rescue Coordination Centre (JRCC) prior to commencement of the Activity with vessel/MODU details (name, call sign and Maritime Mobile Service Identity (MMSI)), satellite communication details (including INMARSAT-C and satellite telephone), area of operation and requested clearance required from other vessels, and Activity start and end date to allow promulgation of radio-navigation warnings.	Email to: rccaus@amsa.gov.au Phone: 1800 641 792/ +612 6230 6811	Within 24–48 hours prior to commencement of the Activity.
	Advise AMSA's JRCC at completion of the Activity.	Email to: rccaus@amsa.gov.au	Immediately following completion of the Activity.
AHO	Notify AHO prior to commencement of the Activity to allow promulgation of related Notices to Mariners.	Email to: datacentre@hydro.gov.au	At least 4 working weeks prior to commencement of the Activity.
DMIRS	Notify DMIRS prior to commencement and after cessation of the Activity.	Email to: petroleum.environment@ dmirs.wa.gov.au	~1 week prior to commencement date and within 1 week after cessation of Activity.

Stakeholder	Purpose of Notification/ Consultation	Notification/ Consultation Method	Timing
NOPSEMA	Notify NOPSEMA of Activity commencement and completion, using Regulation 29 – Start or end of an activity notification form available at: https://www.nopsema.gov.au/environmentalmanagement/notification-and-reporting/	Email to: submissions@nopsema.gov.au	At least 10 days prior to commencement and within 10 days of completion of Activity.
	Notify NOPSEMA of the end of operation of the EP, using Regulation 25A – End of operation of environment plan notification from available at: https://www.nopsema.gov.au/environmentalmanagement/notification-and-reporting/		At the end of operation of the EP.
Other Stakeholders (refer to **Section 5.6**)	Notify of key Activity milestones	Email	e.g. mobilisation timing prior to start of operations, Activity completion.

6. Environmental Impact and Risk Assessment

In accordance with Regulation 13(5) of the OPGGS(E)R, an environmental risk assessment was undertaken to evaluate impacts and risks arising from the Activity described in **Section 3**. This Section describes the process undertaken by SapuraOMV to identify, assess and manage all potential environmental impacts and risks associated with the Kanga-1 exploration well campaign from planned activities and from unplanned events.

The impact and risk assessment process takes account of the nature and scale of the Activity, and all potential environmental impacts that may or will occur directly or indirectly from planned activities (routine) and from unplanned events. In addition, the process demonstrates how the introduction of appropriate control and management measures will effectively manage potential impacts and risks to ALARP and acceptable levels.

The outcomes of the assessment are presented in **Section 7** for planned activities and **Section 8** for unplanned events.

6.1 Assessment Methodology

SapuraOMV's HSE Management System (HSE-MM-MAN-0001) and Risk Management Procedure (AU-HS-PRO-001-1.0) sets out the process for a consistent and repeatable approach to risk management to ensure all hazards and risks associated with operations and project implementation activities are identified, evaluated, managed, documented and closed out in a safe, practical and effective manner. Fundamental to the risk management process is that all risks must be managed to ALARP, and an acceptable level.

The impact and risk assessment process applied to this EP is consistent with the requirements of the *Australian Standards ISO 31000:2018 Risk Management – Guidelines*, and the *AS/NZS Handbook 203: 2012 Managing Environment-Related Risk*. The key steps used for the risk assessment process are shown in **Figure 6-1** and described further in **Section 6.2**.

6.2 Assessment Process

SapuraOMV has followed the process in **Figure 6-1** for the environmental impact and risk assessment, through the following key steps:

- Establishing the context. This takes into account:
  - The description of the Activity (**Section 3**), including the nature and scale of the Activity.
  - The relevant corporate policies, standards and systems (**Sections 2** and **9**).
  - The relevant legislation/guidance/guidelines, including species action plans and marine reserve management plans (**Sections 2**, **4, Appendix B** and **Appendix D**).
  - The existing environment (physical, biological and socio-economic) considering the environmental values/receptors/sensitivities/attributes in the environment that will, or may be affected directly or indirectly by the Activity, including potential emergency conditions, whether resulting from accident or any other cause (**Section 4** and **Appendix D**).
  - The stakeholder context obtained from appropriate consultation with relevant authorities and other relevant interested persons or organisations (**Section 5**).
- Identification of hazards/risks associated with the Activity.
- Identification of the existing control measures in place.

- Assessment of the impact/risk with existing control measures in place to determine the inherent risk.
- Identification and consideration of potential additional control measures to reduce the impacts and risks to ALARP and acceptable levels.
- Assessment of impacts and risks with any additional control measures in place to determine the residual risk and evaluate if the risk has been reduced to ALARP and is acceptable.
- Application of further additional control measures if needed.

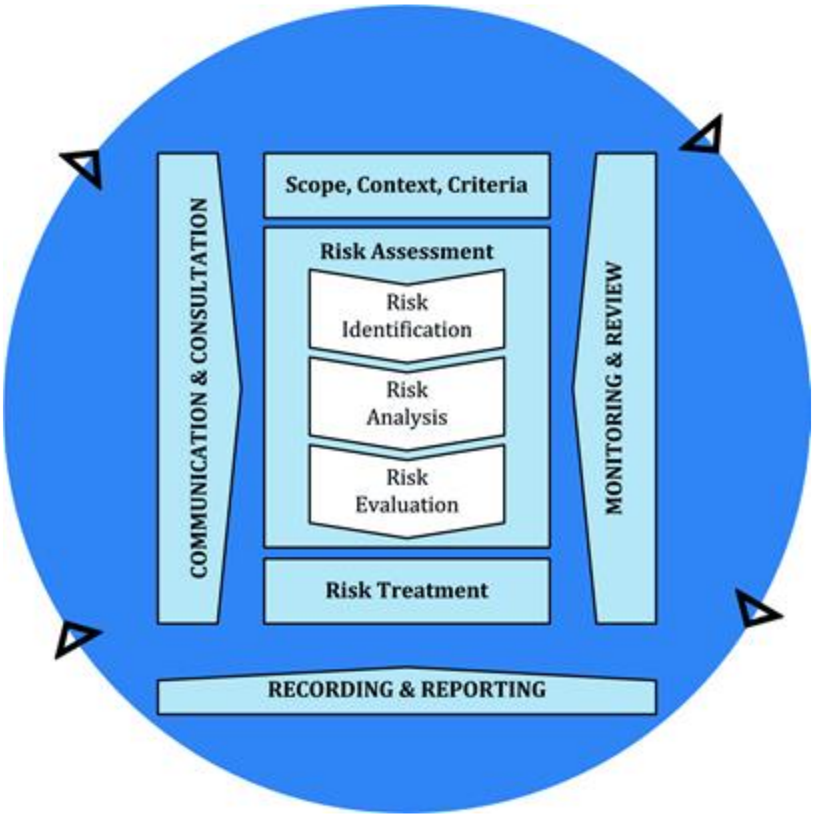


Figure 6-1 Risk management process

Source: AS ISO 31000: 2018 Risk Management – Guidelines

6.3 Impact and Risk Identification

An environmental impact identification (ENVID) workshop was held on 20 February 2020. The ENVID workshop was attended by personnel from different technical disciplines including SapuraOMV's HSE and Drilling Departments, and specialist environmental consultants.

The aim of the workshop was to identify hazards/risks associated with the Activity, identify controls and management measures to treat the impacts and risks, and to assign a level of risk based on the consequence (severity) of the impact/risk and the probability of the consequence occurring (the likelihood). The outcomes of the workshop and agreed actions were recorded.

6.3.1 Determination of Severity of Consequence

Once the potential hazards/risks and environmental receptors are identified, the potential consequence of any impact is assessed and assigned a rating. Consequence is defined using the SapuraOMV consequence severity classification (**Table 6-1**), based on the SapuraOMV risk matrix.

Table 6-1 SapuraOMV severity of consequence classification

Consequence Classification	Indicative Impact				
	Health and Safety	Security	Natural Environment	Reputation/ Govt. / Community/ Media	Financial (USD)
Critical (V)	Fatality.	Massive effect. Disastrous consequences: long-term disruption to rule of law, general disorder, extensive property damage, severe impact on SEP operations and / or local community, may require international assistance.	Destruction of sensitive environmental features. Severe impact on ecosystem. Very long (or permanent) term impacts (restitution time >10 years) on populations (global or national), ecosystems or environmentally sensitive areas of international or national importance. Regulatory & high level Government intervention/action.	Critical impact on business reputation /or international media exposure.	Financial loss in excess of 25 million.
Major (IV)	Permanent disabling injury and/or long term off work.	Major effect. Serious consequences: medium-term disruption to rule of law, general disorder, property damage, impact on SEP operations and / or local community, may require state assistance.	Long-term impact (restitution time 1-10 years) on populations (regional and national significance), ecosystem and sensitive environmental features (e.g. wetlands) of national and regional importance. Likely to result in regulatory intervention/action.	Significant impact on business reputation and/or national media exposure.	Financial loss from >20 million to 25 million.
Moderate (III)	Injury requiring medical treatment, time off work or rehabilitation.	Localised effect. Significant consequences: short to medium-term disruption to law and order, short-term impact on local community, property damage.	Short-term impact (restitution time <1 year) on sensitive environmental features (e.g. hatchery/spawning ground) of national or regional importance, populations (national or regional) and ecosystems. Medium term impacts (restitution time 1-3 years) on populations (local), ecosystems or environmentally sensitive areas of local importance. Triggers regulatory investigation.	Moderate to small impact on business reputation.	Financial loss from >10 million to 20 million.
Minor (II)	Injury requiring medical treatment with no lost time.	Minor effect. Some consequences: short-term disruption to law and order, no impact on local community, on property damage.	Short-term impact (restitution time <1 year) on fauna, flora, habitat, populations (local) or environmentally sensitive areas of local importance but no negative effects on ecosystem. Requires immediate regulator notification.	Some impact on business reputation.	Financial loss from 25,000 to 10 million.
Negligible (I)	Minor injury - first aid treatment.	Slight effect. Few consequences: inconvenience through disruption to legal process, no impact on local community or environment.	Temporary impact (restitution time days to weeks) on fauna/flora, habitat, aquatic ecosystem or water resources. No measurable impact to local populations, ecosystems or environmentally sensitive areas of local importance. Localised, temporary impact to individual organisms. Incident reporting according to routine protocols.	Minimal impact to reputation.	Financial loss from 0 to <25,000.

6.3.2 Determination of Likelihood

Likelihood is defined as the chance or frequency of the consequence occurring. The likelihood accounts for the effective implementation of selected control measures. Likelihood is defined with the SapuraOMV likelihood descriptors (**Table 6-2**), based on the SapuraOMV risk matrix.

Table 6-2 SapuraOMV likelihood descriptors

Level		Criteria
Almost Certain	A	Consequence is expected to occur in most circumstances. (Occurs about once weekly or more; or around 50 times per year).
Likely	B	Consequence could occur in most circumstances. (Occurs once about monthly; or around 12 times per year).
Possible	C	Consequence has occurred here or elsewhere. (Occurs once yearly).
Unlikely	D	Consequence hasn't occurred here but could. (Occurs once in 10 years or more).
Remote	E	Consequence is extremely unlikely, or never occurred before in industry.

6.4 Impact and Risk Assessment

The environmental impacts and risks for planned activities (routine) and unplanned events (accidents/incidents) of the proposed Activity in this EP were assessed with the SapuraOMV risk matrix (**Table 6-3**). The risk assessment matrix is based on the consequence (the severity of the impact or the extent of damage, see **Section 6.3.1**) and the probability (the likelihood, see **Section 6.3.2**) of a risk occurring.

Inherent risk levels were determined with standard management and control measures in place (i.e. legislation, industry standards and codes) in accordance with the SapuraOMV risk matrix (**Table 6-3**).

Table 6-3 SapuraOMV risk matrix

			Consequence Severity				
			Negligible	Minor	Moderate	Major	Critical
			I	II	III	IV	V
Likelihood	Almost Certain	A	3 (Medium)	3 (Medium)	4 (High)	5 (Unacceptable)	5 (Unacceptable)
	Likely	B	2 (Low)	3 (Medium)	3 (Medium)	4 (High)	5 (Unacceptable)
	Possible	C	2 (Low)	2 (Low)	3 (Medium)	3 (Medium)	4 (High)
	Unlikely	D	1 (Very Low)	2 (Low)	2 (Low)	3 (Medium)	3 (Medium)
	Remote	E	1 (Very Low)	1 (Very Low)	2 (Low)	2 (Low)	3 (Medium)

Information used to inform the impact and risk assessment included:

- Proposed exploration well Activity details including equipment, proposed location, timing of the Activity and environmental aspects (e.g. seabed disturbance) (see **Section 3**);
- An understanding of the general MODU/vessel activities/operations during the Activity and the nature and scale of potential impacts and the possible threats to environmental receptors (physical, biological and socio-economic) (see **Sections 3** and **4**);
- Review of the available scientific literature on the environmental sensitivities in the receiving environment (see **Section 4** and **Appendix D**);
- Modelling of the trajectory and fate of spilled hydrocarbons (**Sections 8.1** and **8.2**); and
- Information from stakeholders obtained during consultation on how their functions, interests and activities may be affected by the proposed Activity (see **Section 5**).

6.5 Control Measures, Environmental Performance Outcomes, Standards and Measurement Criteria

For each planned activity and unplanned event, a set of control measures, environmental performance outcomes (EPOs), environmental performance standards (EPSs) and measurement criteria are identified. These were used to address potential environmental impacts and risks identified during the risk assessment.

Each term is defined as:

- **Control measure**: a system, an item of equipment, a person or a procedure that is used as a basis for managing environmental impacts and risks.
- **Performance outcome**: a measurable level of performance required for the management of environmental aspects of an activity to ensure that the environmental impacts and risk will be of an acceptable level.
- **Performance standard**: a statement of the performance required of a control measure.
- **Measurement criteria**: defines how environmental performance will be measured and determine whether the outcomes and standards have been met.

6.6 Demonstration of ALARP

6.6.1 ALARP Decision Framework

During the impact and risk assessment, appropriate controls and mitigation measures for each hazard/ risk were identified through relevant legislation, guidelines, codes and standards, together with professional judgement and experience of participants of the ENVID workshop.

A hierarchy of controls was applied in order to reduce the potential for the identified hazards/risks to be realised, or if realised, reduce the consequence. Control measures were applied, to eliminate the hazards/risks, or, if this is not reasonably practicable, to minimise the impacts and risks to ALARP. **Table 6-4** presents the hierarchy of control measures in order of preference for hazard/risk control (i.e. the most effective measure is to eliminate the hazard/risk completely and the least effective is to 'manage' the hazard/risk with personal protective equipment).

Table 6-4 Hierarchy of control measures

Control	Description
Elimination	Remove the risk or hazard completely.
Substitution	Change the risk for a lower one (e.g. replace a hazardous substance with one which is less hazardous).
Isolation	Isolate people, equipment or the environment from the risk.
Engineering	Engineer out the risk; redesign the procedures, process or equipment (e.g. re-route the source of discharge to a closed drain system).
Administrative	Implement a process or administrative procedure; or provide instruction or training to personnel to reduce the risk.
Protective	Use of protective equipment (e.g. the use of vapour masks).

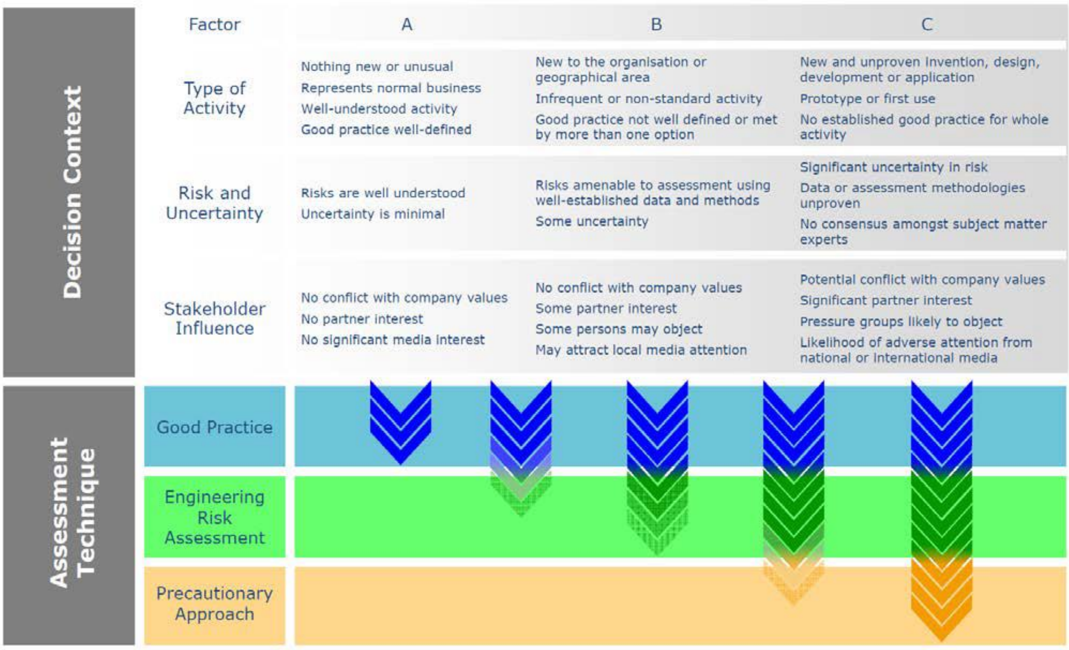
6.6.2 ALARP Decision Context

In alignment with NOPSEMA's ALARP Guidance Note (NOPSEMA, 2015), and in addition to SapuraOMV's HSE Management System (HSE-MM-MAN-0001) and Risk Management Procedure (AU-HS-PRO-001-1.0), SapuraOMV have adopted the framework developed by Oil and Gas UK (OGUK) (OGUK, 2014) to determine the assessment technique required to demonstrate that potential impacts and risks are ALARP (**Figure 6-2**). Specifically, the framework provides guidance on the factors that may affect the decision context relating to:

- Type of activity;
- Risk and uncertainty; and
- Stakeholder influence.

This framework provides appropriate tools, commensurate to the level of uncertainty or novelty associated with the impact or risk (referred to as the Decision Type A, B or C). Decision types and methodologies to establish ALARP are as follows:

- **Context A decisions** – where the risks are relatively well understood, the potential risks are low, activities are established practice and there is no significant stakeholder interest. In cases where good practice may not be sufficiently well-defined, engineering risk assessment may be required to further guide the decision.
- **Context B decisions** – where there is greater uncertainty or complexity around the activity and/or risk, the potential impact is moderate or being undertaken in areas of increased environmental sensitivity, and the activity/risk is generating some concerns from stakeholders. In this instance established good practice is not considered sufficient and further assessment is required to support the decision and ensure that the risk is ALARP.
- **Context C decisions** – typically involve sufficient complexity, high potential impact, uncertainty or stakeholder interest to require a precautionary approach. In this case, relevant good practice will still have to be met, additional assessment will be required and the precautionary approach applied.



Source: Oil & Gas UK (2014)

Figure 6-2 Impact and risk-related decision-making framework

6.7 Residual Risk and Impact

Where additional controls are identified that might reduce impacts, the residual risk is then evaluated and ranked. This iterative risk evaluation process is employed until such time as any further reduction in the residual risk is not reasonably practicable to implement (i.e. cost is grossly disproportionate to the environmental benefit gained). At this point, the impact or risk is reduced to ALARP.

SapuraOMV requires further detailed review and management consideration of any residual risk ranking above 3 (**Table 6-3).** Further, a residual risk ranking of 5 is considered to be intolerable.

6.8 Demonstration of Acceptability

The model used for determining acceptance of residual risk is provided in **Figure 6-3**. Potential environmental impacts and risks are only deemed acceptable once all reasonably practicable alternatives and additional measures have been taken to reduce the potential impacts and risks to ALARP.

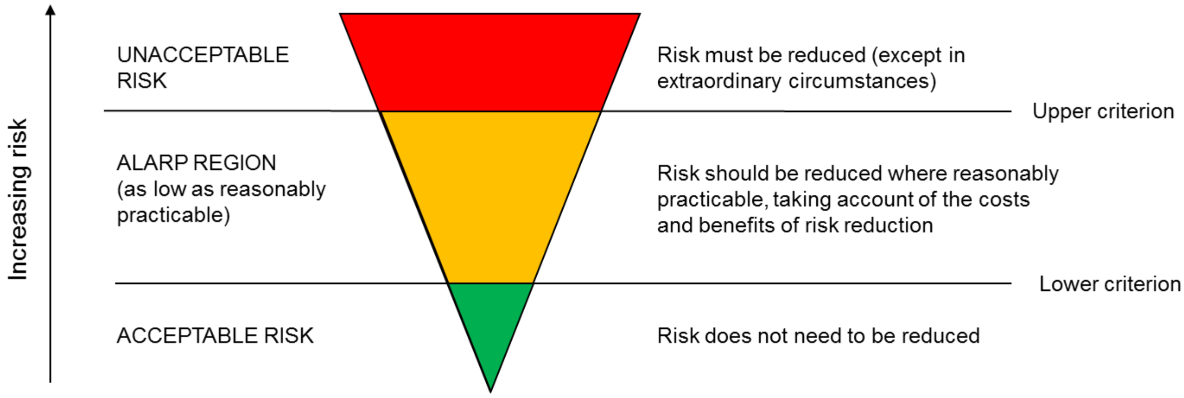


Figure 6-3 Residual risk acceptance model

SapuraOMV considers a range of factors when evaluating the acceptability of environmental impacts or risks associated with the Activity. This is based on NOPSEMA's Guidance Note – Environment Plan Content Requirements Rev 4 (NOPSEMA, 2019c). To define the acceptable level of impacts and risks in **Sections 7** and **8**, the following were considered by SapuraOMV:

- Environmental impacts and risks are reduced to ALARP, and residual risk determined to be between very low (1) and medium (3);
- Principles of Ecological Sustainable Development (ESD):
  - Decision-making processes should effectively integrate both long and short-term economic, environmental, social and equity considerations;
  - If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;
  - The principle of inter-generational equity - that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations; and
  - The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision making.
- Legislative and other requirements (e.g. laws, policies, standards, conventions, statutory instruments such as recovery plans for threatened species, plans of management for protected places).
- Internal context where SapuraOMV policies, standards and procedures have been identified and implemented.
- External context where societal values and relevant stakeholder objections and claims have been considered and addressed.

Acceptable levels are evaluated independently of the ALARP process and acceptability criteria are considered when selecting EPOs that apply to managing a particular impact or risk.

7. Environmental Assessment for Planned Activities

This Section provides a description and evaluation of the environmental impacts and risks for planned (routine) activities using the methodology described in **Section 6**. During the ENVID seven hazards specifically associated with planned activities were identified. A summary of the residual risk rankings determined for each hazard is provided in **Table 7-1**. **Sections 7.1** to **7.7** provide a detailed description and evaluation of the environmental impacts and risks from planned activities.

Table 7-1 Summary of residual risk rankings for planned activities

Hazard	Consequence	Likelihood	Residual Risk
Section 7.1 – Physical Presence – Interference with Other Marine Users			
Timing and location of the Activity; physical presence of the MODU and vessels on site.	I (Negligible)	C (Possible)	2 (Low)
Section 7.2 – Physical Presence – Seabed Disturbance			
Positioning of MODU (spudding/ respudding), drilling activity, vessel mooring and use of ROV.	I (Negligible)	C (Possible)	2 (Low)
Section 7.3 – Light Emissions			
Artificial lighting on the MODU and vessels. Underwater lighting associated with ROV operations (if required).	I (Negligible)	D (Unlikely)	1 (Very Low)
Section 7.4 – Noise Emissions			
Underwater noise generated from operation of MODU, vessel and helicopter activities (engine, propeller noise, machinery noise, drilling).	I (Negligible)	C (Possible)	2 (Low)
Underwater noise generated from acoustic downhole profiling (VSP/checkshot).	II (Minor)	D (Unlikely)	2 (Low)
Section 7.5 – Atmospheric Emissions			
Fuel combustion (marine diesel) to power the MODU and vessels and to operate machinery, engines, mobile/fixed plant and equipment.	I (Negligible)	D (Unlikely)	1 (Very Low)
Section 7.6 – Routine Operational Discharges			
Discharge of liquid (sewage, bilge water, cooling water, grey water, desalination brine, oily water and deck drainage) as part of routine MODU and vessel operations.	I (Negligible)	B (Likely)	2 (Low)
Section 7.7 – Drilling and Cement Discharges			
Discharge of drill cuttings and drilling fluids into the water column and onto the seafloor.	I (Negligible)	B (Likely)	2 (Low)

7.1 Physical Presence – Interference with Other Marine Users

Planned Activity			
The following activities were identified as having the potential to result in interaction with other marine users in the operational area: • Physical presence and movement of the MODU and vessels.			
Hazard Identification			
The physical presence of the MODU and vessels in the operational area has the potential to cause disruption or displacement of other marine users, including shipping, fisheries, and offshore petroleum support vessels in the area. For the duration of the drilling activity, the MODU will be required, under the OPGGS Act, to maintain a 500 m petroleum safety zone (PSZ). Marine users are permitted within the 4.6 km (2.5 nm) radius cautionary area (centred around the MODU), so long as they approach and operate with caution, however only authorised vessels are permitted within the PSZ. A semi-submersible MODU will be towed to site for the exploration well Activity. Once onsite the MODU will be supported by two vessels during drilling operations, but up to four support vessels during rig positioning and anchor handling operations. The MODU and support vessels will be onsite for ~40 days, possibly extending in the event of unforeseen circumstances (e.g. need to respud, weather or equipment issues). The MODU and vessels will operate 24-hours per day, 7 days a week for the duration of the Activity.			
Standard Control Measures			
Control Measure	**Environmental Benefit**	**Evaluation of Decision**	**Decision**
MODU and vessels will be fitted with lights, signals, AIS transponders and navigation and communications equipment, as required by the *Navigation Act 2012*.	MODU and vessel navigational aids and communication equipment will enable other marine users to be made aware of its presence and position; to reduce the possibility of interaction.	Benefit outweighs the cost. Control is standard practice.	**Accept**
Australian Hydrographic Office (AHO) will be informed of the Activity prior to commencement.	Notification to AHO will enable them to generate navigation warnings (i.e. Notice to Mariners).	Benefit outweighs the cost. Control is standard practice.	**Accept**

Notification to AMSA's Joint Rescue Coordination Centre (JRCC).	Notification to AMSA's JRCC will enable promulgation of radio-navigation warnings.	Benefit outweighs the cost. Control is standard practice.	**Accept**
Stakeholder consultation with relevant stakeholders.	Communicating information about the Activity to other marine users ensures they are informed and aware, thereby reducing the likelihood of interference occurring.	Benefit outweighs the cost. Control is standard practice.	**Accept**
MODU will be attended by at least one support vessel, who will monitor the 500 m PSZ around the MODU.	Presence of at least one support vessel increase chances of early detection and warning vessels approaching the exclusion zone.	Benefit outweighs the cost. Control is standard practice.	**Accept**
MODU and vessel bridge-watch will be maintained 24 hours/ day.	Maintaining constant bridge watch will assist with early detection of approaching vessels.	Benefit outweighs the cost. Control is standard practice.	**Accept**

Environmental Impact Assessment

Tourism and recreational activities are not expected to occur in the operational area given the water depths, lack of seabed features and distance from the mainland. Consequently, the physical presence of the MODU and support vessels has the potential to impact:

- Shipping; and
- Commercial fisheries

Three Commonwealth and 10 State managed fisheries overlap the operational area (**Section 4.7.1**). Potential impacts to commercial fisheries may be a temporary loss of access to fishing grounds when the MODU and vessels are in the operational area, which could potentially result in reduced catches and income.

Automatic Identification System (AIS) data from AMSA indicates that vessel traffic, mainly from offshore petroleum support vessels and local traffic, will be encountered in the operational area, but the level of shipping traffic is expected to be low (**Figure 4-10**). Other vessels that might traverse the area will need to navigate to avoid the MODU (including PSZ) and support vessels, with potential implications for operational costs and schedules.

The Activity will occur over a relatively short duration (~40 days in total) and the area affected represents only a very small portion of the available area for fishing, shipping and other petroleum activities. As such, the consequences of potential temporary displacement of other users of the area due to the Activity are expected to be '*Negligible (1)*'.
Assessment of Likelihood and Inherent Risk Ranking
An analysis of the current fishery closures, historical fishing effort data, fishing methods and consultation feedback (**Section 5**) has revealed that there has not been any recent (since 2014) State or Commonwealth managed fishing activity in the operation area (**Section 4.7.1**). There are no recognised shipping routes in or near the operational area with the nearest designated shipping fairway located approximately 48 km to the east (**Figure 4-10**). With the proposed controls, other users will be aware of the Activity and there are no navigation hazards or restrictions that would obstruct or hinder other vessels from planning a very minor deviation in route to avoid the MODU/vessels. Allowing for unforeseen changes to plans of potential fishers, the likelihood of impacts on other marine users from the physical presence and movement of the MODU and vessels in the operational area with standard control measures in place is considered '*Possible (C)*'. The inherent risk ranking to other marine users is evaluated as '*Low*' (2).
Additional Control Measures Considered (ALARP Evaluation)

Control Measure	Environmental Benefit	Evaluation of Decision	Decision
Manage timing of the Activity	Schedule Activity to avoid sensitive/peak periods of use by other marine users (e.g. offshore petroleum support vessels, commercial fishers).	It is not possible to avoid all types of marine users. Overall, a low predicted impact as the operational area does not fall within recognised shipping route, commercial fishing effort is not high and Activity duration is short.	**Reject**

ALARP Assessment
There are no alternatives to the use of the MODU and vessels to undertake the Activity. The impact and risk assessment and evaluation has identified a range of control measures that when implemented are considered to manage the risk of interference to other marine users from the physical presence of the MODU and support vessels. There are no reasonably practicable additional or alternative control measures to further reduce the risk of interference to other marine users. Managing the timing of the Activity to avoid sensitive/ peak periods of use by other marine users is not possible as marine users could potentially be in the area all year round. SapuraOMV's stakeholder consultation process is described in **Section 5**. During EP preparation, details of the Activity have been communicated to relevant stakeholders as appropriate. In consultation, stakeholders are made aware of the operational area boundaries, the 500 m PSZ around the MODU, and the expected timing of the Activity. Notice to Mariners and AUSCOAST warnings will be issued prior to commencement of the Activity. The MODU and vessels will maintain

navigation aids and communication equipment in compliance with industry standards and legislation requirements. Concerns raised by stakeholders regarding the proposed Activity have been addressed (**Section 5).** With the proposed control measures in place, the residual risk ranking of interaction/ interference with other marine users of the area was assessed as '*Low*' (2), classified as a Type A decision and cannot be reduced further. With no additional or alternative control measures identified that would offer a net environmental benefit, the impacts and risks to other marine users are considered to be ALARP.		
Residual Risk Summary		
Consequence	**Likelihood**	**Residual risk**
Negligible (I)	Possible (C)	Low (2)
Demonstration of Acceptability		
Are environmental impacts and risks reduced to ALARP, and the residual risk ranking between '*Very Low (1)*' to '*Medium (3)*'?		Yes – risks are reduced to ALARP, and the residual risk ranking is *Low* (2).
Is the Activity carried out in a manner consistent with the principles of ESD?		Yes – the Activity was evaluated as having the potential to result in negligible consequence, and not result in serious or irreversible environmental damage.
Are the potential risks and hazards consistent with SapuraOMV's policy and standards?		Yes – aligns with SapuraOMV's HSE Policy and HSEMS.
Have legislative and other requirements been met? Industry codes, standards and guidelines applied?		Yes – management consistent with the: • Safety of Life at Sea (SOLAS) 1974; • *Navigation Act 2012*; and • AHP20 Mariner's Handbook for Australian Waters (5th edition).
Have stakeholder expectations been addressed?		Yes – stakeholder expectations have been addressed.
The Activity has been evaluated in accordance with SapuraOMV's HSE Policy objectives. The presence of the MODU and vessels presents a restricted zone to other users. However, the impact and risk assessment process indicates that the area of restriction is localised (500 m PSZ), is of short duration (~40 days) and occurs at a location that is not likely to significantly affect other marine users, given the low fishing activity (absence of fishing effort in the area) and separation from shipping lanes. The residual risk ranking was assessed as '*Low*' (2). On this basis, it is considered that adherence to the environmental performance standards will manage the impacts and risks to other marine users from the physical presence aspect to an acceptable level.		

Environmental Performance Outcomes, Standards and Measurement Criteria			
Environmental Performance Outcome	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
MODU and vessel presence / movements managed to minimise adverse interference to other marine users.	Consultation ongoing with all relevant persons as per **Section 5.9** during the Activity.	Ongoing consultation records maintained in SapuraOMV stakeholder database, including assessment of feedback and SapuraOMV response.	SapuraOMV Senior HSE Specialist
	The Australian Hydrographic Office (AHO) will be notified no less than 4 working weeks before operations commence for the promulgation of related notices to mariners.	Email records confirm AHO notified in the required timeframe prior to commencement of operations.	SapuraOMV Senior HSE Specialist
	Notification will be provided to AMSA's JRCC for promulgation of radio-navigation warnings 24-48 hours before operations commence, including following information: • Vessel details, including name, call sign and Maritime Mobile Service Identity (MMSI); • Satellite communications details, including INMARSAT-C and satellite telephone; • Area of operation; • Requested clearance from other Vessels; and • Notification of operations start and end.	Email records confirm AMSA notified in the required timeframe prior to commencement of operations.	MODU OIM Vessel Masters SapuraOMV Senior HSE Specialist
	MODU will be attended by at least one support vessel, who will monitor the 500 m PSZ around the MODU.	Daily drilling reports demonstrate at least one support vessel in operational area to enforce exclusion zone.	Vessel Masters MODU OIM

	MODU and vessels will be fitted with lights, signals, AIS transponders and navigation and communications equipment, as required by the *Navigation Act 2012*.	Records (e.g. OVID/CMID) confirm that required navigation equipment is fitted to MODU and vessels to ensure compliance with the *Navigation Act 2012*.	MODU OIM Vessel Masters
	MODU and vessel bridge-watch will be maintained 24 hours/ day to assist with early detection of approaching vessels.	MODU/Vessel Bridge Logbook.	MODU OIM Vessel Masters

7.2 Physical Presence - Seabed Disturbance

Planned Activity			
The following activities were identified as having the potential to result in seabed disturbance: • Positioning of the MODU (anchors and chains) at the Kanga-1 well location; • ROV activities (if required); • Support vessel anchoring (if required); and • Well spudding and re-spudding (if required).			
Hazard Identification			
As described in **Section 3.2.2**, the MODU will be secured to the seabed through a series of anchors and anchor chains, which for a typical moored semi-submersible MODU in ~147 m water depth results in up to 4,800 m^2 of benthic habitat in the operational area that may be disturbed. Should drilling difficulties arise and a re-spud is required, this area could double. Well spud activities will result in the disturbance of an area of approximately 20 m^2 around the well. The pre-spud ROV survey of the well site may result in localised and temporary scouring of the seabed and some increased turbidity, should the ROV pass in close proximity to the seabed, resulting in mobilisation of finer fractions of seabed sediments. The extent of this footprint is likely to be minimal, but as a conservative measure, an estimate of seabed disturbance is ~4 m^2. Seabed disturbance from vessel anchoring operations is predicted to be highly localised and will be restricted to the vessel anchor and chain. Anchoring is expected to have a footprint of up to 1,300 m^2, including physical disturbance to the seabed associated with the chain as the vessel swings while at anchor (chain drag) (NERA, 2018a). Total disturbance from vessel anchoring is unlikely to exceed 3,900 m^2 at the designated vessel anchoring area(s). The total potential extent of the benthic disturbance is expected to be ~0.0087 km^2 within the 16 km^2 operational area. Seabed disturbance from drilling and cement discharges is discussed in **Section 7.7**. Seabed disturbance from dropped objects is discussed in **Section 8.5**.			
Standard Control Measures			
Control Measure	**Environmental Benefit**	**Evaluation of Decision**	**Decision**

Rig move and positioning plan based on an approved mooring design.	Anchor installation and retrieval operations will be managed by implementation of the plan, based on the approved mooring design, to ensure that the mooring lines are installed as per design and the MODU remains on station and within the operational area.	Benefits considered to outweigh the negligible costs.	**Accept**
All anchors and equipment will be recovered from the seabed upon completion of the Activity.	The placement of equipment on the seabed may result in a temporary disturbance to benthic communities in the operational area. To promote the recovery and recolonisation of the seabed, all equipment will be retrieved at the end of the drilling campaign where safe and practicable to do so.	Benefits considered to outweigh the negligible costs.	**Accept**

Environmental Impact Assessment

There are no known shipwreck sites in the operational area or surrounds. Seabed disturbance during the Activity has the potential to impact:

- Benthic habitats and fauna.

Anchoring of the MODU and support vessels will result in depressions on the seabed and localised scouring, and direct and indirect impacts to associated benthic communities and habitats. This may result in direct mortality of benthic fauna within the footprint of the anchor and chain. For vessel anchoring, disturbance may be exacerbated by movement of the vessel on the anchor line, such as through 'swinging' under the influence of wind, tides and currents or dragging of the anchor and cable; but this is anticipated to have minimal impacts in soft sediments (NERA, 2018a). Depressions left by anchors will remain viable habitat that would be expected to recolonise with benthic species within weeks to months following removal of the disturbance (Currie and Isaacs, 2005) and gradually infill following retrieval of the equipment through deposition of detrital matter and movement of sediments by water currents.

Placement and retrieval of anchors and the use of the ROV may result in temporary, localised plumes of suspended sediment. NERA (2018a) detailed that soft sediments suspended into the water column have the potential to affect benthic communities through a decrease in water quality or light penetration near the seabed. NERA (2018a) surmised that given the hydrodynamics in open ocean areas, the area of decreased water quality is expected to be localised and temporary, as sediments would settle out of the water column relatively quickly. However, this may result in deposition and potential smothering of marine

benthic habitat and communities in the immediate vicinity. The seabed in the operational area consists of mud and calcareous clay within an open ocean area, thus impacts in relation to suspended sediments and deposition would be on a similar localised temporary scale or less as identified by NERA (2018a). The benthic substrate within the operational area is expected to be made up of unconsolidated soft sediment, predominantly mud and calcareous substrates and be featureless with no known sensitive seabed features (e.g. reefs, sponge gardens or seagrass meadows) (**Section 4.4.5**). There are no fauna BIAs or KEFs that relate to the seabed of the operational area. The nearest seafloor KEF (Ancient Coastline at 125 m depth contour) is located ~2.6 km south of the operational area at its closest point. Direct impacts to this KEF are not expected, as any silt plumes generated would have dissipated over this distance in the presence of near-seabed currents, and it is not expected that sedimentation/smothering impacts would occur to benthic communities. Given that the Activity is limited to drilling a single well in water depths of ~147 m at a location where the widespread nature of soft sediment in fauna communities is characteristic of the region (RPS, 2012; Brewer et al. 2007), the potential disturbance is considered highly localised and will not result in a loss of sensitive or geographically restricted habitats, and the consequences of disturbance are considered to be '*Negligible (I)*'.			
Assessment of Likelihood and Inherent Risk Ranking			
The likelihood of measurable changes to fauna habitat values within the operational area due the physical presence of the MODU and support vessels with standard control measures in place is considered '*Likely (B)*'. The inherent risk ranking on seabed disturbance from the Activity is evaluated as '*Low (2)*'.			
Additional Control Measures Considered (ALARP Evaluation)			
Control Measure	**Environmental Benefit**	**Evaluation of Decision**	**Decision**
No anchoring by MODU	Using another form of offshore drilling unit such as a jack-up MODU, would eliminate the requirement to place anchors on the seabed.	Use of a jack-up MODU is not possible given the ~147 m water depth of the operational area. A jack-up MODU would still require the placement of spud cans on the seabed.	**Reject**
Use of dynamic positioning (DP) to hold MODU position	Using DP would eliminate the requirement to place anchors on the seabed.	DP not practical in this water depth. Potentially more impacts from underwater noise and increased atmospheric emissions.	**Reject**

No anchoring of vessels within the operational area	No anchoring of vessels within the operational area would eliminate seabed disturbance from anchor placement/ drag.	Not practicable. Anchoring may be required when performing support vessel duties. Risk is already low. Benefit does not outweigh the cost.	**Reject**
Use of Vertically Loaded Anchor (VLA) to mitigate MODU ground chain impact	VLA allows uplift at the anchor point resulting in a reduction to seabed disturbance.	Increased disturbance below the sediment-water interface. Increased turbidity and noise during installation of VLA into sediment substrata (jetting into substrate). Additional cost and schedule implication. Remains untested in Australia.	**Reject**
Vessel and MODU anchoring locations determined based on previous geophysical and geotechnical survey	Reduces the likelihood of anchoring occurring in areas of high sensitivity. Assessment of seabed topography reduces likelihood of anchor drag leading to seabed disturbance.	This control measure is achievable and practicable as the site survey is already scheduled to occur.	**Accept**

ALARP Assessment

The impact assessment and evaluation has identified a range of standard control measures that when implemented are considered to manage impacts and risks from MODU and vessel anchoring, and other drilling activities. Further opportunities to reduce impacts have been investigated with one additional control accepted, namely a pre-drilling site survey of the operational area prior to MODU mobilisation. The survey will verify the absence of significant seafloor features across the operational area thereby reducing the likelihood of measurable changes to ecosystem function or damage/reduction in fauna habitat values due the physical presence of the MODU and support vessels from '*Likely (B)*' to '*Possible (C)*'. With the proposed control measures in place, the residual risk of seabed disturbance was assessed as '*Low*' (2), classified as Type A decision and cannot be reduced further. With no reasonable additional or alternative control measures identified that would offer a net environmental benefit, the impacts and risks are considered ALARP.

Residual Risk Summary

Consequence	Likelihood	Residual risk
Negligible (I)	Possible (C)	Low (2)

Demonstration of Acceptability	
Are environmental impacts and risks reduced to ALARP, and the residual risk ranking between '*Very Low (1)*' to '*Medium (3)*'?	Yes – risks are reduced to ALARP, and the residual risk ranking is *Low* (2).
Is the Activity carried out in a manner consistent with the principles of ESD?	Yes – the Activity was evaluated as having the potential to result in negligible consequence, and not result in serious or irreversible environmental damage.
Are the potential risks and hazards consistent with SapuraOMV's policy and standards?	Yes – aligns with SapuraOMV's HSE Policy and HSEMS.
Have legislative and other requirements been met? Industry codes, standards and guidelines applied?	N/A –no relevant environmental guidelines/legislation regarding the environmental management with respect to this Activity.
Have stakeholder expectations been addressed?	N/A – no concerns raised.
Use of anchors for offshore mooring of vessels and MODU is standard industry practice, both on the NWS and internationally. With the proposed control measures in place, and with no sensitive seabed features expected to occur in the operational area, the relatively small area of MODU anchoring seabed disturbance (between ~4,800 m^2, and at worst up to 9,600 m^2 if a re-spud is required) and possibly support vessel anchoring (up to ~3,900 m^2) is a very small proportion of the habitat in the region. The small area of impact coupled with the short duration of the Activity, the potential consequence of seabed disturbance on receptors is ranked as *'Negligible (I)'*. Stakeholders have been informed of the proposed Activity, as detailed in **Section 5**, no concerns have been raised by stakeholders regarding this hazard/risk. The Activity has been evaluated in accordance with SapuraOMV's HSE Policy objectives and the residual risk ranking was assessed as '*Low*' (2). On this basis, it is considered the adopted control measures appropriate to manage the impacts of disturbance to the seabed to a level that is acceptable.	

Environmental Performance Outcomes, Standards and Measurement Criteria			
Environmental Performance Outcome	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
Disturbance to the seabed is limited to planned activities within the operational area.	Seabed disturbance from MODU mooring limited to that required to ensure adequate MODU station keeping capacity.	Records confirm Rig Move and Positioning Plan, based on mooring design analysis, implemented during anchor deployment.	MODU OIM

	All anchors and equipment will be recovered from the seabed upon completion of the Activity, where safe and practicable to do so.	ROV 'as-left' survey report confirms recovery of all subsea equipment.	MODU OIM
	Anchoring only to occur in suitable locations selected from pre-drilling site survey.	Pre-drilling site survey report, identifying anchoring locations.	SapuraOMV Drilling Manager
		Vessel logs demonstrate anchoring only at designated location(s).	Vessel Masters

7.3 Light Emissions

Planned Activity			
The following activities were identified as having the potential to generate light emissions: • Light spill from safety and navigational lighting on the MODU and vessels; and • Underwater light from ROV activities (if required).			
Hazard Identification			
The MODU and support vessels will have external lighting to facilitate navigation and safe operations. Lighting will be used on the MODU and vessels 24 hours a day for the duration of the Activity (~40 days). Direct light spill on surface waters will be limited to the area directly adjacent to the MODU and support vessels as they operate within the operational area. Spot lighting may be used on an as-needed basis (e.g. ROV deployment and retrieval). Lighting will typically consist of bright white lights (i.e. metal halide, halogen, fluorescent), typical of lighting used in the offshore petroleum industry and not dissimilar to lighting used for other offshore activities in the region, including shipping and fishing. Lighting on the ROV will change underwater ambient light levels up to several metres from the light source. The impacts from the MODU and vessels may be: • Disruption to behaviour and orientation of light sensitive marine fauna (e.g. turtles and seabirds); and • Light glow may attract light-sensitive species (e.g. seabirds and fish), in turn affecting predator-prey dynamics. External lighting is located over the entire MODU, with most external lighting directed towards working areas such as the main deck and drill floor. These areas are typically lower than 20 m above sea level. The distance to the horizon at which the brighter components of the MODU lighting will be directly visible can be estimated using the formula: Horizontal distance (km) = 3.57 x √ (height (m)) Using this formula, the approximate distances at which the MODU will be visible at sea level is 16 km (main deck ~20 m above sea level). This distance will be less for the vessels, as they bridge deck is typically ~5 m above sea level.			
Standard Control Measures			
Control Measure	**Environmental Benefit**	**Evaluation of Decision**	**Decision**

Lighting will be minimum required for safe work conditions and navigational purposes	Light spill from unnecessary lighting reduced, lowering likelihood of impacts to the fauna from MODU/vessel lighting.	Good industry practice. Benefits in reducing impacts to marine fauna outweigh the minor costs.	**Accept**

Environmental Impact Assessment

Light emissions during the Activity have the potential to impact:

- Marine turtles;
- Seabirds and migratory shorebirds; and
- Fish and plankton.

There is no known critical habitat within the operational area for EPBC listed species, and no BIAs for these potentially affected fauna. BIAs for whale shark foraging and pygmy blue whale distribution overlap the operational area, but these species are not expected to be impacted by light emissions.

Marine Turtles

Marine turtles are particularly sensitive to artificial light and it is known to pose a threat to marine turtles as it can disrupt critical behaviours (DoEE, 2017a). Light pollution reaching turtle nesting beaches is widely considered detrimental owing to its ability to alter important nocturnal activities, including choice of nesting sites and orientation/navigation to the sea by hatchlings (Witherington and Martin, 2003). Pendoley (2014) found that first time nesting females are likely to be disturbed by light when they are selecting their first nesting beach, but experienced nesting females are not likely to be disturbed. Furthermore, Pendoley (2017) concluded there is no biological reason or evidence for light impacts on internesting turtles.

The most significant risk posed to marine turtles from artificial lighting is the potential disorientation of hatchlings following their emergence from nests (Rich and Longcore, 2006 in EPA, 2010). During this period, light spill onto beaches or into nearshore waters from coastal port infrastructure and ships may 'entrap' hatchling swimming behaviour, reducing the success of their seaward dispersion and potentially increasing their exposure to predation via silhouetting (Salmon et al. 1992).

The National Light Pollution Guidelines states that a 20 km buffer (based on sky glow) to important habitat for turtles should be applied when considering possible impacts from light (DoEE, 2020). Given the Kanga-1 operational area is located ~122 km away from the nearest turtle nesting beach (Legendre Island), and the nearest BIA boundary for marine turtles (flatback turtle) is ~46 km to the southeast of the operational area, impacts to adults and hatchlings are expected to be '*Negligible (I)*'.

Seabirds

Studies in the North Sea confirmed that artificial light was the reason that birds were attracted to and accumulated around illuminated offshore infrastructure; but that migratory birds are attracted to lights on offshore platforms when travelling within a radius of 3–5 km from the light source. Outside this area their migratory path will be unaffected (Marquenie et al. 2008). Birds may either be attracted by the light source itself or indirectly as structures in deep water environments tend to attract marine life at all trophic levels, creating food sources and providing artificial shelter for seabirds (Surman, 2002). The light sources associated with the MODU and vessels may also provide enhanced capability for seabirds to forage at night.

The operational area may be occasionally visited by migratory and oceanic birds, but it does not contain any emergent land that could be used as roosting or nesting habitat and contains no known BIAs (including feeding) for any species. Migratory shorebirds may be present in or fly through the region between July and December and again between March and April as they complete migrations between Australia and offshore locations (DSEWPaC, 2012c). Given the closest island (Legendre Island) is ~122 km to the southeast, only a small number of seabirds and shorebirds are expected to be affected by artificial light emissions. Consequently, light emissions from the MODU and/or vessels are unlikely to attract and/or affect the behaviour of large numbers of seabirds. As such, impacts to seabirds are considered '*Negligible (I)*'.

Fish

The response of fish to light emissions varies according to species and habitat. Fish may be directly or indirectly attracted to light emissions in the immediate vicinity of the MODU and vessels. Experiments using light traps have found that some fish and zooplankton species are attracted to light sources (Meekan et al. 2001) from up to 90 m away (Milicich et al. 1992). Lindquist et al. (2005) concluded that artificial lighting associated with offshore oil and gas activities (i.e. platforms) resulted in an increased 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 for predatory species, and marine predators are known to aggregate at the edges of artificial light halos. While the operational area does overlap the foraging BIA of the whale shark, given that a large proportion of the whale shark's diet is comprised of krill and other planktonic larvae, it is unlikely that a light source will lead to a significant increase in whale shark abundance in the vicinity of the MODU and vessels.

During the Activity, light spill onto the surface waters will be localised and confined to immediately adjacent to the MODU and vessels. Fish may be temporarily attracted to the surface waters to prey on aggregations of plankton and zooplankton. As a result, this may lead to predation by higher predators (e.g. predatory fish and sharks). Any effects on fish behaviour from lighting is predicted to be short-term and localised. Overall, risks and impacts to fish from light emissions are considered to be '*Negligible (1)*' with no long-term impacts on local fish populations.

Overall, impacts and risks to sensitive marine fauna from light emissions are predicted to be '*Negligible (1)*'.

Assessment of Likelihood and Inherent Risk Ranking

Given the lack of important areas of marine fauna that may be sensitive to light emission within or near the operational area, the likelihood of impacts to fish, avifauna and turtles within the operational area from the MODU and support vessels with standard control measures in place is considered '*Unlikely (D)*'. The inherent risk ranking from light emissions during the Activity is evaluated as '*Very Low (1)*'.

Additional Control Measures Considered (ALARP Evaluation)			
Control Measure	**Environmental Benefit**	**Evaluation of Decision**	**Decision**
Substitute external lighting with a lower intensity and longer wavelength light source	Long wavelength and low intensity lights reduce potential for impacts on certain sensitive receptors from light emissions.	Given the potential impacts to turtles during this Activity is negligible, implementing this control would not result in a reduction in consequence; and there would be considerable cost and logistical effort to source and replace all external lighting.	**Reject**
Limit or exclude night time activities	Would eliminate potential impacts of artificial light during hours of darkness when light sources are more apparent and potential impacts are greatest.	Would double the duration of the Activity thereby increasing impacts from other sources (e.g. waste, air emissions etc.). Lighting required by law for navigational and safety purposes.	**Reject**

ALARP Assessment

There are no safe alternatives to the use of artificial lighting on the MODU and vessels. Artificial lighting is required for operational and navigation safety during the Activity. A minimum level of artificial lighting is required on a 24-hour basis to alert other marine users of the Activity and the presence of the MODU and vessels onsite. There are also minimum light requirements that will be necessary to provide safe working conditions. Reducing lighting at night to only navigation requirements would restrict the working hours resulting in the Activity taking more than twice as long to complete. The increased risks / impacts with potentially larger scale consequences associated with reducing light levels are considered to present a cost that is grossly disproportionate to any environmental benefit.

The Activity will not compromise the objectives set out in the National Light Pollution Guidelines for Wildlife (DoEE, 2020), as the operational area is >20 km from any important habitat (foraging, breeding, roosting or dispersal) for EPBC listed species that may be sensitive to light emissions (i.e. turtles, seabirds).

There are no reasonably practicable additional or alternative control measures to further reduce the impacts and risks to marine fauna from light emissions. The lighting onboard the MODU and vessels will be compliant with industry standards, is not dissimilar to lighting used for other offshore activities in the region (shipping and fishing) and is of short duration. As such, the residual risk ranking of light emissions was assessed as '*Very Low*' (1), classified as Type

A decision, and cannot be reduced further. With no additional or alternative control measures identified that would offer a net environmental benefit, the impacts and risks of using artificial lighting at an intensity that will allow work to proceed safely is ALARP.		
Residual Risk Summary		
Consequence	**Likelihood**	**Residual risk**
Negligible (I)	Unlikely (D)	Very Low (1)
Demonstration of Acceptability		
Are environmental impacts and risks reduced to ALARP, and the residual risk ranking between '*Very Low (1)*' to '*Medium (3)*'?		Yes – risks are reduced to ALARP, and the residual risk ranking is *Very Low* (1).
Is the Activity carried out in a manner consistent with the principles of ESD?		Yes – the Activity was evaluated as having the potential to result in negligible consequence, and not result in serious or irreversible environmental damage.
Are the potential risks and hazards consistent with SapuraOMV's policy and standards?		Yes – aligns with SapuraOMV's HSE Policy and HSEMS.
Have legislative and other requirements been met? Industry codes, standards and guidelines applied?		Yes – management consistent with the: • Convention of the Safety of Life at Sea (SOLAS) 1974; • *Navigation Act 2012*; • Convention on the International Regulations for Preventing Collisions at Sea 1972 (COLREGS); • Marine Order 30 (Prevention of Collisions); • Marine Order 21 (Safety of Navigation and Emergency Procedures); • National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (DoEE, 2020); and • Relevant recovery plans and conservation advices for marine turtles and birds.
Have stakeholder expectations been addressed?		N/A – no concerns raised.

Lighting of the MODU and vessels is industry standard and required to meet relevant maritime and safety regulations (e.g. *Navigation Act 2012*). The impact assessment has determined that routine light emissions from the MODU and vessels are unlikely to result in a potential impact greater than localised behavioural disturbance to fauna within the operational area during the Activity, and with no long-term effects. Further opportunities to reduce the impacts and risks from light emissions have been investigated above.

Stakeholders have been informed of the proposed Activity, as detailed in **Section** 5, and no concerns have been raised by stakeholders regarding this hazard/risk. With the control measures proposed, the residual risk ranking from artificial light emissions was assessed as '*Very Low*' (1). On this basis, it is considered the adopted control measures are appropriate to manage the impacts of light emissions to a level that is acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria

Environmental Performance Outcome	Environmental Performance Standard	Measurement Criteria	Responsibility
MODU and vessel lighting is reduced to minimum required for navigation and safe operations.	MODU/vessels compliant with: • COLREGS; • Marine Order 30 (Prevention of Collisions); and • Marine Order 21 (Safety of Navigation and Emergency Procedures).	MODU/vessel inspection confirms compliance with regulations.	MODU OIM Vessel Masters
	Environmental awareness induction provided to MODU and vessel crew that includes requirements to minimise artificial lighting.	Induction presentation.	SapuraOMV Senior HSE Specialist
		Induction attendance records.	SapuraOMV Senior HSE Specialist

7.4 Noise Emissions

Planned Activity
The following activities were identified as having the potential to result in underwater noise emissions: • MODU operations (engines, onboard machinery, drilling); • Vessel operations (propeller cavitation, DP thrusters, operation of machinery and equipment); • Helicopter operations; and • Acoustic downhole profiling (Checkshot or VSP).
Hazard Identification
MODU, Vessel and Helicopter Operations
MODU noise The MODU to be used for the Kanga-1 exploration well will be moored, so there will be no additional noise from using DP equipment. Therefore, noise associated with a moored MODU will be restricted to the normal operation of the MODU and drilling activities, such as the operation of onboard machinery and drill pipe operations. Noise emitted by the normal operation of the MODU is expected to be significantly less than from drilling activities. A MODU is primarily a low-frequency sound source (90% of the emitted acoustic energy concentrated below 250 Hz) with tonal components in the kHz range and an average broadband sound level of 118 dB re 1 µPa within 1 km (Jimenez-Arranz et al. 2019). However, sound level fluctuations are noticeable with time, likely associated with changes in the operational conditions of the MODU (Jimenez-Arranz et al. 2019). McCauley (1998) reported received noise levels of the order of 115 and 117 dB re 1 µPa at 405 m and 125 m, respectively, from a moored MODU while actively drilling (with support vessel on anchor). SVT undertook modelling for a MODU by extrapolating the measured data of McCauley (1998) and applying a safety factor to account for uncertainties and potential differences between rigs. This yielded a source level for a semi-submersible rig during drilling operations of 167 dB re 1 µPa @ 1 m (Shell, 2018). As drilling is a continual activity, and does not involve significant percussive elements, the peak pressure is not relevant to the assessment of noise impact. The MODU is expected to be on location for ~40 days. **Vessel noise** Vessel noise comprises a combination of continuous noise generated by engine and machinery noise, and modulated broadband noise produced by propeller rotation and cavitation (Jensen et al. 2009; Wales and Heitmeyer, 2002; Hildebrand, 2009). Support vessels will sometimes use DP while maintaining position.

Cavitation from the thruster propellers while in DP mode can be a significant source of underwater noise, the source will cycle on-off, and is not present for a majority of the time.

Vessel noise emissions vary with the size, speed, and engine type and the activity being undertaken. Noise levels for a range of vessels have been measured at 164-182 dB re μPa at 1 m (SPL) at dominant frequencies between 50 Hz and 7 kHz (Wyatt, 2008; Simmonds et al. 2004). Studies of underwater noise generated from a DP support vessels when holding position at a drill site indicate highest measured levels up to 137 dB re 1 μPa at 405 m with levels of 120 dB re 1 μPa recorded at 3.5 km when the vessel was maintaining position beside the rig for loading purposes (McCauley, 1998). The support vessels will ensonify the surrounding waters most whenever they are holding position near the MODU. This sound level will be higher than for any machinery on the vessels. McCauley (1998) also measured underwater sound levels while the vessel was transiting at 11 knots, and found the distance to 120 dB re 1 μPa to be within 0.5 - 1 km. One vessel will be present in the PSZ at all times throughout the Activity (see **Section 7.1**), but not always on the same location.

All vessels will travel no faster than 6 knots within the operational area to comply with EPBC Regulation 2000 – Part 8 Interacting with Cetaceans and Whale Shark Management Program Guidelines and to reduce the likelihood of collisions (see **Section 8.6**). Implementing these controls may reduce the noise generated by vessels in proximity to cetaceans and whale sharks as they will be travelling slower; which may reduce underwater noise from engines and propeller cavitation.

Helicopter noise

Helicopters will service the MODU on average three times per week. The presence of the helicopter and its associated sound field will be highly transient. On approach to the MODU the helicopter will descend to the helideck where there is greatest potential to ensonify the water column. Sound pressure will be greatest at the sea surface and rapidly diminish with increasing depth. The primary source of noise from a helicopter is the main rotor. Dominant tones from helicopters are generally below 500 Hz (Richardson et al. 1995). Typically, noise does not transmit well from air into water due to impedance at the air-water interface. Noise levels from a Bell 212 helicopter flying at altitudes of 610 and 152 m were measured at 101 and 109 dB @ 3 m water depth, respectively (Richardson et al. 1995). This provides an indication of the low level of received noise that may be expected from a helicopter.

Acoustic Downhole Profiling

Acoustic downhole profiling (VSP or checkshot) is a routine activity conducted as part of exploration drilling activities and involves placing a number of receivers in the well borehole and transmitting impulsive sound energy to them from a sound source. Acoustic downhole profiling uses highly directional sound energy; it is focussed towards the seabed, but will also ensonify the surrounding water column. Acoustic downhole profiling noise is not continuous. Each discharge of the acoustic source generates a short, discrete, low frequency sound impulse. Sound impulses during acoustic downhole profiling are much lower than those generated during typical marine seismic surveys. The underwater sound generated by the array will be strongest directly under the source and will rapidly decrease with distance from the MODU. The duration of acoustic downhole profiling is short, 12-24 hours, and uses relatively small airguns that generate impulsive low frequency noise.

The sound source is anticipated to be deployed 5-10 m below the water surface from the MODU or a support vessel. The source is expected to generate a peak pressure around 239 dB re 1 μPa pk @ 1 m, a sound pressure level (SPL) of 224 dB re 1 μPa SPL (rms) and sound exposure level (SEL) of 225 dB re 1 μPa^2.s @ 1 m, with the majority of the noise concentrated at low (<100 Hz) frequencies (Jimenez-Arranz et al. 2017). Modelling of VSP undertaken by Chevron Australia and reported in Chevron (2010) using 3 x 250 in^3 air guns at a source depth of 5 m recorded an amplitude spectrum peak of 190 dB re 1 μPa @ 1 m from the source. The results reported also demonstrated that the received source level did not exceed 160 dB re 1 μPa^2.s at a distance of 500 m from the source and 170 dB re 1 μPa^2.s at 100 m from the source.			
Standard Control Measures			
Control Measure	**Environmental Benefit**	**Evaluation of Decision**	**Decision**
Vessels and helicopters will comply with EPBC Regulations 2000 – Part 8 Division 8.1	Reduces risk of physical and behavioural impacts to cetaceans from vessels and helicopters because if cetaceans are sighted, then vessels can slow down or move away.	Operational costs to adhere to marine fauna interaction restrictions, such as vessel speed and direction, are based on legislated requirements and must be accepted.	**Accept**
Implementation of EPBC Act Policy Statement 2.1 - Part A Standard Management Procedures, for whales during all acoustic downhole profiling operations.	Includes controls that reduce the risk of harm to marine fauna. The checklist includes standards for: • Marine fauna observation; • Pre-start-up observations; • Soft-start, operational and shut-down protocols; and • Low visibility and night-time operations.	Some operational costs associated but benefits in reducing impacts to marine fauna outweigh the costs incurred.	**Accept**
Environmental awareness induction will be provided to MODU/vessel crew prior to activities that include marine fauna interaction requirements.	Reduces risk of physical and behavioural impacts to marine fauna because all crew are aware of requirements.	Good industry practice, some operational costs associated, but environmental benefit outweighs cost.	**Accept**

Machinery and equipment maintained in accordance with planned maintenance system (PMS).	Reduces risk of excessive noise due to poor maintenance.	Standard industry practice, environmental benefit outweighs cost.	**Accept**
Environmental Impact Assessment			

Underwater noise generated by the Activity has the potential to impact sensitive receptors, including:

- Transient, EPBC-listed cetaceans, turtles or whale sharks; and
- Fish.

The operational area is located in waters ~147 m deep. The fauna associated with this area will be predominantly soft-sediment benthic invertebrates, pelagic and demersal species of fish, with migratory species such as turtles, cetaceans and whale sharks transiting the area seasonally.

The context of the exposure of sound plays a critical and complex role in the way an animal might respond (Gomez et al. 2016; NMFS, 2016). Elevated underwater noise can affect marine fauna, including cetaceans, turtles, sharks and fish in three main ways (Richardson et al. 1995; Simmonds et al. 2004):

- Injury to hearing or other organs. Hearing loss may be temporary (temporary threshold shift (TTS)) or permanent (permanent threshold shift (PTS));
- Masking or interference with other biologically important sounds such as communication or echolocation; and
- Disturbance leading to behavioural changes or displacement of fauna.

Listed threatened and/or migratory species that could be potentially impacted by underwater noise and that may be present within the operational area include cetaceans, turtles and whale sharks. The operational area overlaps the distribution BIA for pygmy blue whales and the foraging BIA for whale sharks migrating to/from Ningaloo; however, these behaviours do not typically involve individuals remaining in one location for extended periods of time. Although five marine turtle species may occur within the operational area, no BIAs or habitat critical to the survival of the species occur within the operational area and the nearest nesting beaches are 122 km away.

Current research shows that cetaceans differ in their hearing capabilities, in both absolute hearing and the frequency band of hearing (Richardson et al. 1995; Southall et al. 2007). Noise impact thresholds proposed by the U.S. National Oceanic and Atmospheric Administration and National Marine Fisheries Service (NMFS, 2018a) for cetaceans, defines cetaceans into three functional hearing groups based on their frequency hearing ranges. The types of cetacean with the potential to occur in the operational area include low-frequency (LF) and mid-frequency (MF) hearing groups. No high-frequency (HF) cetaceans are likely to be present in the operational area and surrounding waters, and accordingly the impact assessment is focused on LF and MF cetaceans. The thresholds that could result in impacts are detailed in **Table 7-2**.

Underwater hearing in sea turtles has not been thoroughly studied. It is thought that sea turtles do not use sound for communication between individuals underwater, but rather that they use sound for navigation, finding prey, and avoiding predators (NOAA, 2016). Turtles are not considered to be as sensitive to sound as cetaceans. Marine turtles do not have an external hearing organ, but can detect sound through bone-conducted vibration in the skull and by using their shell as a receiving surface (Lenhardt et al. 1985). Based on limited data regarding noise levels that illicit a behavioural response in turtles, the United States National Science Foundation criterion of 166 dB re 1 µPa (SPL) is typically applied (NSF, 2011; **Table 7-2**). Popper et al. (2014) reported that turtles are highly likely to exhibit a behavioural response when they are near an airgun (tens of metres), a moderate response if they encounter the source at intermediate ranges (hundreds of metres), and a low response if they are far (thousands of metres) from the airgun.

The hearing capabilities of whale sharks have not been studied specifically, but it has been suggested that, similar to other cartilaginous species, they are likely to be most responsive to low frequency sounds (Myberg, 2001). No specific impact criteria or thresholds have been identified for sharks and rays. As a conservative and precautionary approach, exposure guidelines for fish with no swim bladder have been used for this assessment (**Table 7-2**). There are no peer reviewed published thresholds for comparison of behavioural disturbance effects in fish as a result of exposure to seismic or continuous sound sources.

Table 7-2 Threshold criteria for underwater noise levels associated with impulsive and continuous sound

Receptor	Generalised Hearing Range	Threshold Criteria for Potential Impacts							
		Physical Injury		PTS		TTS		Behavioural	
		Mortal or potential mortal injury	Recoverable injury	Impulsive	Continuous	Impulsive	Continuous	Impulsive	Continuous
LF cetaceans	7 Hz to 35 kHz[a]			219 dB PK[a] or 183 dB SEL_{24h}[a]	199 dB SEL_{24h}[a]	213 dB PK[a] or 168 dB SEL_{24h}[a]	179 dB SEL_{24h}[a]	160 dB RMS[b]	120 dB RMS [b]
MF cetaceans	150 Hz to 160 kHz[a]			230 dB PK[a] or 185 dB SEL_{24h}[a]	198 dB SEL_{24h}[a]	224 dB PK[a] or 170 dB SEL_{24h}[a]	178 dB SEL_{24h}[a]		
Marine turtles	50 to 1600 Hz[d] 50-400 Hz (greatest sensitivity)			232 dB PK[e]		226 dB PK[e]	Moderate risk within tens of metres of source[c]	166 dB re 1 µPa[f]	Moderate risk within tens of metres of source[c]
Fish and sharks (no	20 Hz to 1.5 kHz[g]	>213 dB PK[c] or	>213 dB PK[c] or			>>186 dB SEL_{24h}[c]	Moderate risk within tens of	(N) High (I) Moderate	

swim bladder)		>219 dB SEL$_{24h}$ [c]	>216 dB SEL$_{24h}$ [c]				metres of source[c]	(F) Low	
Fish (swim bladder not involved in hearing)	100 Hz to 1 kHz[h]	>207 dB PK[c] or 210 dB SEL$_{24h}$[c]	>207 dB PK[c] or 203 dB SEL$_{24h}$[c]			>>186 dB SEL$_{24h}$[c]		(N) High (I) Moderate (F) Low	
Fish (swim bladder hearing)	100 Hz to 2 kHz[h]	>207 dB PK[c] or 207 dB SEL$_{24h}$[c]	>207 dB PK[c] or 203 dB SEL$_{24h}$[c]			186 dB SEL$_{24h}$[c]		(N) High (I) High (F) Moderate	
Fish eggs and fish larvae		>207 dB PK[c] or 210 dB SEL$_{24h}$[c]	(N) Moderate (I) Low (F) Low			(N) Moderate (I) Low (F) Low		(N) Moderate (I) Low (F) Low	

Note: Relative risk (high, moderate, low) is given for animals at three distances from the source defined in relative terms as near (N) – tens of meters, intermediate (I) - hundreds of meters, and far (F) – thousands of meters.

[a] NMFS (2018a) - hearing range representative of the group based on an incomplete sampling of species
[b] NMFS (2018b)
[c] adapted from Popper et al. (2014)
[d] DoEE (2017a)
[e] Finneran et al. (2017)
[f] NSF (2011)
[g] Chapuis et al. (2019)
[h] Popper et al. (2003) – hearing range representative of the group, but differences between some species noted

Cetaceans

The context of exposure plays a critical and complex role in the way an animal might respond to noise emissions (Gomez et al. 2016; NMFS, 2016). Without appropriate control measures in place, noise emissions from a seismic source have the potential to impact cetaceans by causing behavioural disturbance impacts or causing changes to hearing (PTS and TTS) as a result of high sound levels at close range. Based upon the predicted sound levels generated during acoustic downhole profiling (239 dB re 1 µPa pk @ 1 m) there is potential for PTS to occur for any cetaceans within a few metres of the source and TTS within a few tens of metres of the source, and with sound levels likely to be above ambient noise levels over several kilometres. These ranges are comparable to ranges modelled for VSP by Matthews (2012) and reported in Salgado Kent et al. (2016) who found that prolonged exposure to multiple pulses of the VSP source could result in TTS within a few hundred metres of the source. If TTS did occur to cetaceans, it would be limited to a few individuals and the effects will be temporary and recoverable. Salgado Kent et al. (2016) reported that seismic pulses, in the order of that used for VSP activities, will reduce to levels <120 dB re 1 µPa over approximately 5–10 km; therefore, a range of behavioural responses may occur within this distance from the VSP source, although actual behavioural avoidance as a result of sound pressure levels greater than 160 dB re 1 µPa is more likely to occur within 1–2 km of the source. This represents a very small proportion of available habitat for cetacean species, including pygmy blue whales.

The auditory bandwidth of baleen whales overlaps the low frequency broadband noise produced by thrusters during vessel positioning and movement. Impacts are likely to be limited to masking or behavioural disturbance, as the noise levels likely to be produced by operations are below proposed injury criteria for low frequency cetaceans (**Table 7-2**). However, masking and behavioural impacts are considered temporary and localised because the marine fauna will be almost constantly moving and therefore no single area will be impacted for any length of time. SVT undertook modelling for a MODU (drilling) and an offshore support vessel operating on DP at three locations in water depths of 152 m to 192 m (Shell, 2018), similar depths to that of the operational area. Results indicated that cetacean criteria for continuous noise sources were not exceeded under any modelled MODU drilling scenario. For the support vessel, the cetacean PTS and TTS criteria were not reached under any modelled scenarios; however, the low-frequency cetacean behavioural criterion may be exceeded by a support vessel on DP, provided that the animal remains within this range for at least one hour (Shell, 2018). This aligns with measurements by McCauley (1998) who found the furthest distance to the behavioural criteria of 120 dB re 1 μPa was reached at 3.5 km from a support vessel maintaining position with DP.

Behavioural responses to noise are highly variable and context-specific. Cetaceans approaching a vessel will be gradually exposed to increasing noise levels and therefore animals will not be startled by sudden or loud noises and behavioural responses are expected to be limited (Southall et al. 2007). However, it is reasonable to expect that cetaceans may demonstrate avoidance behaviour to the noise generated by vessels. Pygmy blue whales may occur in the operational area, with overlap of the distribution BIA for this species (see **Figure 4-6**). Therefore, when transiting through the area, pygmy blue whales may deviate slightly from their path. Potential impacts from vessel noise are likely to be restricted to temporary avoidance behaviour to individuals transiting through the operational area and are therefore considered localised with no lasting effect. The Conservation Management Plan for the Blue Whale (DoE, 2015a) details that shipping and industrial noise, which includes drilling activities, are classed as a minor consequence for which the definition is: individuals are affected but no affect at a population level.

Reactions of whales to circling aircraft (fixed wing or helicopter) are sometimes conspicuous if the aircraft is below an altitude of approximately 300 m, uncommon at 460 m and generally undetectable at >600 m (NMFS, 2001). Helicopters will only be at low altitudes within the operational area when landing or taking off from the MODU. In the event that cetaceans are close to the MODU, responses to helicopter noise are expected to consist of short-term behavioural responses, such as increased swimming speed.

Overall, any impacts from acoustic downhole profiling operations and MODU and vessel operations noise on cetaceans are assessed as '*Minor (II)*' (potential for PTS or TTS) and '*Negligible (I)*' (potential for behavioural effects) on individuals, respectively, but not at the population level.

Marine Turtles

Behavioural responses by marine turtles from impulsive sound have been reported for sound levels of between 166 dB re 1 μPa (NSF, 2011) and 175 dB re 1 μPa (McCauley et al. 2000a; 2000b; Moein et al. 1995). Popper et al. (2014) reported that turtles are highly likely to exhibit a behavioural response when they are near an airgun (tens of metres), a moderate response if they encounter the source at intermediate ranges (hundreds of metres), and a low response if they are far (thousands of metres) from the airgun. Based on the above thresholds, turtles may actively swim to avoid the sound source within a few kilometres.

The Recovery Plan for Marine Turtles in Australia (DoEE, 2017a) identifies noise interference as a threat to turtles. It details that exposure to chronic (continuous) loud noise in the marine environment may lead to avoidance of important habitat. Popper et al. (2014) details that there is no direct evidence of mortality or potential mortal injury to sea turtles from ship noise. The area affected by sound levels that can cause behavioural responses does not contain critical habitat or BIAs for marine turtles and is in open ocean where marine turtles can move away from increased sound levels. Low numbers of marine turtles are predicted in the operational area and therefore impacts would be limited to a small number of individuals and unlikely to have a significant impact at a population level.

As such, any impacts from acoustic downhole profiling operations and MODU and vessel operations noise on marine turtles are evaluated to be '*Minor (II)*' (potential for physiological harm) and '*Negligible (I)*' (potential for avoidance), respectively on individuals, but not at the population level.

Sharks and Fish

There is a wide range of susceptibility and resilience to underwater noise pulses among fish; direct physical damage may occur to fish if they approach within a very close range of a few metres (<5 m) of a seismic source (Gausland, 2000; McCauley et al. 2003). However, demersal and epibenthic fish species are located towards the bottom of the water column and are beyond this range of direct physical damage, and pelagic fish species are highly mobile and are likely to move away from the noise source if the sound levels become uncomfortable (McCauley et al. 2003).

The benthic substrate within the operational area is expected to be made up of unconsolidated soft sediment, predominantly mud and calcareous clay substrate and be featureless with no known sensitive seabed features (such as reefs, sponge gardens or seagrass meadows) (**Section 4.4.5**). Therefore, site-attached fish species are not expected. It is expected that any impacts to fish, including sharks, from acoustic downhole profiling activities will be localised and of no lasting effect, and restricted to temporary behavioural changes (avoidance) in any isolated individuals that may transit the area in close proximity to the operating acoustic source. This aligns with the Popper et al. (2014) guidelines, which report that there is the potential for high risk of behavioural impacts in fish species near a seismic source (tens of metres) with the level of risk declining to low at thousands of metres from the seismic source. Therefore, disturbance to pelagic fish species may occur; however, given the absence of any spawning or aggregation habitat within operational area, any impact would be localised to individuals and would not result in any detrimental impacts in stock levels. As such, any impacts from acoustic downhole profiling activities are considered to be '*Minor (II)*'.

Behavioural responses in fish, which are less sensitive to noise than cetaceans, may occur within tens or hundreds of metres from vessels and other continuous/ non-impulsive noise sources (Popper et al. 2014). While fish may show an initial behavioural response, fish are known to quickly habituate to continuous noise sources (Spiga et al. 2012; Nichols et al. 2015; Johansson et al. 2016; Holmes et al. 2017). Popper et al. (2014) notes that there is no direct evidence of mortality or potential mortal injury to fish from ship noise. Popper et al. (2014) details that risks of mortality and potential mortal injury, and recoverable injury impacts to fish with no swim bladder (including sharks) is low and that TTS in hearing may be a moderate risk near (tens of metres) the vessel. For fish with a swim bladder risks of mortality and potential mortal injury impacts are low. No cumulative impacts are expected as there are no sensitive benthic habitats likely to support site-attached fish in the operational area. Behavioural impacts are more likely such as moving away from the MODU and vessels.

The operational area overlaps the foraging BIA for whale sharks migrating to/from Ningaloo (with peak numbers expected March to July). The Conservation Advice for whale sharks (*Rhincodon typus*) (TCCS, 2015a) does not identify noise impacts as a threat to the species. Potential impacts from MODU and vessel noise are likely to be restricted to temporary avoidance behaviour to individuals transiting through the operational area and are therefore considered localised with no lasting effect. There are no habitats or features within the operational area that would restrict fish and sharks from moving away from noise sources. As such, any noise impacts from the Activity on sharks and fish are considered to be '*Negligible (I)*'.

Protected Areas

The nearest protected area, the ancient coastline KEF is located ~5.1 km south of the proposed Kanga-1 well location. While the noisiest activities may temporarily generate sound levels above ambient noise levels at this range, the benthic communities associated with this KEF are not expected to be impacted, as the noise levels will be below thresholds that can cause injury or behavioural impacts. As such, any noise impacts from the Activity on Protected Areas are considered to be '*Negligible (I)*'.

Summary

With the exception of acoustic downhole profiling, no sources of noise associated with the Activity are expected to have the potential to result in PTS or TTS. It is possible that physical and behavioural impacts may occur from acoustic downhole profiling operations. Potential behavioural responses for various groups of sound sensitive marine fauna are expected, at a worst case, to be limited to a few kilometres from the source for the duration of acoustic downhole profiling.

Given the generally low level of noise expected from the MODU, vessels, helicopters and associated activities, and the relatively short duration of noise emissions (~40 days), significant impacts to threatened or migratory species are not expected. Some temporary and localised behavioural response may result from the noise levels emitted, but these will not be at levels that could cause mortality or injury to marine fauna, or cause a decrease in local population size or area of occupancy of species.

Overall, any impacts from acoustic downhole profiling operations and MODU/vessel operations noise on marine fauna are evaluated to be '*Minor (II)*' (potential for physiological harm) and '*Negligible (I)*' (potential for avoidance), respectively on individuals.

Assessment of Likelihood and Inherent Risk Ranking

With standard controls in place (see above) including the implementation of soft start procedures and fauna monitoring/shutdowns in accordance with EPBC Policy 2.1, physical impacts to marine fauna individuals such as PTS/TTS are '*Unlikely (D)*'. Prolonged exposure to multiple pulses of the acoustic downhole profiling source could result in TTS within a few hundred metres of the source (Salgado Kent et al. 2016), but this would occur after many minutes or hours, and marine fauna are likely to move to avoid such sound exposures before TTS effects occur.

Given helicopters will maintain a >500 m horizontal separation from cetaceans (as per the EPBC Regulations), and the predominantly seasonal presence of whales within the operational area, interactions between helicopters and cetaceans resulting in behavioural impacts are also '*Unlikely (D)*'. However, if noise sensitive fauna are present in the vicinity of the MODU or vessels during noise generating operations, localised behavioural responses including avoidance of the area of elevated underwater sound may occur, and the likelihood of these impacts from noise emissions to marine fauna individuals during the Activity is

‘*Possible (C)*’. Therefore, the inherent risk ranking from noise emissions during the Activity is evaluated as ‘*Low (2)*’ for the acoustic downhole profiling survey and ‘*Low (2)*’ for MODU/vessel operations noise.			
Additional Control Measures Considered (ALARP Evaluation)			
Control Measure	**Environmental Benefit**	**Evaluation of Decision**	**Decision**
Adjust the Activity schedule to occur entirely outside of sensitive periods (e.g. peak whale shark season).	Adjusting the Activity schedule to avoid sensitive periods for marine fauna adjacent to the operational area may reduce risk of impacts from noise emissions.	Cost disproportionate to the environmental benefit. Variation of timing of Activity may not be logistically feasible as Activity is subject to schedule constraints and MODU/vessel availability. Risks are already low with standard controls in place. Significant cost and schedule impacts if activities avoid specific timeframes. Differences in lifecycle events and peak activity times between species complicates selection of least sensitive period.	**Reject**
Dedicated marine fauna observer (MFO) onboard for duration of the Activity.	A dedicated MFO onboard support vessels for the duration of the Activity would improve the ability to spot marine fauna and implement separation distances.	Given that vessel bridge crews already maintain a constant watch during operations, additional MFOs would not further reduce the likelihood or consequence of impact. The risk of vessel noise impacting fauna is already low and cost of keeping a dedicated MFO onboard the vessels for the entire duration of the Activity is considered grossly disproportionate to the environmental benefit.	**Reject**

Vessels will comply with Whale Shark Interaction Guidelines (DPaW, 2013)	Reduces risk of physical and behavioural impacts to whale sharks from vessels because if whale sharks are sighted, then vessels can slow down or move away.	Benefits in reducing impacts to whale sharks outweigh the minor costs.	**Accept**
Dedicated MFO during acoustic downhole profiling operations.	A dedicated MFO onboard during acoustic downhole profiling operations would improve the ability to spot and identify marine fauna at risk of harm from underwater higher intensity noise emissions.	Good industry practice, environmental benefit outweighs cost.	**Accept**

ALARP Assessment

The Activity will generate various types of sound; however, the effects associated with MODU and vessel operations and acoustic downhole profiling operations are well understood and regularly practised offshore. Sound emissions from drilling equipment, support vessel thrusters and helicopters are unavoidable; however, these will be intermittent during the Activity. Given the open water, oceanic location of the operational area, it is not expected that any behavioural disturbance would result in impacts greater than incidental changes to transitory behaviours, with population impacts from changes to behaviours not expected. Further opportunities to reduce impacts have been investigated with two additional controls accepted. The additional control of vessel compliance with whale shark interaction guidelines does not change the inherent consequence, likelihood or risk. Similarly, a dedicated MFO during acoustic downhole profiling does not change the inherent consequence, likelihood or risk the likelihood of physiological marine fauna impacts. Nonetheless, both of these additional control measures are adopted as both are good industry practice.

SapuraOMV considers the adopted control measures to be appropriate in reducing the environmental impacts associated with underwater sound on marine fauna, and the residual risks from noise emissions were assessed as '*Low*' (2) and classified as a Type A decision. There are no other reasonably practicable control measures that may be adopted to further reduce the impacts without disproportionate costs, compared to the benefit of the potential impact reduction. Therefore, the residual risk from noise emissions generated during the Activity is considered to be reduced to ALARP.

Residual Risk Summary – Noise from MODU, Vessels, Helicopters and Mechanical Equipment

Consequence	Likelihood	Residual risk
Negligible (I)	Possible (C)	Low (2)

Residual Risk Summary – Acoustic Downhole Profiling Survey		
Consequence	**Likelihood**	**Residual risk**
Minor (II)	Unlikely (D)	Low (2)

Demonstration of Acceptability	
Are environmental impacts and risks reduced to ALARP, and the residual risk ranking between '*Very Low (1)*' to '*Medium (3)*'?	Yes – risks are reduced to ALARP, and the residual risk ranking is *Low* (2).
Is the Activity carried out in a manner consistent with the principles of ESD?	Yes – the Activity was evaluated as having the potential to result in negligible or minor consequence, and not result in serious or irreversible environmental damage.
Are the potential risks and hazards consistent with SapuraOMV's policy and standards?	Yes – aligns with SapuraOMV's HSE Policy and HSEMS.
Have legislative and other requirements been met? Industry codes, standards and guidelines applied?	Yes – Management consistent with EPBC Regulations Part 8 and Whale Shark Interaction Guidelines. Implementation (for cetaceans and whale sharks) of standard management measures of EPBC Act Policy Statement 2.1 for acoustic downhole profiling operations. Controls implemented will minimise the potential impacts from the Activity to species identified in recovery plans and conservation advices as having the potential to be impacted by noise emissions. Relevant species recovery plans, conservation management plans and management actions, including but not limited to the: • Blue Whale Conservation Management Plan 2015 – 2025 (DoE, 2015b); and • Conservation Advice (*Rhincodon typus*) whale shark (TSSC, 2015a). • Recovery Plan for Marine Turtles in Australia (DoEE, 2017a)
Have stakeholder expectations been addressed?	N/A – no concerns raised.

During acoustic downhole profiling operations, the EPBC Act Policy Statement 2.1 Part A will be implemented with the additional control measure of an MFO on board (Part B: Additional Management Procedures).

Anthropogenic noise from seismic surveys has been identified as a threat to pygmy blue whales in the Conservation Management Plan for the Blue Whale (DoE, 2015a). Seismic noise has not been identified as a threat to whale sharks in either the Approved Conservation Advice (TSSC, 2015a) or previously in force Whale Shark Recovery Plan 2005 – 2010 (DEH, 2005b), and noise pollution is not identified as a pressure to whale sharks in the Marine Bioregional Plan for the NWMR (DSEWPaC, 2012a). Noise interference has been identified as a threat to marine turtles (DoEE, 2017a).

The above listed controls to be adopted during the Activity are in alignment with the actions identified in the relevant conservation management documents, such as:

- Anthropogenic noise in BIAs will be managed such that any blue whale continues to utilise the area without injury;
- EPBC Act Policy statement 2.1 – Interaction between offshore seismic exploration and whales is applied to all seismic source operations; and
- Soft start provisions of EPBC Act Policy 2.1 implemented to afford protection for marine turtles.

The impact assessment has determined that the MODU, drilling activities, vessels, helicopters and acoustic downhole profiling noise disturbance is unlikely to result in a potential impact greater than localised non-significant impacts to marine fauna, with no lasting effect. Stakeholders have been informed of the proposed Activity, as detailed in **Section 5** and there are no concerns raised by stakeholders regarding this hazard/risk. With the control measures proposed, the residual risk ranking associated with noise emissions was assessed at '*Low*' (2). On this basis, it is considered that adherence to the environmental performance standards will manage the impacts and risks from noise emissions to an acceptable level.

Environmental Performance Outcomes, Standards and Measurement Criteria

Environmental Performance Outcome	Environmental Performance Standard	Measurement Criteria	Responsibility
No death or injury to marine fauna populations from MODU, vessel and helicopter operations.	Vessel and helicopter activities are undertaken in accordance with EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans: • Vessels will not knowingly travel faster than 6 knots within 300 m of a whale or 150 m of a dolphin; • Vessels will not knowingly get closer than 100 m of a whale or 50 m of a dolphin;	Daily operations reports note when cetaceans were sighted in the caution zone and interaction management actions implemented.	Vessel Masters
		Flight reports note when cetaceans were sighted in the caution zone and interaction	Helicopter Pilot

	• If a cetacean approaches, the vessel within the above zones, the vessel will avoid rapid changes in engine speed or direction; • Helicopters will not fly lower than 1650 ft when within 500 m horizontal distance of a cetacean except when landing or taking off and will not approach a cetacean from head on.	management actions implemented.	
	Vessels adopt measures consistent with the DPaW Whale Shark Management Program (2013), including: • Taking action to avoid approaching or drifting closer than 30 m of a whale shark; and; • Not exceeding 8 knots within 250 m of a whale shark.	Daily operations reports note when whale sharks were sighted in the caution zone and interaction management actions implemented.	Vessel Masters
	Environmental awareness induction provided to MODU and vessel crew that include marine fauna interaction requirements.	Induction presentation.	SapuraOMV Senior HSE Specialist
		Induction attendance records.	SapuraOMV Senior HSE Specialist
	Machinery and equipment maintained in accordance with planned maintenance system (PMS) to reduce risk of excessive noise due to poor maintenance.	PMS records.	Chief Engineers
No death or injury to marine fauna populations from acoustic downhole profiling operations.	Part A of EPBC Policy Statement 2.1 is applied in full to mitigate potential impacts to whales including: • Observation zone: 3+ km horizontal radius from sound source. • Low power zone: 1 km horizontal radius from sound source. • Shut-down zone: 500 m horizontal radius from sound source.	MFO report confirms that precaution zones and procedures are implemented in accordance with Part A of EPBC Policy Statement 2.1.	MFO

	• Pre-Start-up visual observations • Soft-start procedures • Start-up Delay procedures • Operational shut-down and low-power procedures • Night-time and low visibility procedures • Sighting reports		
	Marine Fauna Observer (MFO) onboard to monitor for presence of marine fauna throughout acoustic downhole profiling operations.	MFO report demonstrates marine fauna observation undertaken throughout daylight hours during acoustic downhole profiling operations.	SapuraOMV Senior HSE Specialist
		Crew list records presence of MFO.	
	All sightings reported to DAWE within 2 months of completing the Activity.	Records demonstrate Cetacean Sightings Application (CSA) report sent to DAWE.	MFO SapuraOMV Senior HSE Specialist

7.5 Atmospheric Emissions

Planned Activity			
The following activities were identified as having the potential to result in atmospheric emissions: • MODU and vessel operations.			
Hazard Identification			
Atmospheric emissions will be generated through the use of combustion engines, compressors, generators, incinerators, and mobile and fixed plant and equipment onboard the MODU and vessels. These emissions will consist of greenhouse gases (GHG), principally CO_2, but also non-GHG pollutants such as sulphur oxides (SOx), nitrogen oxides (NOx), volatile organic compounds (VOCs), aromatic hydrocarbons, heavy metals and particulate matter (e.g. soot). The MODU and vessels may use ozone-depleting substances (ODS) in closed-system rechargeable refrigeration systems. There is no plan to release ODS to the atmosphere. Atmospheric emissions from the MODU and vessels during the Activity have the potential to result in localised changes in air quality and subsequent exposure of marine avifauna to air pollutants. Atmospheric emissions have the potential to contribute to regional, national and global GHG emissions.			
Standard Control Measures			
Control Measure	**Environmental Benefit**	**Evaluation of Decision**	**Decision**
MARPOL 73/78 Annex VI (Prevention of Air Pollution) and Marine Order 97	Reduces likelihood of impacts to air quality due to emissions.	Control is a legislated requirement. Implementation of the regulations will reduce the atmospheric emissions released into the environment.	**Accept**
Combustion equipment maintained in accordance with PMS	Combustion equipment maintenance will reduce atmospheric emissions released into the environment.	Good industry practice, environmental benefit outweighs cost.	**Accept**
Fuel use will be measured, recorded and reported for the MODU and vessels	Abnormalities are detected and investigated early, reducing the possibility of increased emissions	Good industry practice, environmental benefit outweighs cost.	**Accept**

Environmental Impact Assessment			
Atmospheric emissions during the Activity have the potential to impact: • Air quality; and • Global GHG effect. Fuel combustion and incineration have the potential to result in localised and temporary reduction in air quality in the immediate vicinity of the discharge point and may also contribute to GHG in the atmosphere. Elevated concentrations (i.e. beyond accepted air quality standards) of air toxins can have adverse consequences to human health and fauna. Emissions may also contribute to the global GHG effect. Given the open, offshore location of the operational area, it is expected that gaseous emissions will quickly dissipate into the surrounding atmosphere. As the Activity will occur in remote, offshore waters (closest town to the operational area being ~163 km SSE, nearest island being Legendre Island ~122 km S), the only sensitive receptors that could potentially be affected are the workforce (i.e. onboard the vessel) and seabirds. While emissions add to GHG in the atmosphere, they are relatively small on a global scale, representing an insignificant contribution to overall GHG emissions. With the absence of nearby sensitive habitats (Legendre Island ~122 km away) and towns, and the localised and temporary effects, the overall consequence of atmospheric emissions from the Activity is considered to be '*Negligible (I)*'.			
Assessment of Likelihood and Inherent Risk Ranking			
The likelihood of atmospheric emissions from the MODU and support vessels causing any material impacts to sensitive receptors or material contributions to overall GHG emissions is considered '*Unlikely (D)*'. The inherent risk ranking from atmospheric emissions during the Activity is therefore evaluated as 'Very *Low* (1)'.			
Additional Control Measures Considered (ALARP Evaluation)			
Control Measure	**Environmental Benefit**	**Evaluation of Decision**	**Decision**
No offshore incineration	Reduction in air emissions.	If waste not incinerated offshore, additional cost, including health, safety and environmental implications, would be incurred associated with onboard storage and transferring waste to shore for disposal. More vessel transits to shore and land transport to landfill	**Reject**

		facility would be required, so unlikely to reduce overall emissions.	

ALARP Assessment

The risk assessment and evaluation has identified a range of existing standard controls that when implemented are considered to adequately manage the impacts and risks from atmospheric emissions. The Activity cannot happen without the MODU and vessels, and the combustion of conventional fuels is essential to undertaking the Activity. Practical and reliable alternative fuel types and power sources for the MODU and vessels have not been identified.

With the adoption of the standard industry controls, including legislative requirements and Marine Orders and the use of low (<0.5%) sulphur diesel fuel, the residual risk ranking from atmospheric emissions was assessed as '*Very Low*' (1), a Type A decision, and cannot be reduced further. With no additional or alternative reasonably practicable control measures identified that would offer a net environmental benefit, the residual risk from atmospheric emissions generated during the Activity is considered to be reduced to ALARP.

Residual Risk Summary

Consequence	Likelihood	Residual risk
Negligible (I)	Unlikely (D)	Very Low (1)

Demonstration of Acceptability

Are environmental impacts and risks reduced to ALARP, and the residual risk ranking between '*Very Low (1)*' to '*Medium (3)*'?	Yes – risks are reduced to ALARP, and the residual risk ranking is *Very Low (1)*.
Is the Activity carried out in a manner consistent with the principles of ESD?	Yes – the Activity was evaluated as having the potential to result in negligible consequence, and not result in serious or irreversible environmental damage.
Are the potential risks and hazards consistent with SapuraOMV's policy and standards?	Yes – aligns with SapuraOMV's HSE Policy and HSEMS.
Have legislative and other requirements been met? Industry codes, standards and guidelines applied?	Yes – requirements of MARPOL Annex VI and Marine Order 97 (Marine Pollution Prevention – air pollution) adopted.
Have stakeholder expectations been addressed?	N/A – no concerns raised.

Atmospheric emissions are an unavoidable by-product of all offshore activities, the impacts are well understood and subject to national and international regulation to avoid unacceptable impacts. The proposed controls meet legislative requirements of the International Convention for the Prevention of Pollution

from Ships (MARPOL 73/78) and associated AMSA Marine Order 97 (Marine Pollution Prevention - Air Pollution) under the *Protection of the Sea (Prevention of Air Pollution) Act 1983* for the management of emissions at sea. The impact assessment has determined that potential impacts are localised and short term and exceedance of air quality standards is extremely unlikely. Stakeholders have been informed of the proposed Activity, as detailed in **Section 5** and no concerns have been raised by stakeholders regarding this hazard/risk. With the control measures proposed, the residual risk ranking associated with atmospheric emissions was assessed as '*Very Low (1)'*. On this basis, it is considered that adherence to the environmental performance standards will manage the impacts and risks from atmospheric emissions to an acceptable level.			
Environmental Performance Outcomes, Standards and Measurement Criteria			
Environmental Performance Outcome	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
Atmospheric emissions managed in accordance with the relevant legislative requirements and Marine Orders.	In accordance with MARPOL 73/78 Annex VI (Prevention of Air Pollution) and Marine Order 97: • MODU and vessels (> 400 GT) will have a valid IAPP Certificate. • Incinerator(s) certified to meet emissions standards. • Personnel responsible for operating incinerators will be trained in accordance with operating manual. • Use of 'low sulphur' diesel (≤ 0.5% m/m). • MODU/ vessels comply with the requirements for ozone depleting substances (ODS), including no deliberate release of ODS.	HSE inspection confirms MODU/vessels hold a valid IAPP certificate.	Chief Engineers
		HSE inspection confirms that vessels have an IMO type approval certificate for onboard incinerator.	Chief Engineers
		Training records of personnel responsible for operating incinerators.	Chief Engineers
		Bunker receipts verify use of 'low sulphur' diesel.	Chief Engineers
		HSE inspection confirms ODS Record Book (where applicable) is current and maintained in compliance with Annex VI.	MODU OIM Vessel Masters
		Fuel use is recorded in the daily operations reports	MODU OIM Vessel Masters

	• Fuel usage measured, recorded and reported.		
	All combustion equipment maintained in accordance with PMS (or equivalent).	PMS records verify combustion equipment maintained to schedule.	Chief Engineers

7.6 Routine Operational Discharges

Planned Activity
The following activities were identified as having the potential to result in planned liquid releases to the marine environment: • MODU and vessel operations.
Hazard Identification
The MODU and vessel will generate sewage, grey water, putrescible waste, bilge, cooling water and brine that will require discharge to the marine environment. During the Activity, these discharges have the potential to reduce water quality which may impact: • Plankton; and • Marine fauna. **Sewage, grey water and putrescible waste** Total volumes of treated sewage and grey water (from the use of ablution, laundry and galley facilities) typically generated at offshore facilities ranges between 0.04 and 0.45 m^3 per person per day (EMSA, 2016; NERA, 2017). Assuming up to 180 people working on the MODU each day and up to 15 people on up to four support vessels (a total of up to 240 people), this equates to up to a maximum 108 m^3 of sewage and grey water discharged daily. The average volume of putrescible wastes produced is estimated at 1-2 kg/person/day (0.001-0.002 m^3; NERA, 2017). This equates to up to a maximum 0.48 m^3 of putrescible waste discharged daily. **Treated bilge water and deck drainage** Bilge water accumulates from closed deck drainage and machinery spaces. It can contain water, oils from machinery spaces or minor spills, detergents, solvents and other chemicals. Bilge water is treated onboard the MODU or vessel using the oily water separator (OWS) to reduce the discharge to below the regulated level of <15 ppm. If not treated, bilge water is retained onboard for disposal at an onshore facility. Deck discharges include water that goes directly overboard or via deck drainage systems. Water sources could include rainfall events and/or deck activities such as cleaning or wash-down of equipment/decks, and water may contain minor quantities of detergents, and oil and grease that has spilled on the deck. **Cooling and brine water** Seawater is used as a heat exchange medium for cooling machinery engines and other equipment. Seawater is drawn from the ocean and flows counter-current through closed-circuit heat exchangers, transferring heat from engines and machinery to the seawater. The seawater is then discharged to the ocean

(i.e. it is a once-through system). Cooling water temperatures vary depending upon the vessel's engine workload and activity, but may be warmer than the ambient water temperature, and may contain low concentrations of residual biocide, used to prevent biofouling inside the heat exchangers. However, scale inhibitors and biocides used in the heat exchange and desalination process discharges are inherently safe because they are usually largely "consumed" in the inhibition process and there is only a low residual chemical concentration in the discharge stream. Brine wastewater will be produced by the MODU and vessel reverse osmosis desalination process that is required to generate freshwater for drinking, showers and cooking. The brine wastewater will have elevated salinity above ambient waters (~10%), which may also contain residual traces of anti-scalant (cleaning agent) used in the cleaning of the potable water supply system. The volume of brine solution discharged is dependent on the requirement for potable water and would vary depending on the number of people onboard the MODU and vessels. The environmental receptors that may be exposed to changes in water quality from these discharges include pelagic fish, marine turtles, cetaceans, seabirds and plankton in surface waters around the MODU and vessels. Environmental risk relating to unplanned (non-routine/accidental) disposal/discharge of waste is addressed in **Section 8.5**.			
Standard Control Measures			
Control Measure	**Environmental Benefit**	**Evaluation of Decision**	**Decision**
Sewage will be managed in accordance with MARPOL Annex IV and AMSA Marine Order 96 (Marine pollution prevention – sewage).	Reduces potential impacts of inappropriate discharge of sewage. Provides compliance with legislated requirements.	Associated cost of ensuring vessel system(s) are in place during MODU/ vessel contracting and in pre-mobilisation audits and inspections, and in reporting discharge levels. Benefits of ensuring MODU/vessel is compliant outweigh the minimal costs of personnel time and it is a legislated requirement.	**Accept**
Onboard treatment system for oily water discharges.	Reduces potential impacts of planned discharge of oily water to the environment. Provides compliance with MARPOL Annex I and Marine Order 91 (Marine pollution prevention - oil).	Associated cost in ensuring certificates are in place during MODU/ vessel contracting and in pre-mobilisation audits and inspections, and in reporting discharge levels.	**Accept**

		Benefits of ensuring MODU/vessels are compliant outweigh the minimal costs of personnel time, and it is a legislated requirement.	
MARPOL Annex V and Marine Order 95 compliant macerator is used on the MODU and support vessels within the operational area.	Reduces potential impacts of planned discharge of putrescible waste to the environment. Provides compliance with MARPOL Annex IV and Marine Order 95 (Marine pollution prevention - garbage).	Associated cost in ensuring compliance through audits and inspections. Benefits of ensuring MODU/vessels are compliant outweigh the minimal costs of personnel time.	**Accept**
PMS ensures efficient operation.	Maintenance will ensure equipment operating efficiently and according to manufacturer specifications.	Good industry practice, environmental benefit outweighs cost.	**Accept**
Deck cleaning and product selection	Improves water quality discharge (reduced toxicity) to the marine environment.	Associated costs of implementing, potential additional cost and delays of chemical substitution. Benefits of reducing potential toxicity outweigh the cost	**Accept**

Environmental Impact Assessment

The changes in water quality as a result of routine discharges may include:

- Temporary localised toxicological effect from contaminants;
- Localised increased turbidity in the water column that may temporarily inhibit photosynthesis by phytoplankton by decreasing light availability in surface waters;
- Temporary nutrient enrichment of surrounding waters potentially resulting in localised oxygen depletion and increased phytoplankton growth; and
- Temporary, localised elevated salinity and water temperature that may impact phytoplankton and sensitive marine fauna close to the source.

Sewage, grey water and putrescible waste
The main environmental impact associated with discharge of sewage and other organic wastes (i.e. putrescible waste) is eutrophication. Eutrophication occurs when the addition of nutrients, such as nitrates and phosphates, causes adverse changes to the ecosystem, such as oxygen depletion and phytoplankton blooms. However, the potential for eutrophication impacts are greatly reduced where natural dissipation rates prevent build up of nutrient levels, such as in oceanic offshore environments. As the operational area is >12 nm from the nearest land, direct discharge to the marine environment of all sewage/greywater and putrescible wastes (even untreated) is considered acceptable under Marine Order 96 (Marine pollution prevention – sewage) 2018 and Marine Order 95 (Marine pollution prevention – garbage). No significant impacts are expected from treated discharges of these wastes during the Activity given the biodegradable nature of the waste, the small volumes released relative to the receiving environment's assimilative capacity, lack of nearby habitats sensitive to any nutrient increases and the highly dispersive nature of the receiving ocean environment. The North West Shelf is characterised as an ecosystem in which nutrients and organic matters are rapidly recycled (Furnas and Mitchell, 1999). Hence, the daily nutrient loadings from the Activity are inconsequential in comparison to the daily turnover of nutrients that takes place. Based on these factors, the consequence of these discharges in terms of eutrophication of the marine environment is considered to be '*Negligible (I)*'.
Treated bilge water and deck drainage
Discharges of oily water will be treated to <15 ppm in accordance with MARPOL Annex I and Marine Order 91 – Marine Pollution Prevention (Oil). Discharge of treated bilge or deck drainage is non-continuous and infrequent. Discharges could introduce low concentrations of hazardous substances (mixture of water, oily fluids, lubricants, cleaning fluids, etc.) into the water column. In turn, this may result in a reduction in water quality, with potential impacts to pelagic organisms. However, potential impacts from toxicity effects would be limited to passive marine biota (i.e. planktonic organisms and fish larvae) that become entrained in the discharge plume; mobile marine fauna such as fish would be able to move away from the area of discharge. Due to the small volumes, the very low levels of contaminants likely to be entrained in the discharge and the rapid dilution and dispersal that will result at the oceanic location, the environmental effects will be temporary, localised and limited to the surface waters (<5 m). Therefore, the impacts to fauna in the water column from deck and bilge discharges are predicted to be localised with no ecosystem-level effects. The water quality is predicted to rapidly return to original state by natural action after the Activity is complete. Based on these factors, the consequence of these discharges in terms of toxicity effects on the marine environment is considered to be '*Negligible (I)*'.
Cooling and brine water
Cooling water will be discharged at a temperature above ambient seawater temperature. Upon discharge it will be subjected to turbulent mixing and transfer of heat to the surrounding waters. Effects of elevated seawater temperature may include a range of behavioural responses in transient, protected marine fauna. However, protected marine fauna with the potential to be in the operational area (e.g. pygmy blue whales and whale sharks) are transient in nature so

significant impacts are not expected. The majority of residual biocide (chlorine) will be neutralised within the cooling water systems. The very low concentrations of chlorine in the cooling water discharges will be rapidly diluted by the prevailing current.

Brine water will sink through the water column where it will be rapidly mixed with receiving waters and dispersed by ocean currents. As such, any potential impacts are expected to be limited to immediately adjacent to the source of the discharge, where concentrations are highest. This is confirmed by Azis et al. (2003) who reported that effects on planktonic communities in areas of high mixing and dispersion, such as those found in the operational area, are generally limited to the point of discharge only. Changes in salinity can affect the ecophysiology of marine organisms and larval stages tend to be more susceptible to impacts of increased salinity (Neuparth et al. 2002). However, some marine species are known to be able to tolerate short-term fluctuations in salinity in the order of 20–30% (Walker and McComb 1990). The receptors with the potential to be exposed to an increase in salinity include pelagic fish species and plankton found in surface waters within the operational area. Pelagic megafauna species (e.g. whale sharks) may be subjected to slightly elevated salinity levels for a very short period if they swim through the area, but they are expected to be able to tolerate short-term exposure.

Given the short duration of the Activity, relatively low discharge volumes and open ocean conditions resulting in rapid mixing, the change in water quality is expected to be temporary and highly localised, and not expected to result in any significant ecological impacts. The potential consequences of elevated temperatures and salinity are therefore considered to be ‘*Negligible (I)*’.

Summary

Due to the relatively short duration of the Activity and intermittent nature of these routine discharges, cumulative impacts to water quality within the operational area are expected to be localised and short-term with no lasting effect. Given the rapid dilution, negligible exposure to hydrocarbon concentrations above impact thresholds and minor increases in salinity and temperature above ambient levels; direct impacts to transient marine fauna, including MNES (e.g. pygmy blue whales and whale sharks) are not expected, with direct impacts limited to planktonic organisms that may be entrained within the discharge plume. In view of the high level of natural mortality and the rapid replacement rate of many plankton species (UNEP, 1985), the potential consequence on planktonic communities is a localised impact on plankton abundance in the vicinity of the point of discharge with negligible ecological significance.

Given the open ocean location of the operational area, and distance from sensitive receptors, relatively small discharge volumes and the temporary reduction in water quality due to routine discharges; the consequences are considered to be ‘*Negligible (I)*’.

Assessment of Likelihood and Inherent Risk Ranking

The likelihood of routine operational discharges from the MODU and support vessels causing any impacts to plankton or marine fauna within the operational area with standard control measures in place is considered ‘*Likely (D)*’. Therefore, the inherent risk ranking from routine operational discharges during the Activity is evaluated as ‘*Low* (2)’.

Additional Control Measures Considered (ALARP Evaluation)			
Control Measure	**Environmental Benefit**	**Evaluation of Decision**	**Decision**
Zero discharge overboard.	Would eliminate potential impacts to operational area of discharges to sea.	Costs associated with containment and onshore disposal. Does not eliminate impact of eventual disposal. Operational area is oceanic location distant from land and where dispersal will be high. Small discharge volumes will meet legislated requirements and standard practice.	**Reject**

ALARP Assessment

Routine discharges are standard offshore industry practice in open waters. The risks and impacts to the marine environment are well understood. Given that all routine discharges will meet or exceed relevant MARPOL legislation and Marine Orders, and involve relatively low volumes over a short period, there is a high level of certainty that effects on water quality will be temporary and localised to the location of discharge, due to the rapid dispersal of the waste streams in the offshore, open ocean environment.

SapuraOMV considers the adopted controls appropriate to manage the impacts of planned routine discharges. As no reasonable additional/alternative controls were identified that would further reduce the impacts without grossly disproportionate cost, the impacts and risks are considered ALARP. As such, the residual risk to the marine environment is predicted to be `*Low* (2)' and classified as a Type A decision.

Residual Risk Summary		
Consequence	**Likelihood**	**Residual risk**
Negligible (I)	Likely (B)	Low (2)

Demonstration of Acceptability	
Are environmental impacts and risks reduced to ALARP, and the residual risk ranking between '*Very Low (1)*' to '*Medium (3)'*?	Yes – risks are reduced to ALARP, and the residual risk ranking is *Low* (2).

<table>
<tr><td>Is the Activity carried out in a manner consistent with the principles of ESD?</td><td colspan="3">Yes – the Activity was evaluated as having the potential to result in negligible consequence, and not result in serious or irreversible environmental damage.</td></tr>
<tr><td>Are the potential risks and hazards consistent with SapuraOMV's policy and standards?</td><td colspan="3">Yes – aligns with SapuraOMV's HSE Policy and HSEMS.</td></tr>
<tr><td>Have legislative and other requirements been met? Industry codes, standards and guidelines applied?</td><td colspan="3">Yes – management consistent with Protection of the Sea (Prevention of Pollution from Ships) Act 1983 and relevant requirements including:
MARPOL Annex IV and Marine Order 96 (Marine Pollution Prevention – sewage);
MARPOL Annex V and Marine Order 95 (Marine Pollution Prevention – garbage); and
MARPOL Annex I and Marine Order 91 (Marine Pollution Prevention – oil).</td></tr>
<tr><td>Have stakeholder expectations been addressed?</td><td colspan="3">N/A – no concerns raised.</td></tr>
<tr><td colspan="4">Planned routine discharges to the marine environment are considered to be standard practice in the industry. The impact assessment has determined that, given the adopted controls, planned routine discharges are unlikely to result in a potential impact greater than localised and short-term impacts, which are not considered as having the potential to affect biological diversity, ecological integrity and have no lasting effect. The adopted controls are industry best practice and meet legislative requirements under Marine Orders 91, 95 and 96. The potential impacts and risks are considered acceptable if the adopted controls are implemented.

Stakeholders have been informed of the proposed Activity (see Section 5), and no concerns have been raised. With the control measures proposed, the residual risk ranking associated with planned routine discharges was assessed as 'Low' (2). On this basis, it is considered that adherence to the environmental performance standards will manage the impacts and risks from routine operational discharges to an acceptable level.</td></tr>
<tr><th colspan="4">Environmental Performance Outcomes, Standards and Measurement Criteria</th></tr>
<tr><th>Environmental Performance Outcome</th><th>Environmental Performance Standard</th><th>Measurement Criteria</th><th>Responsibility</th></tr>
</table>

Environmental values are protected beyond 500 m of the discharge.	Sewage is managed in accordance with MARPOL Annex IV and AMSA Marine Order 96 (as appropriate to vessel class): • A valid International Sewage Pollution Prevention (ISPP) Certificate, as required by vessel class; • A MARPOL-approved sewage treatment plant (STP); • A sewage holding tank sized appropriately to contain all generated waste (black and grey water); • Comminuted/disinfected sewage is only discharged when ≥3 nm from land and while vessel is moving > 4 knots; • Sewage that has not been comminuted/disinfected is only discharged when ≥12 nm from land and while vessel is moving >4 knots; and • Sewage will be comminuted/disinfected on the MODU before discharge (> 12 nm).	MODU/vessel inspection confirms: • Valid ISPP (as applicable); • MARPOL-approved STP; and • Sewage holding tanks Vessel logs demonstrate that all sewage discharges are compliant with MARPOL Annex IV and AMSA Marine Order 96	Chief Engineers
	STP maintained in accordance with PMS.	MODU/Vessel inspection records PMS records confirm that STP is maintained to schedule	Chief Engineers
	Food waste will be macerated to a particle size of <25 mm when discharged from a stationary vessel or facility at a distance >3 nm from land.	Garbage Record Book	MODU OIM Vessel Masters
	Macerators are maintained as per the PMS to ensure they are functional.	PMS records confirm that the macerator is maintained to schedule or repaired/replaced as required	MODU OIM Vessel Masters

Zero discharges of deck drainage and bilge to the marine environment if oil-in-water content exceeds 15 ppm.	Compliance with Marine Order 91 – Marine Pollution Prevention – Oil (as appropriate to vessel class): • A valid International Oil Pollution Prevention (IOPP) Certificate; • Machinery space bilge/ oily water will pass through a MARPOL-approved OWS to reduce oil-in-water content to <15 ppm prior to discharge while en-route; • Where the oil-in-water content exceeds 15 ppm, the oily water is contained on-board and disposed of at a licensed onshore facility or to a carrier licensed to receive waste; • Treated oily water will only be discharged when MODU/vessels en-route; and • The MARPOL-approved oil-water separator will be calibrated and maintained in accordance with the PMS.	MODU/vessel inspection confirms: • Valid IOPP; and • MARPOL-approved OWS	Chief Engineers
		Oil Record Book	
		PMS records	
No substantial adverse effect on marine fauna from reduced water quality from detergents/cleaning agents	Detergents/ cleaning agents used onboard will be biodegradable and phosphate free.	MODU/Vessel inspection records verify detergents/ cleaning agents used	MODU OIM Vessel Masters

7.7 Drilling and Cement Discharges

Planned Activity
The following activity was identified as having the potential to result in a planned release of drilling and cement discharges: • Exploration drilling operations (**Section 3.2**)
Hazard Identification
The discharge of drilling fluids, drill cuttings, cement, and cementing fluids and additives has the potential to: • Reduce water quality (through increased turbidity and potential toxicity); and • Smother benthic habitats/communities in the vicinity of the well. **Drilling operations** The proposed Activity includes the drilling of a single exploration well in water depths of ~147 m. The well will be drilled as a series of sections. The surface hole section will be drilled without a riser in place (i.e. riserless drilling) using seawater and pre-hydrated gel (PHG) sweeps to clean the hole. While drilling the surface hole section, drilling cuttings and drilling fluid (e.g. seawater and sweeps) will be discharged directly to the seabed at the well site for riserless drilling (where they will accumulate on the seabed surrounding the wellhead). Typically, drill cuttings range in size from clay-sized particles (~0.002 mm) to coarse gravel (>30 mm) (IOGP, 2016). Cuttings size is determined by TD, lithology, drill bit and SCE specifications. Once the surface casing is installed, thereby establishing a closed circulating system, the remainder of the well will be drilled with a shale-inhibited (e.g. KCl/polymer) water-based mud (WBM). The WBM and drill cuttings will be discharged from the MODU just above the sea surface, resulting in dispersion of the cuttings and residual muds over a larger area as they sink to the seabed. The WBM will be made up of low toxicity drilling fluid solid additives (e.g. barite) and chemicals that are either completely inert or additives in such low concentrations they pose little or no risk to the environment (Neff, 1987; Neff, 2005). Drilling fluids will be selected and assessed with SapuraOMV's Chemical Risk Assessment Procedure (AU-HS-PRO-010-1.1) to ensure the potential impacts of the chemicals selected are acceptable and ALARP. Extracted cuttings will be returned to the MODU so that drilling fluids can be recovered before being discharged overboard. Drilling fluids are contained within the drilling fluids circulation system. Mud pits (tanks) within this system provide capacity for storing drilling fluids. The mud pits are cleaned out when drilling operations are complete. Approximate volumes of drilling discharges to the marine environment expected during drilling of the Kanga-1 exploration well are as follows:

Planned Activities				
Well Section	**Cuttings ~ volume (m^3)**	**Drilling fluid type**	**Drilling fluid ~ volume (m^3)**	**Discharge point**
Top Hole	98	Seawater[1] with pre-hydrated bentonite (PHB)/XC Polymer[2] sweeps	233	Seabed
Surface	361	Riserless: Seawater with PHB/XC Polymer sweeps + weighted PHB mud	1,632 (Riserless)	Seabed
Intermediate	114	WBM	358	Surface
Reservoir	13	WBM	40	Surface
End of well		All remaining WBM to be discharged at end of well	392	Surface
Total Planned Activities	**586**	**WBM + PHB/XC Polymer sweeps**	**2,654**	
Contingency Activities				
1 x Re-spud top hole section	98	Seawater with pre-hydrated bentonite (PHB)/ XC Polymer sweeps	233	Seabed
1 x Sidetrack Intermediate section	114	WBM	358	Surface
Total Contingency Activities	**212**	**WBM + PHB/XC Polymer sweeps**	**591**	

[1] Seawater volume is not included in the estimated Drilling Fluid Volume.

[2] XC Polymer sweeps may be used to supplement the PHB sweeps in the event there is insufficient drill water or time to hydrate the bentonite.

Cementing operations

Cement will be used to fix casing strings in place, and to form cement plugs as permanent barriers when abandoning the well. Two primary casing cement jobs are planned for cementing the surface casing and production liner in place. These cement jobs will provide a structural base for the well, isolate loss zones and different pressure regimes, and are critical to well integrity. Small volumes of cement may be extruded to seabed during these processes. The only planned cementing operational discharge to sea is when washing and cleaning the surface cementing equipment and lines with water after each cement job, to prevent cement setting hard in the lines. Cement spacer in well returns and residual surface tank volumes will also be discharged to sea during cementing operations.

The approximate amounts of discharges expected during cementing operations are as follows:

Planned Activities					
Casing Cement Job	**Cement length (m)**	**Discharge Type**	**Discharge ~ volume (m^3)**	**Hole section**	**Discharge point**
Conductor	73	Excess wet G-cement + spacers + flushing surface lines/dead volume	35	Top hole	Seabed
Surface Casing	1,137		36	Surface Hole	Seabed
Production Liner	490	Excess wet HTB[1] cement + spacers + flushing surface lines/dead volume	14	Intermediate Hole	Surface
Open Hole P&A Plugs	360		13	Reservoir Hole	Surface
Cased Hole P&A Plugs	100	Spacers + flushing surface lines/dead volume	10		Surface
Total Planned Activities		**Excess wet cement + spacers + flushing surface lines/dead volume**	**108**		
Contingency Activities					
2 x Suspension plugs		Spacers + flushing surface lines/dead volume	10	N/A	Seabed
Failed[2] surface and conductor casing cement jobs		Wet G-cement + spacers + flushing surface lines/dead volume	162	Surface Hole	Seabed
Failed Production Liner + Open Hole P&A cement jobs		Wet HTB cement + spacers + flushing surface lines/dead volume	55	Intermediate Hole	Surface
1 x Re-spud top hole section		Excess wet G-cement + spacers + flushing surface lines/dead volume	35	Top hole	Seabed
1 x Sidetrack intermediate section			10	Intermediate Hole	Surface
Total Contingency Activities		**Excess wet cement + spacers + flushing surface lines/dead volume**	**270**		

[1] HTB is High Temperature Blend cement

[2] In the scenario where the cement job does not meet technical and/or safety standards, in which case the entire cement volume is circulated out and the job is repeated.

It is intended that any bulk cement remaining at the end of the well will be provided to the next operator at the end of the drilling program (as it remains on the MODU). Should this option not be available, the remaining cement will be mixed and operationally discharged as a slurry to the marine environment. The remaining bulk cement at the end of the well is estimated to be 84 m^3.

Contingency activities

The contingency activities of a re-spud/sidetrack/failed cement job are not considered likely, nonetheless, they are included to ensure that the credible worst case scenario is evaluated.

Standard Control Measures

Control Measure	Environmental Benefit	Evaluation of Decision	Decision

Chemical selection procedure for drilling completions and cementing chemicals	Aids in the process of chemical management that reduces the impact of drilling and cement discharges to sea. Only environmentally acceptable products are used.	Cost associated with implementation of procedure. Environmental benefit of using lower toxicity chemicals outweighs procedural implementation costs.	**Accept**
Only seawater and WBM will be used (i.e. no synthetic based muds (SBM))	The use of WBM only in the drilling program will reduce the consequence of impacts by eliminating hydrocarbon residue on cuttings that would result from the use SBM.	Does not compromise drilling operation objectives. Environmental benefit outweighs cost.	**Accept**
Use of solids control equipment (SCE) that is appropriately maintained for effective operation	Quantities of drilling fluids discharged will be minimised through the use of SCE, which includes recirculation of the mud where possible.	Cost associated with implementation of procedure. Benefits of implementing procedure and measures implemented outweigh costs.	**Accept**
Bulk operational discharges conducted under MODU's permit to work (PTW) system (to operate discharge valves/pumps) or risk assessed using the MODU contractors risk assessment prompt cards	The MODU's PTW may slightly reduce the likelihood of bulk discharges occurring, although discharges are often operationally required and cannot be eliminated.	Cost associated with implementation of procedure. Benefits outweigh the cost.	**Accept**
Bulk dry cement will not be wholly discharged overboard except in emergency situations.	Bulk dry cement has the potential to disperse across a wider area, potentially affecting a larger area of the marine environment. Where cement cannot be transferred to the next operator at the completion of the Activity, it will be mixed and discharged overboard as a slurry. A slurry would have a greater	Standard industry practice, environmental benefit outweighs cost.	**Accept**

	tendency to settle on the seafloor closer to the well location.		
Drilling fluids program	Manage drilling fluids use during the Activity to minimise effects on the environment.	Standard industry practice, environmental benefit outweighs cost.	**Accept**
Drilling fluids will adhere to American Petroleum Institute (API) specifications	Manage drilling fluids use during the Activity to minimise effects on the environment.	Good industry practice, environmental benefit outweighs cost.	**Accept**

Environmental Impact Assessment

The potential environment impacts from drilling and cement discharges include:

- Localised and temporary increase in total suspended solids (TSS) (turbidity), increasing light attenuation in surface waters
- Potential contamination and toxicity effects; and
- Localised smothering of the seabed and associated benthic habitats and communities (mortality and burial of benthic fauna).

Receptors potentially impacted by drilling and cement discharges during the Activity include:

- Plankton;
- Pelagic marine fauna; and
- Benthic habitats and fauna.

Water Quality

Turbidity

The discharge of drill cuttings and unrecovered fluids is expected to increase turbidity (TSS) in the water column, for short, temporary periods over the expected Activity duration of ~40 days. Turbid plumes will form in the immediate area around the drilling location as a result of particles brought into suspension from discharges. Typically, larger particles, representing ~90% of mud solids, will quickly settle to the sea floor adjacent to the source, while the remaining fine grained particles (~10%) will form a plume that drifts with prevailing currents away from the source and is diluted rapidly in the receiving waters (Neff, 2005; 2010). Numerous field and modelling studies of cuttings and WBM have found extremely rapid dilution and dispersion of dissolved and particulate fractions in well-mixed ocean settings (as is the case within the operational area) to non-chronic concentrations within ~15 m of the discharge point (Neff, 2010). IOGP (2016) reports that drill cuttings would settle quickly, leading to short exposure times in the water column.

Phytoplankton and zooplankton productivity may be temporarily reduced within the immediate area surrounding the discharge, due to decreased light penetration and particles clogging gills or digestive tracts. However, drilling discharges will only have a very highly localised potential area of ecological impact with no material effect on pelagic productivity.

Given, the depth of the seabed (~147 m), no light-based benthic primary production occurs at the site with no concomitant turbidity effects.

While very high concentrations of TSS have been shown to result in mortality of pelagic animals (>1,830 mg/L), such concentrations do not occur from drill cuttings discharges (IOGP, 2016). In addition, pelagic fauna usually avoid or move away from plumes of suspended cuttings, thereby minimising the risk of harm (IOGP, 2016). Marine megafauna such as cetaceans and whale sharks are not expected to be in direct contact with the plumes, given that plumes rapidly disperse. Any potential contact would be of a short duration, given the rapid dispersion of the plume and transitory nature of the marine megafauna.

Given the nature of the discharges, the deep, open water surrounding the MODU and the relative energy of the receiving environment, dilution of plumes created by drilling activities is predicted to be rapid such that potential impacts to pelagic plankton productivity and marine fauna mortality from increased turbidity are expected to be '*Negligible (I)*'.

Potential toxicity

In part, the toxicity associated with chemicals in the muds and cuttings discharge stream and the cement slurry will depend on their bioavailability to organisms in the receiving waters and sediments. Many drilling fluid additives that are likely to be used, such as bentonite, are listed 'E' category fluids under the OCNS and also considered to Pose Little or No Risk to the Environment (PLONOR) (OSPAR, 2013). Most of the metals detected in drilling muds are present primarily as trace impurities in barite or bentonite clay (Neff, 2008). The metals of environmental concern (due to their potential toxicity) that may be present in some drilling mud barites include cadmium, chromium, copper, mercury, lead, and zinc (Neff, 2008). However, modern WBMs are prepared with high quality barite obtained from sources with much lower trace metal content than historically, with most metals of concern being at concentrations similar to those of fine-grained marine sediments. WBM have been shown to have little or no toxicity to marine organisms (Jones et al. 1996), and that the lack of toxicity and low bioaccumulation potential of the drilling fluids means that the effects of the discharges are highly localised and are not expected to spread through the food web (Neff, 2010). Several metal bioaccumulation bioassays of WBM cuttings found that metal concentrations in the tissues of exposed animals were very similar to those in the tissues of unexposed animals (IOGP, 2016). Cementing discharges (cement, cement slurry, additives and spacers, etc.) also have the potential to result in toxicity effects. However, discharge of cement at the sea surface has not demonstrated significant harm to water column flora and fauna (Neff, 2005).

Early life stages of fish (embryos, larvae) and other plankton would be most susceptible to the toxic exposure from drilling fluids, as they are less mobile and therefore can become exposed to the plume at the outfall. Jenkins and McKinnon (2006) reported that levels of suspended sediments greater than 500 mg/L are likely to produce a measurable impact upon larvae of most fish species. However, impact is expected to be limited due to high levels of natural mortality and a rapid replacement rate (UNEP, 1985), intermittent exposure and the dispersive characteristics of the open water in the operational area. As such, exposure of planktonic communities is not considered to result in significant impacts at the population level and is considered to result in an undetectable or limited local degradation of the environment, rapidly returning to original state by natural action.

Marine fauna found in the water column, such as cetaceans, fish and sharks are expected to actively avoid discharge plumes and associated turbidity and toxicity within the water column, thereby minimising the risk of harm (IOGP, 2016). The operational area overlaps the distribution BIA for pygmy blue whales and the foraging BIA for whale sharks. The Blue Whale Conservation Management Plan (DoE, 2015a) identified chronic chemical pollution (toxins) as having a risk level of '*Low*'. The Conservation Advice for whale sharks (*Rhincodon typus*) (TCCS, 2015a) does not identify chemical pollution as a threat to the species. However, direct contact with the plumes, given their proximity to the MODU (immediately around the well site) is unlikely and any potential contact would be of a short duration, given the rapid dispersion of the plume and transitory nature of these species. As such, acute or chronic effects are not expected.

Toxicity impacts are not predicted from cement, as it is considered PLONOR (Cefas, 2019). The low toxicity and low bioaccumulation potential of WBM means that the effects of these discharges are highly localised and are not expected to spread through the food web. The potential for impact is limited to the area around the well location where chemical concentrations will be highest; beyond this area chemical concentrations will be rapidly diluted to levels below toxicity thresholds.

Therefore, potential toxicity impacts to pelagic plankton productivity and marine fauna are expected to be '*Negligible (I)*' from drilling and cementing discharges.

Smothering

Drill Cuttings

Deposition from the combined surface hole and bottom hole cuttings is expected to be confined to within a few hundred metres around the well location (Jones et al. 2007; 2012). The depth of accumulated cuttings will be greatest close to the well location where the heavier particles are deposited. A summary of various studies determined that ecological impacts to the benthos are only expected when sediment deposition exceeds a thickness >6.5 mm (IOGP, 2016). Some types of epibenthic organisms may be smothered where this cuttings threshold is exceeded. The thin layer of drill cuttings material that occurs (low deposition) away from the immediate area of the well site will likely be naturally reworked into surface sediment layers through bioturbation.

The effects of drilling discharges on the benthic environment are related to the total mass of solids and fluids discharged, the relative energy of the water column, and the nature of the benthic habitat (Neff, 2005). Benthic habitats in the operational area are considered to be of low sensitivity (i.e. no known significant benthic habitat; see **Section 4.4.5**), and impact on soft sediment communities is not expected to affect the diversity or ecosystem function in this area, and thus is only considered a localised impact. Recovery of benthic communities from burial and organic enrichment occurs relatively rapidly through recruitment of new individuals from planktonic larvae and migration from adjacent undisturbed sediments. Ecological recovery usually begins shortly after completion of drilling and is often well advanced within a year. Full recovery may be delayed until concentrations of biodegradable organic matter decrease through microbial biodegradation to the point where surface layers of sediment are oxygenated. Mobile benthic fauna, such as demersal fish, may be temporarily displaced from areas where cuttings and cement discharges accumulate.

Cement

Impacts of cement on the marine environment are associated mainly with smothering surrounding benthic and/or infauna communities and is not expected to pose any toxicological impacts to receptors. The potential impacts of smothering from a surface release are expected to be significantly less than from the seabed release due to smaller volumes, the intermittent nature of these discharges, and the high potential for dispersion via ocean currents given the open water location. Comparative modelling (BP, 2013) also indicated that less than 0.1% of the cement solids would be deposited on the seabed within 1.5 km of the point of discharge and that no significant seabed deposition would occur at any location from a surface discharge.

Modelling of larger volumes of cement (200 tons) have indicated that cement from top-hole sections displaced to the seabed may affect the seabed immediately around the well to a radius of approximately ~10–20 m (depending on height) from the well, resulting in the potential for disturbance of 0.002 km^2 (BP, 2013). The cement discharged to the seabed around the well will change the existing soft-sediment seabed habitat to a hard substrate habitat, but the affected area will not extend beyond that already altered by the primary cuttings piles and will therefore not impact any additional area of seabed. Hardened cement will provide a surface for colonisation by epifauna.

Summary

The ancient coastline KEF is located ~5.1 km south of the proposed Kanga-1 well location. Given that the area potentially impacted by cement discharges, drill cuttings and drilling fluids (10 m to 1.5 km, as described above) will be highly localised, drilling and cement discharges are not expected to influence benthic communities or ecological values of the KEF. It is expected that drilling and cement discharges may result in a localised alteration of seabed substrate within a habitat that is considered homogenous and not overly sensitive.

Overall, smothering impacts to sensitive habitat and fauna are expected to be '*Negligible (I)*' from drilling and cementing discharges because of the relatively small disturbance footprint in homogeneous not overly sensitive habitat.

Assessment of Likelihood and Inherent Risk Ranking

The likelihood of minor impacts to marine fauna and habitat within the operational area with standard control measures in place is considered '*Likely (D)*'. The inherent risk ranking from routine operational discharges during the Activity is evaluated as '*Low* (2)'with the consequence ranking from the above impact assessment of '*Neglibible (1)*'.

Additional Control Measures Considered (ALARP Evaluation)

Control Measure	Environmental Benefit	Evaluation of Decision	Decision

Centrifuges and driers	Further reduce drilling fluids from cuttings, thereby reducing discharges to marine environment. Does not reduce the volume of drill cuttings discharged to sea.	Given the low environmental impact of the cuttings discharged and low cost of WBM, the additional cost associated with changes to equipment is considered disproportionate to the environmental benefit.	**Reject**
Skip and ship to shore of drilling/cement waste and bulk product	Eliminate discharges to sea, reducing potential impacts to marine environment.	Storage space required for containment of waste; increase in transfers to vessels resulting in increased potential impacts and risks. Increased transfers results in increased fuel usage, increased safety risks to personnel during transfer; high cost to transport and dispose onshore. Cost outweighs the benefit given the low impact expected from drilling and cement discharges and increase in safety risks and additional costs.	**Reject**
Riserless mud recovery system	Provides an opportunity to re-use drilling fluids while drilling riserless, thereby reducing environmental discharges. Does not reduce the volume of drill cuttings discharged to sea unless the skip and ship control measure is also adopted.	Given the low environmental impact of the cuttings discharged (due to the chemicals selected) and the short duration of discharge, the additional cost associated with changes to equipment and change to the well design is considered disproportionate to the environmental benefit.	**Reject**
Cuttings re-injection	Minimise/eliminate overall discharges to sea, reducing potential impacts to marine environment.	Significant cost to drill injection well and manage the re-injection process. Additional discharges while drilling the	**Reject**

		injection well. Not justifiable for a single well. Unlikely to realise any net environmental benefit given the need to drill another well (additional discharges).	
Cement Backload – End of Contract	Eliminate discharges to sea of residual excess cement, reducing potential impacts to marine environment.	Backload of bulk materials is not able to remove 100% of the stored material due to dead volumes in silos and tanks. Would introduce, increased health and safety risks and additional financial costs associated with moving bulk cement back to vessels and then onshore for disposal. Given the low impact expected from cement discharges, the costs are grossly disproportionate to the benefit.	**Reject**

ALARP Assessment

Within the operational area, limited values and sensitivities have been identified with the potential to be impacted by drilling and cement discharges. The benthic substrate within the operational area is expected to be made up of unconsolidated soft sediment, and predominantly bare muddy substrates (**Section 4.4.5**). This will be verified with a pre-drilling site survey. The impact assessment and evaluation has determined that, given the adopted controls, impacts to water quality and benthic habitats may result in localised and short-term effects, with no lasting effects on ecosystem function.

Further opportunities to reduce impacts from drilling and cement discharges have been investigated, but there are no reasonably practicable additional or alternative control measures. With the proposed control measures in place, the residual risk ranking of seabed disturbance was assessed as '*Low*' (2), classified as Type A decision and cannot be reduced further. With no reasonably practicable additional or alternative control measures identified that would offer a net environmental benefit, the impacts and risks are considered ALARP.

Residual Risk Summary

Consequence	Likelihood	Residual risk

Negligible (I)	Likely (B)	Low (2)

Demonstration of Acceptability

Are environmental impacts and risks reduced to ALARP, and the residual risk ranking between '*Very Low (1)*' to '*Medium (3)*'?	Yes – risks are reduced to ALARP, and the residual risk ranking is *Low* (2).
Is the Activity carried out in a manner consistent with the principles of ESD?	Yes – the Activity was evaluated as having the potential to result in negligible consequence, and not result in serious or irreversible environmental damage.
Are the potential risks and hazards consistent with SapuraOMV's policy and standards?	Yes – aligns with SapuraOMV's HSE Policy and HSEMS.
Have legislative and other requirements been met? Industry codes, standards and guidelines applied?	N/A – no environmental legislation or other requirements deemed relevant to drilling and cement discharges.
Have stakeholder expectations been addressed?	N/A – no concerns raised.

Drilling and cement discharges to the marine environment are considered to be standard practice in the industry and there are no relevant Australian environmental legislative requirements that relate specifically to discharges. With the commitment of using WBM, SapuraOMV's Chemical Risk Assessment Procedure (AU-HS-PRO-010-1.1) and the American Petroleum Institute (API) specifications for drilling fluids, a reduced environmental impact footprint is achieved.

Stakeholders have been informed of the proposed Activity, as detailed in **Section 5** and there are no concerns raised by stakeholders regarding this hazard/risk. Temporary and localised effects from drilling and cement discharges are considered likely to occur. Given the generally low toxicity of discharges, the highly localised area, the short-term impact and the short duration of the Activity, the residual risk from the discharge of drill cuttings, drilling fluids and cement on the benthic communities and water quality has been assessed as '*Low*' (2). On this basis, it is considered that adherence to the environmental performance standards will manage the impacts and risks from drilling and cement discharges to an acceptable level.

Environmental Performance Outcomes, Standards and Measurement Criteria

Environmental Performance Outcome	Environmental Performance Standard	Measurement Criteria	Responsibility
Reduce impacts on water quality, seabed and	All drilling fluids, mud and cementing chemicals will be assessed as per the Chemical Risk Assessment Procedure (AU-HS-PRO-010-1.1).	Chemical risk assessment report demonstrates selection (primary ranking of Gold/Silver or D/E),	SapuraOMV Senior HSE Specialist

marine fauna from drilling and cement discharges		assessment and approval process for selected chemicals is followed.	
	Only WBM to be used.	Chemical log	SapuraOMV Drilling Manager
	Drilling Fluids Program developed prior to the Activity.	Drilling Fluids Program	SapuraOMV Drilling Manager
	Drilling fluids will adhere to API specifications.	Drilling Fluids Program	SapuraOMV Drilling Manager
	Drill cuttings will be returned to the MODU to be processed using SCE prior to discharge.	Daily Drilling Report (DDR)	MODU OIM
	SCE maintained in accordance with PMS.	PMS records	MODU OIM
	Bulk operational discharges will be conducted under the MODU’s PTW system (to operate discharge valves/pumps).	Records demonstrate bulk discharge authorised under PTW.	MODU OIM
	Bulk dry cement will not be wholly discharged overboard except in emergency situations.	DDR to document details of cement discharge (dry cement/ left over cement).	MODU OIM

8. Environmental Assessment for Unplanned Events

SapuraOMV's environmental assessment identified eight potential sources of environmental risks associated with unplanned events for this Activity. The results of the environmental assessment are summarised in **Table 8-1**. A comprehensive risk and impact assessment for each of the unplanned events and subsequent control measures proposed by SapuraOMV to reduce the risk and impacts to ALARP and acceptable levels are detailed in the following subsections.

Table 8-1 Summary of risk assessment ranking for unplanned events

Hazard	Consequence	Likelihood	Residual Risk
Section 8.1 – Hydrocarbon Spill – Loss of Well Control			
Hydrocarbon spill from loss of primary and secondary well control.	V (Critical)	D (Unlikely)	3 (Medium)
Section 8.2 – Hydrocarbon Spill – Vessel Collision			
Hydrocarbon spill from ruptured fuel tank from a vessel collision.	III (Moderate)	E (Remote)	2 (Low)
Section 8.3 – Hydrocarbon Spill – Refuelling spill			
Hydrocarbon spill from hose rupture during fuel bunkering.	II (Minor)	C (Possible)	2 (Low)
Section 8.4 – Minor Hydrocarbon or Chemical Spills			
Accidental hydrocarbon/chemical release.	II (Minor)	C (Possible)	2 (Low)
Section 8.5 – Solid Releases – Loss Overboard			
Accidental loss of solid hazardous/ non-hazardous waste/ dropped objects.	I (Negligible)	C (Possible)	2 (Low)
Section 8.6 – Marine Fauna Collision			
Vessel collision with marine fauna that may be in operational area during the Activity.	II (Minor)	D (Unlikely)	2 (Low)
Section 8.7 – Introduction of Invasive Marine Species			
Introduction of invasive marine species from the use of non-local vessels/ discharge of ballast water.	III (Moderate)	D (Unlikely)	2 (Low)
Section 8.8 – Oil Spill Response			
Oil spill response activities including use of vessels, aircrafts, dispersants and/ or land-based operations.	IV (Major)	E (Remote)	2 (Low)
Section 8.9 – MODU Loss of Station			
MODU mooring system failure.	IV (Major)	E (Remote)	2 (Low)

8.1 Hydrocarbon Spill – Loss of Well Control

Activity
The following events were identified as having the potential to result in hydrocarbon spill from a loss of well control: • Loss of primary and secondary well control during drilling through hydrocarbon bearing formation.
Hazard Identification
During drilling through a hydrocarbon bearing formation(s) a loss of well control (LOWC) incident could result in the release of hydrocarbons (oil and gas) to the marine environment. A worst case incident would involve the highly unlikely scenario of a subsea blowout with uncontrolled release of reservoir hydrocarbons over an extended period. To determine and assess the extent of the environment that may be affected and the receptors at risk, stochastic oil spill modelling was undertaken for the worst credible discharge scenario of a LOWC (Level 3 spill), assuming total failure of the multiple barriers and unrestricted flow until a relief well could be drilled to 'kill' the well after 77 days. Unrestricted flow for 77 days at an average rate of ~4,480 m^3/day (total oil released ~345,014 m^3) is considered conservative (e.g. OPEP source control measures for a LOWC Level 3 spill such as capping stack application or emergency BOP intervention are not effective). Oil spilled into the marine environment will spread rapidly and can have adverse effects on marine ecosystems that are exposed to sufficiently elevated concentrations of hydrocarbons, and/or lower concentrations for extended periods. Uncontained oil tends to rise to the surface because it is less dense than seawater, and a slick of fresh oil forms on the sea surface. Some oil will become entrained in the water column as it is jetted out of the well under pressure and forms small droplets (smaller than ~75 µm) that tend to remain suspended in the water column. These droplets are exposed to bacterial degradation and dispersion by ocean currents. Larger droplets of entrained oil tend to rise to the surface and can surface some distance from the source. The slick is thickest close to the discharge point and rapidly gets thinner as the oil spreads over the sea surface and weathers. Soluble elements of the oil mixture can dissolve into the seawater from entrained droplets and from under the surface slick. When the oil reaches the surface, it is subject to natural physico-chemical weathering mechanisms, such as evaporation, emulsification, photo-oxidation and sedimentation (if it attaches to suspended particles). Some of these mechanisms also act on entrained oil; particularly dissolution, microbial biodegradation and sedimentation. Therefore, a large component of the spilled oil is lost to the atmosphere, assimilated in the water column and/or seabed sediments through natural mechanisms and its physical properties begin to change through weathering. The environmental consequences of a LOWC are highly variable and dependent on the characteristics of the hydrocarbons released, the rate and volume of the release, the time of year, the biotic and abiotic dynamics of the receiving environment, water depth at the release point, the proximity of the release point to sensitive environmental receptors and the sensitivity of the receptors to elevated hydrocarbons. Modelling outputs were used to inform the environmental impact assessment and to assist with emergency planning. Therefore, the following risk assessment is specific to the nature and scale of the credible LOWC

spill in the context of the geographic location that may be affected and environmental values at scales relevant to the area. Spill response actions such as (but not limited to) shoreline clean-up, offshore containment and recovery, and oiled wildlife response are described in the Kanga-1 Exploration Well OPEP for a Crude Oil Spill (**Appendix F**) and are assessed in **Section 8.8,** which will further mitigate the predicted level of risk.

Modelling Approach

Stochastic oil spill modelling is used to determine the total area that could be exposed to hydrocarbons, including trace concentrations of oil in the water column. Modelling is also used to inform impact assessment by understanding the potential location and extent of oil at concentrations likely to result in environmental consequences. Mapping areas that could be exposed at the moderate contact thresholds in **Table 4-1** (NOPSEMA, 2019a) by a spill is a useful tool for impact or consequence assessment. Hence, the moderate contact thresholds in **Table 4-1** are used to inform the risk assessments in this Section and **Section 8.2** (Hydrocarbon Spill – Vessel Collision).

While stochastic modelling provides useful data for calculating probabilities of exposure to pre-defined threshold concentrations / thicknesses and the maximum extent of contact, based on a large number of theoretical spill events (n = 120); prediction of the fate and weathering of spilled oil is complemented with deterministic modelling; that is, when one of the 120 stochastic simulations is selected for further analysis. Selection is generally based on the 'worst case' shoreline loading across all shorelines or specific locations of interest/sensitivity. In short, deterministic modelling is useful to evaluate the risks associated with individual spills and provides a more realistic representation of the impacts/consequences from a single (worst credible) spill. Therefore, these runs complement the stochastic modelling as they provide insight into the persistence, duration and extent of contact / exposure of sensitivities to oil as it weathers, and the potential response preparedness required.

Oil spill modelling was carried out with SINTEF's Oil Spill Contingency and Response (OSCAR) system (version 12.0). OSCAR is a system of integrated models to 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. The weathering model (Daling et al. 1997) is supported by an extensive oil library that contains detailed, laboratory-derived data for a wide range of hydrocarbons subjected to a wide range of environmental conditions.

Stochastic Spill Modelling Information

Volume and Type of Release

Hydrocarbons that could be released to the environment are light crude oil and gas from a subsea blowout. Quantitative hydrocarbon spill modelling (GHD, 2020a) was undertaken for the worst case subsea spill discharge rates and volumes from a well blowout at the Kanga-1 well location, to inform the environmental impact assessment and to assist with emergency planning. Key parameters including worst case release volumes assumed for modelling are provided in **Table 8-2**.

Table 8-2 Spill specifications modelled for Kanga-1 subsea LOWC scenario

Parameter	LOWC Scenario
Depth of spill	147 m
Hydrocarbon type	Light Crude
Liquid release volume	345,014 m^3 (2,170,070 bbl)
Gas release volume	5,776,235 sm^3 (203,986,000 scf)
Release duration	77 days
Timing of spill risk period	All months of the year
Modelling duration	112 days

Target Hydrocarbon

The target hydrocarbons most likely to be encountered are from the Late Jurassic sandstone formations within the WA-412-P permit area, which would involve light crude oil and gas. A hydrocarbon modelling analogue was selected from within the SINTEF Oil Library that provides the best match to the expected (target) hydrocarbon. *OSELVAR 2011 13°C* (Oselvar) was selected as the most appropriate modelling analogue for the exploration target crude oil, based on the laboratory assay properties of crude from the nearby Mutineer Exeter field, which produces from the same Late Jurassic sandstone formations targeted by Kanga-1. **Table 8-3** presents the bulk properties of Mutineer Exeter crude oil and the SINTEF oil Oselvar, with distillation curves presented in **Figure 8-1**. A comparison of the bulk properties (**Table 8-3**) indicates a close match between Oselvar and Mutineer Exeter across most parameters. Though the asphaltene content in Oselvar is lower than Mutineer Exeter, the simulated oil weathering indicates Oselvar has a strong tendency to emulsify. Emulsification is likely aided by the relatively high wax content of the oil, which when paired with moderate asphaltene content can produce a wax-stabilised emulsification.[5]

Table 8-3 Comparison of whole crude properties of Mutineer Exeter and SINTEF Oselvar

Property	Mutineer Exeter Crude Oil (Intertek, 2015)	SINTEF *OSELVAR 2011 13°C*
Specific Gravity	0.81	0.791
API Gravity	43.1	47.4
Viscosity (cP)	2.2 @ 20°C	3 @ 13°C
Wax Content (%)	<5	4.2
Pour Point (°C)	<-36 (upper)	-36

Asphaltene (%)	0.18	0.1

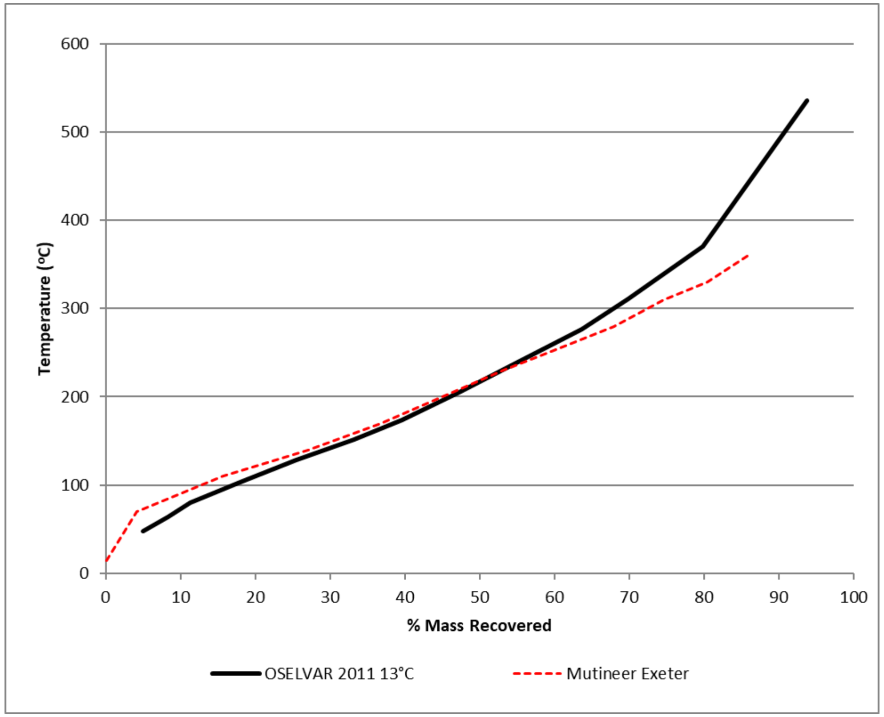


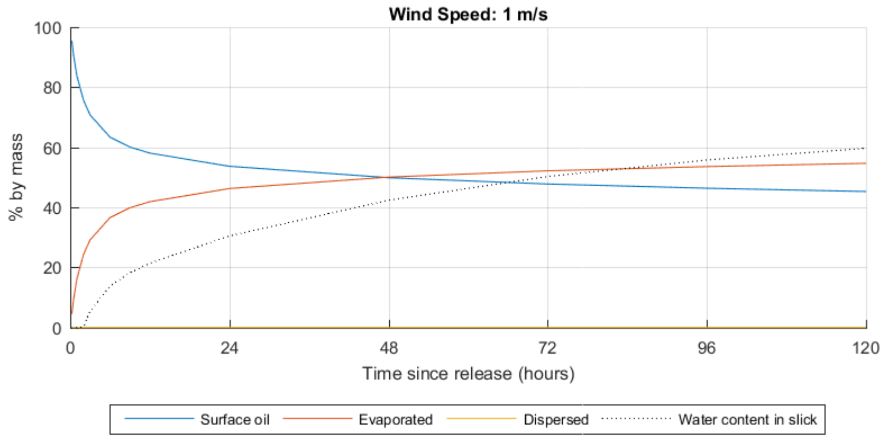
Figure 8-1 Comparison of boiling point curves for Mutineer Exeter and Oselvar

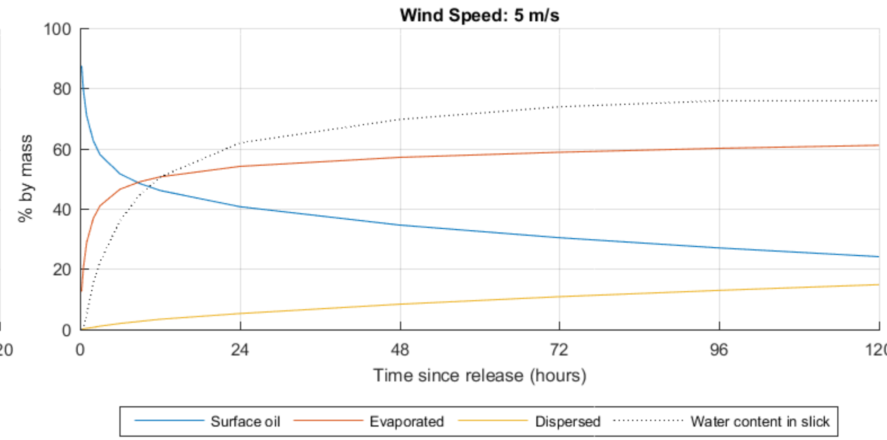
Hydrocarbon Weathering

An analysis of hydrocarbon weathering for Oselvar was undertaken with the SINTEF Oil Weathering Model (OWM). OWM predicts the weathering (i.e. mass balance partitioning) of hydrocarbons under steady-state met-ocean conditions. OWM simulations were run for sustained wind speeds of 1 m/s (low winds), 5 m/s (moderate winds) and 10 m/s (high winds). The OWM simulations are based on 100 m^3 of hydrocarbon released instantaneously onto the sea surface.

[5] Simulated weathering of other oils in the SINTEF database with similar ranges in asphaltene and wax content (Jordbaer w/ 0.2% asphaltene & 2.5% wax, Draguen w/ 0.13% asphaltene & 2.4% wax) for a 5 m/s wind speed all had predicted water content in oil that ranged from 75-85%, which indicates all have high emulsification potential. Hence, the sensitivity of emulsification is relatively low for the range of wax content and asphaltene considered for the simulated (Olesevar) and target (Mutineer-Exeter) analogues.

Figure 8-2 presents the results of weathering analysis. Oselvar has a moderate tendency to evaporate. Under low wind speeds (1 m/s) ~55% of the surface slick is predicted to have evaporated after 5 days (120 hours). Under moderate wind speeds (5 m/s) ~60% of the surface slick is predicted to evaporate after 72 hours with ~15% dispersed to the water column and ~25% remaining as floating oil. Under high wind speeds (10 m/s) a higher degree of oil dispersion into the water column (~45% after 72 hours) is predicted relative to moderate winds, while the remainder of the oil (~55%) has evaporated and no floating oil remains. Under such a scenario, dispersed oil may resurface once the wind speed reduces and evaporation may continue. Oselvar has a high tendency for emulsion formation, with the surface slick entraining 60-75% water content under the range of wind speeds assessed.





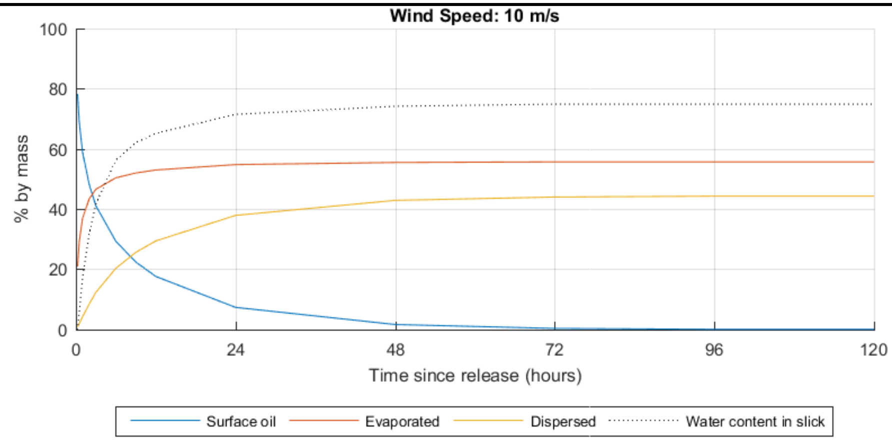


Figure 8-2 Simulated weathering of SINTEF Oselvar for wind speeds of 1 m/s (top left), 5 m/s (top right) and 10 m/s (bottom)

Deterministic Spill Modelling Information

Deterministic model simulations were performed for three (3) of the 120 stochastic realisations selected for either high accumulated shoreline loadings or short arrival times to key geographic receptors to represent the 'worst case' environmental outcomes. These deterministic simulations were also used to develop the Kanga-1 Exploration Well OPEP for a Crude Oil Spill (AU-HSE-KG1-EX-PLN-037) to inform response planning. Information from the stochastic and deterministic simulations in this Section were used to identify priorities for protection in the Kanga-1 Exploration Well OPEP for a Crude Oil Spill (AU-HSE-KG1-EX-PLN-037) (**Appendix F**) at the onset of LOWC incident (in the event of a spill the actual trajectory will depend on the nature of the spill and the environmental conditions at the time).

Stochastic Spill Modelling Results

The modelling results are described below for the fate and transport of hydrocarbons at the moderate contact threshold values defined in **Table 4-1** for the MEZ, which are adopted to rank the impact (or consequence) of a potential LOWC spill.

As described previously, for each set of 120 model runs (realisations) that comprise the LOWC stochastic simulation, the oil spill model spatially tracks surface, total submerged (entrained plus dissolved), dissolved and shoreline oil that are at or above the adopted NOPSEMA (2019a) thresholds. Because of the large amount of simulated data, this information is further distilled and reported here in the following manner:

- **Contact probability** is the percentage of realisations that a threshold was exceeded at any instant, during any realisation, at a particular horizontal model location or region (comprised of many horizontal model locations e.g. KEF, AMP, region such as the Montebello Islands). For example, a total submerged oil contact probability of 60% at the Glomar Shoals KEF means that a threshold was exceeded in 60% of the 120 realisations anywhere in the water column for at least one model time step over this KEF's area.

- **Minimum arrival time** is the shortest time from the start of any of the 120 realisations (which is equal to the time of release) that a threshold was exceeded at any instant, during any realisation, at a particular horizontal model location or anywhere in a region (e.g. KEF, AMP).
- **Maximum time-averaged concentration:** Time-averaged concentration (dissolved, total submerged and surface oil only) at a horizontal model grid cell for a particular realisation is the average for all time steps when the concentration exceeds the threshold. The maximum time-averaged concentration is the highest time-averaged concentration of a model grid cell at a horizontal model location across all realisations. When calculated for a region (e.g. KEF, AMP), the maximum-time-averaged concentration of the grid cell anywhere in the area (surface oil) or volume (dissolved and total submerged oil) is reported. Note that periods when there is no or below threshold oil concentrations do not contribute to (ie reduce) the reported averages.
- **Accumulated oil ashore** is the sum of all oil that has arrived at a shoreline cell or region (e.g. all shoreline model cells for the Montebello Islands) over the duration of the realisation and does not consider weathering losses. Hence, accumulated oil ashore is a conservative over-estimate of the peak shoreline oiling when compared to deterministic simulations that do simulate weathering.

Figure 8-3 shows the extent of potential area of hydrocarbon contact for each of the four oil phases (surface, dissolved, total submerged, accumulated shoreline) at the moderate thresholds, which define the spatial extent of the MEZ as at least one exceedance for one time step across any of the 120 stochastic simulations. The outer extent of the MEZ is primarily defined by the total submerged oil component. Though not described in this Section, the low contact thresholds for each of the four oil phases that define the EMBA are also illustrated in **Figure 8-3**, which again shows that the outer bounds of the EMBA are defined by the total submerged oil. Lastly, the high contact thresholds for surface, dissolved and accumulated shoreline thresholds (as described in **Table 4-1**, note there is no NOPSEMA (2019a) high threshold for entrained [total submerged] oil) are illustrated in **Figure 8-4**, which shows that these are only exceeded in close proximity to the well location.

Sea Surface Hydrocarbons above 10 g/m^2 (lower limit for potential ecological impacts)

Surface oil above the MEZ contact threshold (10 g/m^2) was predicted to extend up to ~400 km from the spill location (**Figure 8-3**). No geographic features (i.e. shorelines) or State Marine Parks were predicted to be contacted by floating oil at the MEZ threshold (10 g/m^2).

High contact probabilities were predicted of the spill reaching the waters overlying the KEFs of the Continental Slope Demersal Fish Communities (Continental Slope, 75%) and the Ancient coastline at 125 m depth contour (Ancient Coastline, 100%). However, these are seafloor features that are not impacted by surface oil. The maximum time-averaged oil concentrations of 37 g/m^2 and 91 g/m^2 were predicted at the Continental Slope and the Ancient Coastline, respectively, with minimum arrival times of 2.6 days and 0.3 days (8 hours), respectively.

Low to moderate contact probabilities (26-32%) were predicted at the Montebello AMP (32%), the Glomar Shoals KEF (31%) and the Exmouth Plateau KEF (26%) with maximum time-averaged surface oil concentrations of 33, 45 and 23 g/m^2, respectively, and minimum arrival times of 5.5, 4.2 and 12.2 days, respectively.

Low probabilities for the MEZ contact threshold were predicted for the Argo-Rowley Terrace AMP (6%) and the Gascoyne AMP (1%) with maximum time-averaged surface oil concentrations of 19 and 11 g/m^2, respectively, and minimum arrival times of 23.3 and 87.8 days, respectively.

Total Submerged Oil above 100 ppb (as appropriate given oil characteristics for informing risk evaluation)

As described in **Table 4-1**, total submerged oil, the combination of dissolved and entrained oil, is simulated by the SINTEF OSCAR oil spill model used in this analysis, so that the application of the NOPSEMA (2019a) thresholds for entrained oil is a conservative measure.

Total submerged oil above the MEZ contact threshold (100 ppb) was predicted up to ~2,000 km from of the spill location, although incidences at this threshold occurred in sparse and sporadic patches. In 80% of simulations, the predicted area of contact at the MEZ contact threshold is restricted to <500 km from the spill site. Generally, total submerged oil exceedances were in the upper portions of the water column rather than near the seabed.

At the MEZ contact threshold (100 ppb), high contact probabilities (>85%) were predicted at the Argo-Rowley Terrace AMP (85%), the Montebello AMP (96%), the Gascoyne AMP (98%), the Continental Slope KEF (100%), the Ancient Coastline KEF (100%), the Exmouth Plateau KEF (100%) and the Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula KEF (the Canyons, 92%). Maximum time-averaged total submerged oil concentrations at these locations ranged between 574 ppb (the Canyons) and 1,004 ppb (Continental Slope). Minimum arrival times of 0.1 days (2 hours) to 7.8 days were predicted at these receptors.

Moderate contact probabilities (42-68%) were predicted at the Montebello Islands State MP (42%), the Barrow Island State MP (43%), the Ningaloo AMP (68%), the Shark Bay AMP (45%), the Abrolhos AMP (48%), the Glomar Shoals KEF (64%), Commonwealth waters adjacent to Ningaloo Reef KEF (68%) and the Western Demersal Slope and Associated Fish Communities KEF (51%). Maximum time-averaged total submerged oil concentrations at these locations ranged between 245 ppb (Abrolhos AMP) and 704 ppb (Glomar Shoals), with predicted minimum arrival times of 3 days (Glomar Shoals) to 41.7 days (Abrolhos AMP).

Moderately low contact probabilities (11-36%) were predicted at the geographic receptors of Imperieuse Reef (18%), Montebello Islands (30%), Barrow Island (31%), Onslow Region (36%) and Ningaloo Region (13%); the marine reserves of Rowley Shoals State MP (15%), Muiron Islands State MP (17%), Ningaloo State MP (35%), Kimberley AMP (11%), Carnarvon Canyon AMP (30%), the Canyons KEF (23%); and Mermaid Reef and Commonwealth waters surrounding Rowley Shoals KEF (32%), Wallaby Saddle KEF (25%) and Perth Canyon and adjacent shelf break and other west coast canyons KEF (Perth Canyon, 19%). These locations had maximum predicted time-averaged total submerged oil concentrations of between 227 ppb (Carnarvon Canyon AMP) and 642 ppb (Imperieuse Reef and the Rowley Shoals State MP), and minimum arrival times of between 8.9 days (Montebello Islands) and 53.5 days (Kimberley AMP).

Dissolved Oil above 50 ppb (potential sub-lethal toxic effects)

Dissolved hydrocarbons at the MEZ contact threshold (50 ppb) were predicted up to ~200 km to the southwest and ~100 km to the northeast (**Figure 8-3**). As with total submerged oil, the exceedances of the dissolved oil threshold were typically in the upper portions of the water column rather than near the seabed.

There were no predicted instances of dissolved hydrocarbons above the MEZ contact threshold at any of the geographic receptors or State MPs. A high contact probability (100%) was predicted at the Ancient Coastline KEF with a maximum time-averaged concentration of 1,543 ppb and minimum arrival time of 0.2 days (4 hours), however as a seafloor feature exposure is unlikely. Low contact probabilities (<9%) were predicted at the Montebello AMP (2%), the Continental Slope KEF (8%) and the Glomar Shoals KEF (3%) with maximum time-averaged concentrations of 138, 653 and 154 ppb, respectively, and minimum arrival times of 20.1, 4.7 and 19.5 days, respectively.

Accumulated Hydrocarbons Ashore above 100 g/m^2 (generally requiring consideration of clean-up effort)

The potential for shoreline hydrocarbon accumulation at the MEZ contact threshold (100 g/m^2) was predicted to occur over a large geographic extent between Java (~1,400 km to the north), Christmas Island (~1,600 km to northwest) and the Albany Region (~1,800 km to the south). The majority of total accumulated shoreline loads for any single stochastic realisation was less than 200 tonnes. Across all shorelines a high contact probability of 98% was predicted at the MEZ contact threshold with a maximum accumulated shoreline load of 1,093 tonnes, minimum arrival time of 4 days (at Dampier Archipelago) and maximum oiled shoreline length of 234 km. The highest accumulated shoreline loadings (~450-1,100 tonnes) were predicted by only six realisations (out of 120). Outside of these, the highest accumulated shoreline loads were up to ~450 tonnes, and were generally predicted during the spring/summer months (October-February) when prevailing westerly/north-westerly winds transport surface oil slicks towards the mainland.

Moderately high contact probabilities (57-69%) are predicted at the relatively proximal locations of Montebello Islands (60%), Barrow Island (68%), Muiron Islands (58%) and the Ningaloo Region (69%) with maximum accumulated shoreline loads of 400, 511, 49 and 76 tonnes, respectively. Minimum arrival times after the start of the incident at these receptors were predicted to be from 7.7 days at Barrow Island to 13.7 days at the Ningaloo Region. Oiled shoreline lengths ranged between 14 km at Muiron Islands to 84 km at the Ningaloo Region.

Low to moderate contact probabilities at the MEZ contact threshold were predicted at Scott Reef (13%), Clerke Reef (12%), Imperiuse Reef (37%), Dampier Archipelago (14%), Lowendal Islands (12%), the Onslow Region (35%), Dirk Hartog Island (15%) and the Shark Bay Region (12%). Moderate maximum accumulated shoreline loads of 24-42 tonnes occurred at these locations except for 366 tonnes at Imperiuse Reef and 4-9 tonnes at Scott Reef, Dirk Hartog Island and the Shark Bay Region. Minimum arrival times ranged between 4-10.5 days at Dampier Archipelago, Lowendal Islands and Imperiuse Reef, to 18.5-60.5 days at the other receptors. Maximum oiled shoreline lengths ranged between 5-33 km.

Low contact probabilities (<7%) were predicted for all other shorelines with loads above the MEZ contact threshold. Maximum accumulated loads were generally less than 6 tonnes except for the Eighty Mile Beach Region (36 tonnes), the Hedland Region (41 tonnes), the Dampier Region (14 tonnes), Thevenard Island (22 tonnes) and the Carnarvon Region (14 tonnes).

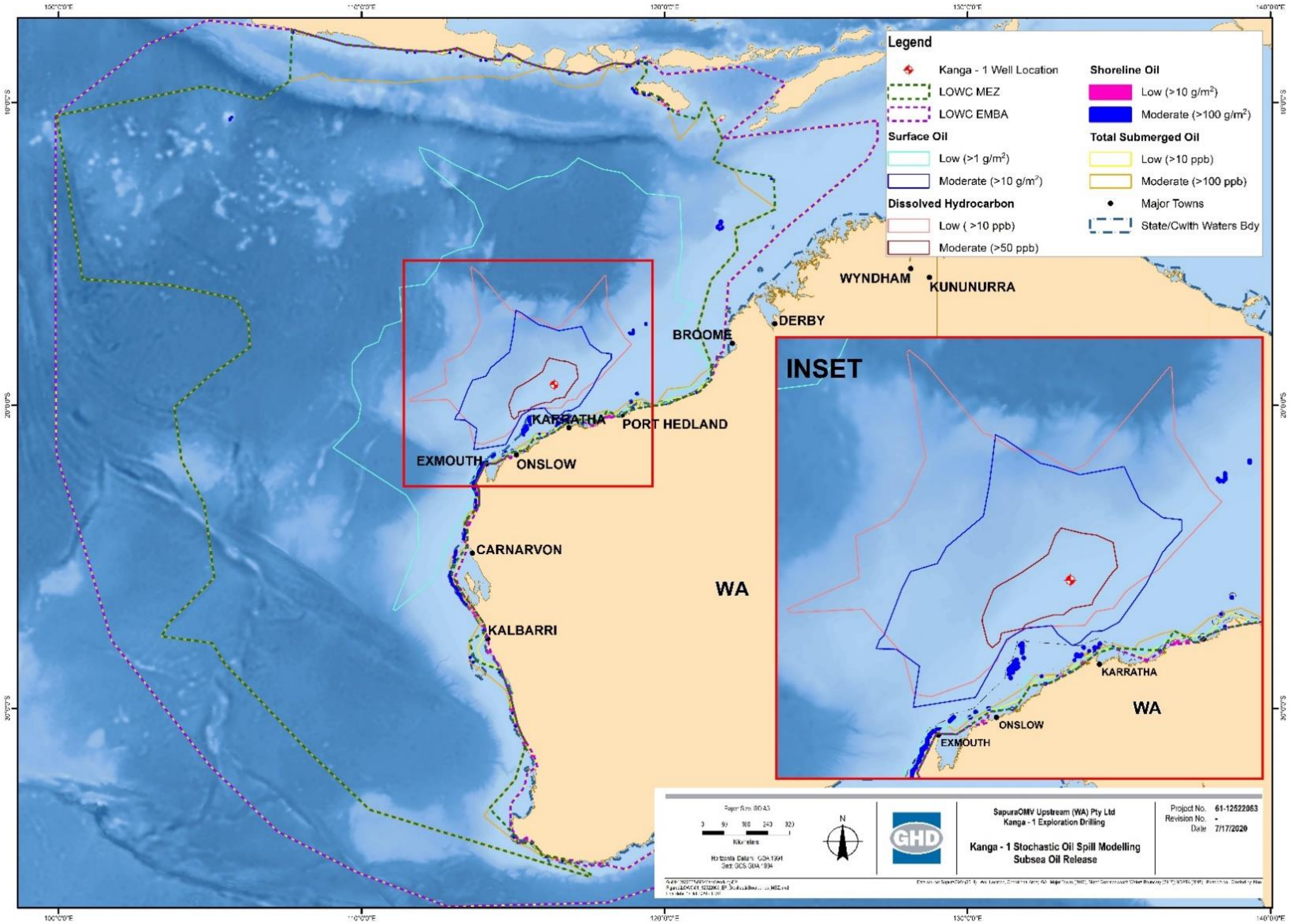


Figure 8-3 Predicted boundaries from LOWC stochastic spill modelling of each of the low (EMBA) and moderate (MEZ) thresholds for all oil phases

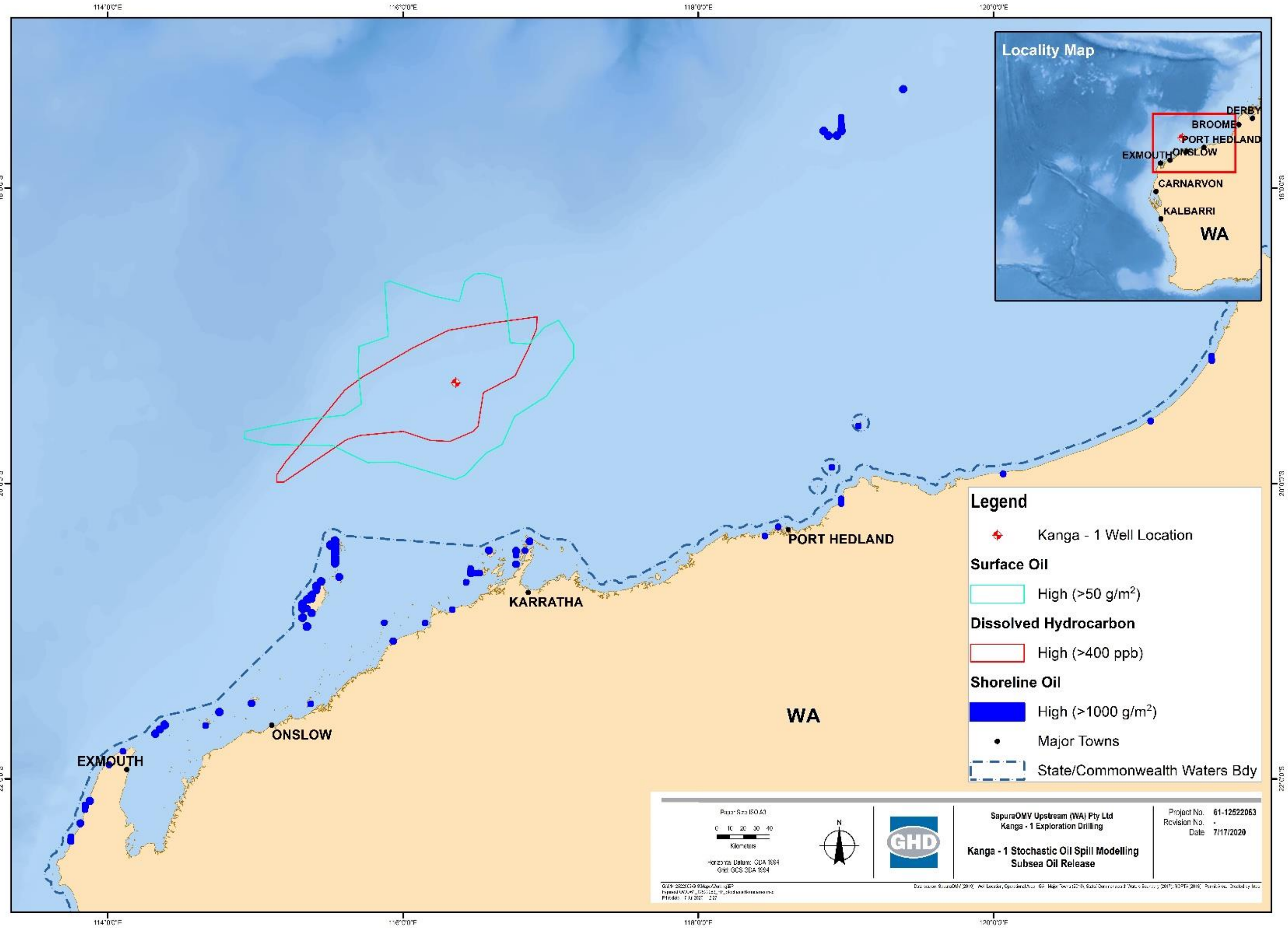


Figure 8-4 Predicted boundaries from LOWC stochastic spill modelling of the surface oil, dissolved oil and accumulated shoreline loading for the high thresholds (HEZ)

Worst Case Deterministic Spill Modelling Results and Effectiveness of Surface and Subsea Dispersant Application

A comparison of two deterministic simulations for the worst case oiling across all shorelines (peak load[6] of ~940 tonnes) and the shorelines of Imperiuse Reef (peak load of ~250 tonnes) are provided in **Figure 8-5** and **Figure 8-6**, respectively. For both of these representative worst case shoreline loadings, the spatial extent of the moderate contact thresholds are considerably smaller than those of the MEZ. To inform the development of the Kanga-1 Exploration Well OPEP for a Crude Oil Spill (AU-HSE-KG1-EX-PLN-037), the worst case oiling across all shorelines (peak load of ~940 tonnes) was utilised to estimate likely upper limits of resourcing spill response requirements, specifically:

- Shoreline loads and their potential spatial and temporal variability.
- The effectiveness of surface dispersant application (SDA) and subsea dispersant application/injection (SSDI).

SDA was simulated with the oil spill model's response module that included both vessels and Fixed Wing Aerial Dispersant Capability (FWADC) aircraft as summarised in **Table 8-4**. Further, varying mobilisation times for vessels and aircraft, as well as the number of aircraft, were included in the evaluation of two SDA response strategies as summarised in **Table 8-5**.

Table 8-4 Summary of surface dispersant application mitigation strategy

Strategy Element	Vessel	Aircraft (FWADC)
Base of operations (location)	Dampier Port	Karratha Airport
Downtime when returned to base (for refuelling etc.)	2 hrs	0.5 hrs
Daily operation hours	8 (daylight only)	8 (daylight only)
Maximum number of sorties	1 per day	5 per day
Cruise speed	13 knots	160 knots
Operational speed (when applying dispersants)	5 knots	90 knots
Dispersant tank size	10 m^3	3 m^3
Dispersant application rate	1:20	1:20
Dispersant efficacy	50%	
Oil searching strategy	>50 g/m^2	
Minimum thickness threshold for dispersant application	>50 g/m^2	
Maximum viscosity threshold for dispersant application	<10,000 cSt	

[6] Deterministic simulations model the degradation of oil on shorelines whereas stochastic simulations track the mass of accumulated oil on shoreline. Hence, peak loads of deterministic runs are lower than accumulated shoreline loads from stochastic modelling results.

Exclusion zones	AMPs, State MPs, State waters, <10 km of depths <10 m LAT, within exclusion zones of offshore facilities

Table 8-5 Summary of asset availability

Asset availability (cumulative totals)	Option #1		Option #2		
	24-48 hrs	48+ hrs	24-48 hrs	48-72 hrs	72+ hrs
Vessels	2	5	2	5	5
Aircraft (Fixed Wing Aerial Dispersant Capability)	1	2	1	2	4

The SSDI simulation was configured by reducing the oil-water interfacial tension parameter, which increases the tendency of oil to break up into smaller droplets during release. The oil-water interfacial tension was reduced to 66% of the model default value to approximate oil treatment by chemical dispersant. The SSDI strategy was implemented in the model from day 1 onwards.

A summary of the simulated SDA response for vessels and aircraft is outlined for options #1 and #2 in **Table 8-6** and **Table 8-7**.

Table 8-6 Summary of option #1 SDA response

Response item	Amount of		Times (hrs)			Idle due to (hrs)				
	Oil handled (m^3)	Dispersant used (m^3)	In port	Cruising	Working	Darkness	Weather	No task	Turn Around	Total Time (hrs)
Aircraft 1	13,183.9	1,318.4	24	602	231	760	0	0	113	1,730
Aircraft 2	10,514.9	1,051.5	48	598	248	804	0	0	154	1,853
Vessel 1	2,722.1	272.2	24	490	544	1,283	0	296	50	2,688
Vessel 2	2,632.0	263.2	24	484	544	1,281	0	308	47	2,688
Vessel 3	2,532.8	253.3	48	445	571	1,267	0	312	46	2,688
Vessel 4	2,621.7	262.2	48	514	502	1,266	0	311	47	2,688
Vessel 5	2,432.3	243.2	48	460	557	1,270	0	307	45	2,688
Total oil treated (m^3):	36,640									
Total dispersant used (m^3):	3,664									

Table 8-7 Summary of option #2 SDA response

Response item	Amount of		Times (hrs)			Idle due to (hrs)				
	Oil handled (m^3)	Dispersant used (m^3)	In port	Cruising	Working	Darkness	Weather	No task	Turn Around	Total Time (hrs)
Aircraft 1	13,135.4	1,313.5	24	604	230	774	0	0	120	1,752
Aircraft 2	10,927.9	1,092.8	48	605	242	803	0	0	151	1,848
Aircraft 3	8,276.6	827.7	72	598	263	838	0	0	172	1,943
Aircraft 4	6,847.6	684.8	72	603	271	862	0	0	178	1,987
Vessel 1	2,339.6	234.0	24	493	537	1,270	0	322	42	2,688
Vessel 2	2,427.4	242.7	24	487	533	1,276	0	323	45	2,688
Vessel 3	2,303.4	230.3	48	489	522	1,263	0	325	41	2,688
Vessel 4	2,475.3	247.5	48	479	519	1,268	0	330	44	2,688
Vessel 5	2,337.7	233.8	48	486	512	1,267	0	332	43	2,688
Total oil treated (m^3):	51,071									
Total dispersant used (m^3):	5,107									

Comparisons of the no dispersant, the two SDA options and the SSDI simulations are presented in **Figure 8-7** (surface and entrained mass balances), and **Figure 8-8** (shoreline loading time series), which predict that:

- The SSDI strategy provided some benefit at the Montebello Islands (reduced shoreline peak load from ~350 to ~300 tonnes), but this was largely counterbalanced by an increased loading at the Ningaloo Region (increased shoreline peak load from ~35 tonnes to ~80 tonnes) with a total peak reduction of only ~30 tonnes across all shorelines (decrease in peak load of ~940 tonnes to ~910 tonnes). The low predicted efficacy of the SSDI is likely related to the subsea dynamics of the oil release at the wellhead where the low exit velocity of the plume (~0.5 m/s) due to the low gas component does not generate enough local turbulence to physically generate small oil droplets for the chemical dispersant to be effective.
- Most treated oil with both SDA options occurred within ~80 km of the well site, where fresh, thick surface oil was most prevalent. The SDA response strategies yielded a moderate reduction to the peak mass of surface oil from ~22,000 tonnes to ~17,000 tonnes (option #1) and ~15,000 tonnes (option #2) with a concomitant increase in the total mass of entrained droplets. The simulated reduction in the surface slick was substantial with a decrease in the peak shoreline loading from ~430 tonnes at Barrow Island and ~350 tonnes at Montebello Islands to ~315 tonnes and ~220 tonnes for option #1, respectively, and to ~220 tonnes and ~150 tonnes for option #2, respectively. Overall, there was a net benefit to shoreline loads as a result of SDA, with the total peak load across all shorelines reducing from ~940 to ~600 tonnes and ~400 tonnes for options #1 and #2, respectively.

In summary, SDA and SSDI are considered as potential spill response strategies in the Kanga-1 Exploration Well OPEP for a Crude Oil Spill (AU-HSE-KG1-EX-PLN-037) (see **Appendix F**) and **Section 8.8** (Spill Response Operations). In the remote likelihood of an unplanned LOWC event, SSDI may be effective if the gas to oil ratio is greater than best estimates utilised here for the oil spill modelling.

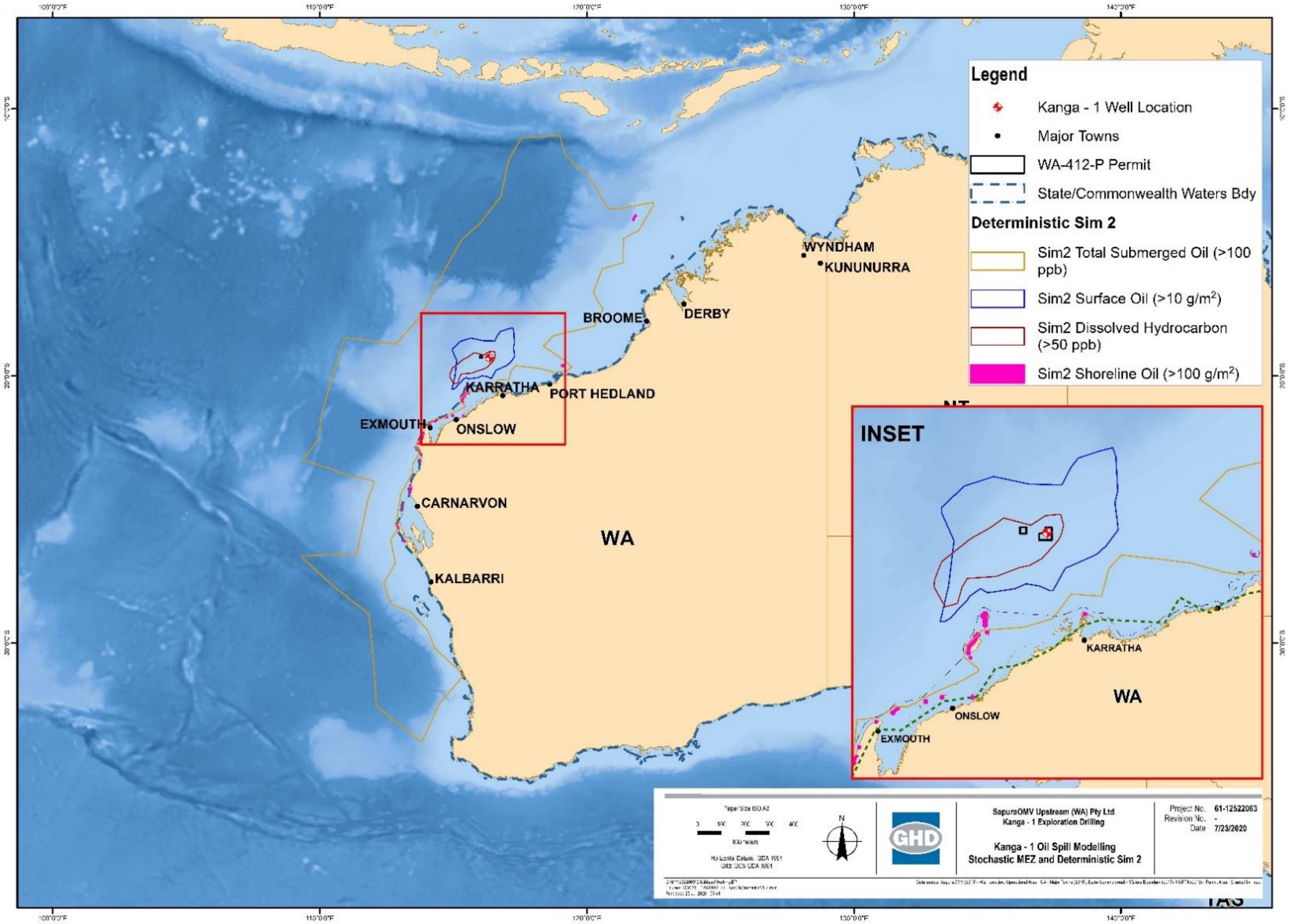


Figure 8-5 LOWC deterministic spill modelling output of predicted hydrocarbon exposure at moderate thresholds for all oil phases for the worst case stochastic realisation of loading across all shorelines

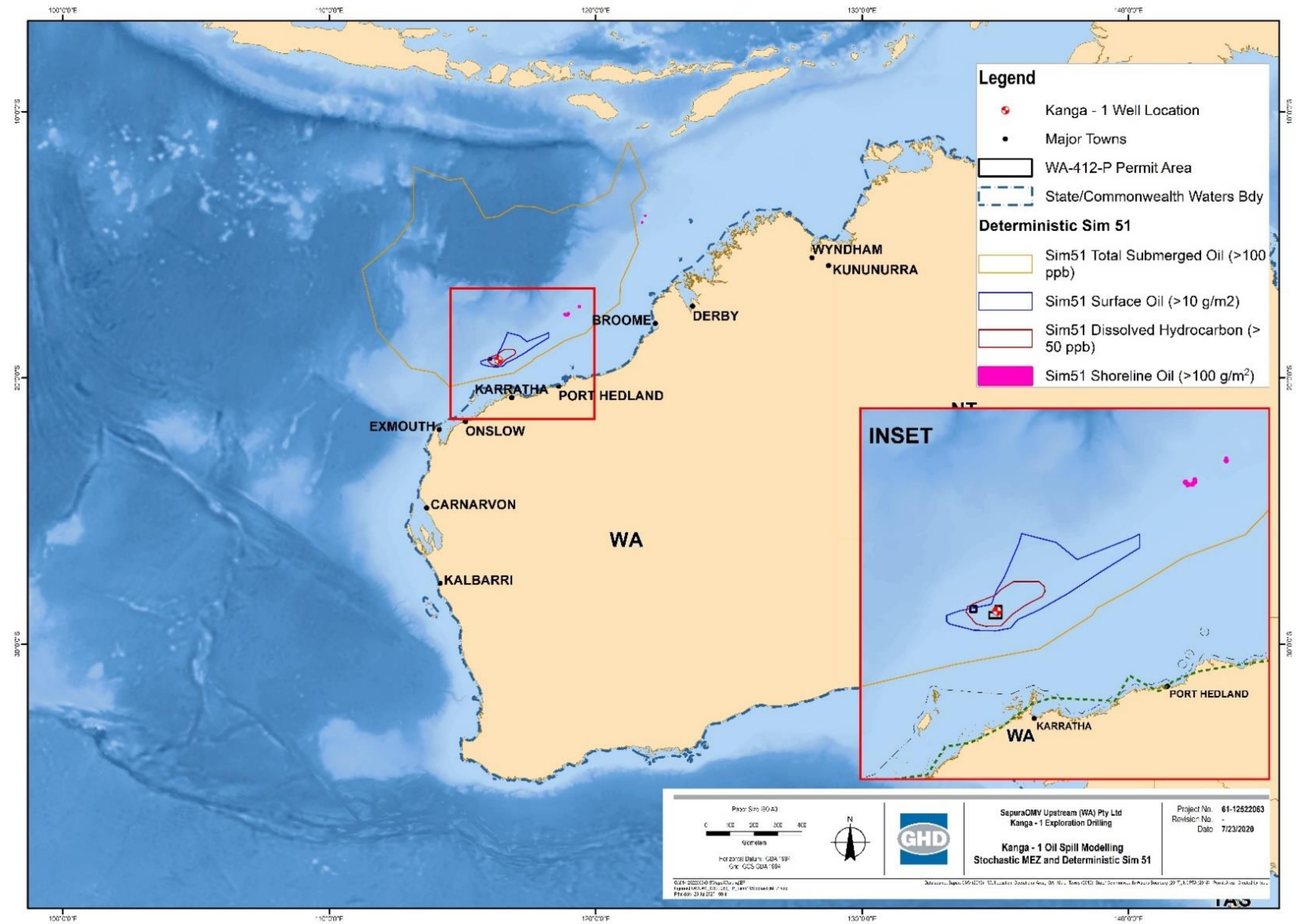


Figure 8-6 LOWC deterministic spill modelling output of predicted hydrocarbon exposure at moderate thresholds for all oil phases for the worst case stochastic realisation of loading at Imperiuse Reef

Figure 8-7 Comparison of no dispersant (orange), SDA (blue) and SSDI (green) response strategies on the mass of surface oil (top) and entrained droplets (bottom)

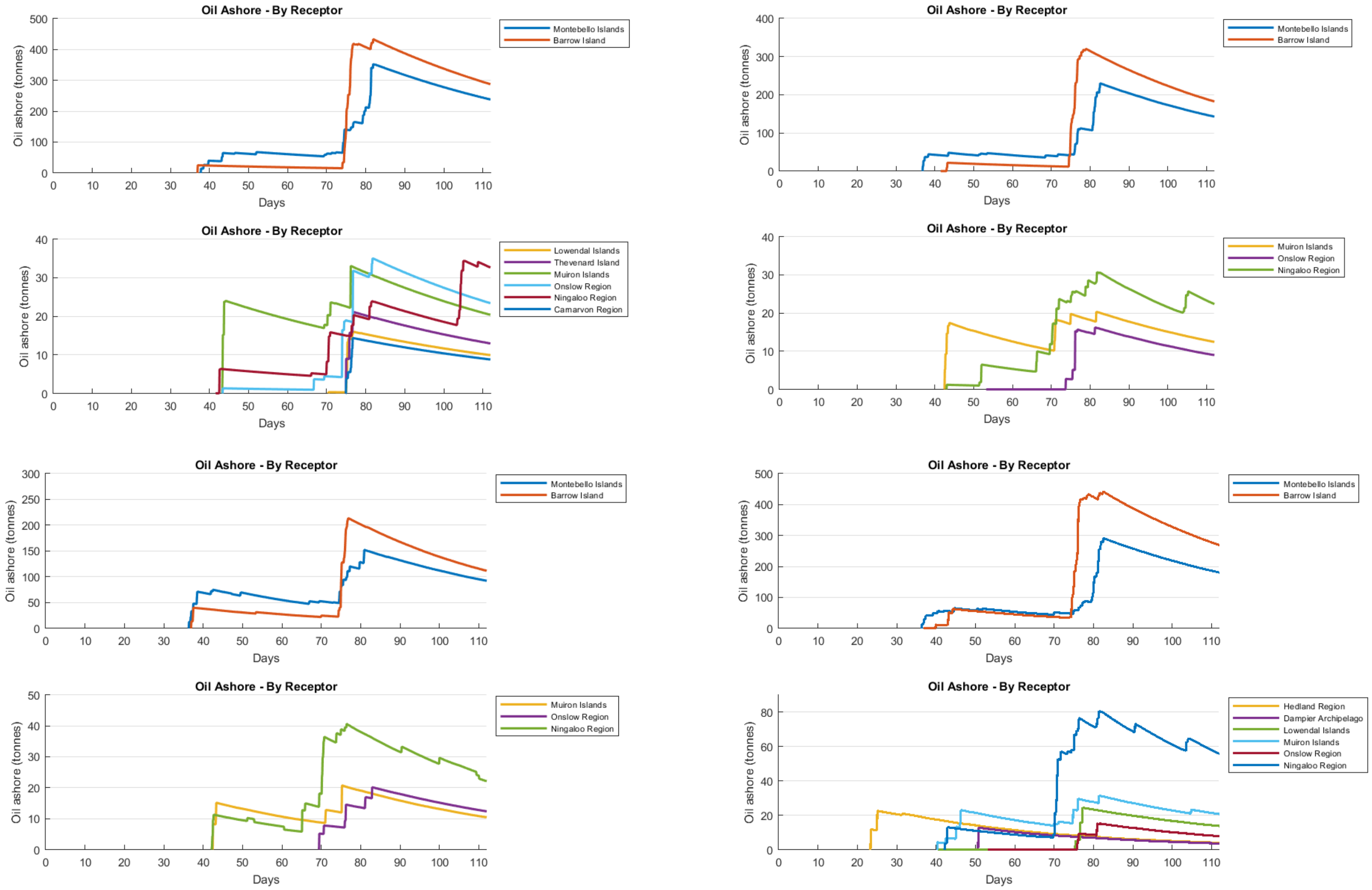


Figure 8-8 Comparison of no dispersant (top left), SDA option #1 (top right), SDA option #2 (bottom left) and SSDI (bottom right) response strategies at receptors with shoreline loadings greater than 10 tonnes

Standard Control Measures			
Control Measure	**Environmental Benefit**	**Evaluation of Decision**	**Decision**
Planned Maintenance System – BOP testing.	Regular testing and maintenance of BOP minimises the risk of failure.	Benefit outweighs the cost. Control is standard practice.	**Accept**
NOPSEMA accepted Well Operations Management Plan (WOMP).	Includes control measures for well integrity and testing and well control, and MODU Safety Case that reduce the risk of unplanned discharges to the marine environment.	Benefit outweighs the cost. Regulatory requirement.	**Accept**
NOPSEMA accepted MODU Safety Case.	Reduces the likelihood of a LOWC by implementing controls for safe operation of the facility. The MODU Safety Case: • Identifies the hazards and risks; • Describes how the risks are controlled; and • Describes the safety management system in place to ensure the controls are effectively and consistently applied.	Benefit outweighs the cost. Regulatory requirement.	**Accept**
Well Control Bridging Document	Well Control Bridging Document covers all aspects of primary and secondary well control for drilling operations implemented to minimise the potential for a LOWC.	Benefit outweighs the cost. Control is standard practice.	**Accept**
API 53 Subsea BOP requirements	Reduces the likelihood of a LOWC by implementing controls for safe operation of the facility.	Benefit outweighs the cost. Control is standard practice.	**Accept**

Offshore personnel competency assessment as per WEMS	Reduces the likelihood of a LOWC by implementing controls for safe operation of the facility.	Benefit outweighs the cost. Control is standard practice.	**Accept**
Barrier verification process	Reduces the likelihood of a LOWC by implementing controls for wellbore integrity and safe operation of the facility.	Benefit outweighs the cost. Control is standard practice.	**Accept**
Operational and Scientific Monitoring Plan (OSMP) comprised of Operational Scientific Monitoring Framework (AU-HS-PLN-005-1.1) and the Operational and Scientific Monitoring Implementation Plan (OSMIP) (AU-HSE-KG1-EX-PLN-038)	Operational monitoring allows adequate information to be provided to aid decision making to ensure response activities are timely, safe and appropriate. Scientific monitoring identifies if potential longer term remediation activities may be required.	Regulatory requirement.	**Accept**
Project-specific Mooring Design Analysis.	Ensure adequate MODU station holding capacity to prevent loss of station. This will reduce the likelihood of a blowout resulting in release of hydrocarbons to the marine environment.	Benefits considered to outweigh costs. Standard practice.	**Accept**
MODU spill response plans (SOPEP/SMPEP, appropriate to class).	Potential impacts to the environment are reduced through effective management of an accidental spill (discharge to sea).	Personnel cost associated with ongoing management (spill response exercises) and implementation of plans. Benefits of ensuring response plans in place, are followed and implemented outweighs costs.	**Accept**
Kanga-1 Exploration Well OPEP for a Crude Oil Spill (AU-HSE-KG1-EX-PLN-037)	Demonstrates the capability and planned response strategies to spills in the marine	Under the OPGGS(E)R, NOPSEMA require that the petroleum activity have an	**Accept**

	environment. May help to reduce the potential impact on the environment.	accepted OPEP. Environmental benefit outweighs cost. Control is a legislated requirement and must be adopted.	
Well Containment Plan	Potential impacts to the environment are reduced through effective implementation of engineering and operational activities to recover from a loss of well containment.	Benefits considered to outweigh costs. Standard practice.	**Accept**
MOU with other operators.	Potential impacts to the environment are reduced with quicker response times due to equipment access from other operators.	Benefits considered to outweigh costs. Standard practice.	**Accept**

Environmental Impact Assessment

An accidental hydrocarbon release to the marine environment as a result of a LOWC has the potential to impact:

- Water and sediment quality;
- Marine and intertidal (shoreline) flora and fauna;
- Protected and significant areas; and
- Socio-economic receptors.

A consequence assessment of sensitive environmental receptors at risk from a Kanga-1 LOWC has been undertaken based on a literature review and the potential exposures predicted by stochastic oil spill modelling. As the stochastic modelling does not consider the potential for response actions to reduce impacts, this consequence assessment is necessarily conservative and actual consequences may be considerably lower than described. **Section 4** and **Appendix D** includes a description of physical, biological and socio-economic environment present in the operational and/or spill (MEZ) areas.

Table 8-8 Exposure and consequence evaluation to ecological receptors within the LOWC MEZ

Receptor	Sensitivity	Consequence Evaluation
Plankton	Plankton are found in nearshore and open waters beneath the surface in the water column. These organisms migrate vertically through the water column to feed in surface waters at night (NRDA, 2012). As they move close to the sea surface it is possible that they may be exposed to both surface hydrocarbons but to a greater extent, hydrocarbons dissolved or entrained in the water column.	Plankton are predicted to be exposed to in-water (dissolved and total submerged) hydrocarbons above the moderate exposure threshold on the shelf and offshore waters of WA. The actual area affected by any single spill event would be considerably smaller than the area represented by the MEZ

	Plankton risk exposure through ingestion, inhalation and dermal contact. There is potential for localised mortality of plankton due to reduced water quality and toxicity from hydrocarbons. Effects will be greatest in the upper 10 m of the water column and areas close to the spill source where hydrocarbon concentrations are likely to be highest. Phytoplankton are typically not sensitive to the impacts of oil, though they do accumulate it rapidly (Hook et al. 2016) due to their small size and high surface area to volume ratio. Oil can affect the ability and the rate of photosynthesis and inhibit growth in phytoplankton, depending on the concentration range (Hook et al. 2016). In general, field and laboratory studies have shown that crude oil concentrations of up to 1 mg/L (1,000 ppb) may stimulate phytoplankton growth; concentrations of between 1 and 100 mg/L may cause slight and severe growth inhibition; and concentrations over 100 mg/L result in severe or complete growth inhibition (Ozhan et al. 2014). Therefore, subsurface hydrocarbons could potentially result in acute exposure. Since regeneration time is very short (e.g. 9-12 hours) any impacts to phytoplankton are expected to be very short-lived (NAS, 2003). Zooplankton (microscopic animals such as rotifers, copepods and krill), that feed on phytoplankton, are vulnerable to hydrocarbons (Hook et al. 2016) and toxic effects can be seen at concentrations ranging from 0.05 to 9.4 mg/L (NAS, 2003). In most cases, eggs and larvae are more sensitive than adults, and larvae more sensitive than eggs, though exceptions to this exist (Volkman et al. 1994). Short-term effects of oil on zooplankton include possible decreases in biomass (usually temporary), as well as lower rates of feeding and reproduction. Long-term effects, such as changes in community structure, have not been found (NAS, 2003). Spawned gametes and larvae would be especially exposed to spill effects since they are generally positively buoyant and would be exposed to surface slicks. The potential impact of this exposure is likely to be mitigated by the very broad distributions of plankton and the limited proportion likely to be exposed.	(**Figure 8-5** and **Figure 8-6**) or EMBA, and given the relatively fast population turnover of open water planktonic populations it is considered that any potential impacts will be low and temporary in nature. Plankton are numerous and widespread, meaning that an oil spill in any one location is unlikely to have long-lasting impacts on plankton populations at a regional level. Once background water quality conditions have been re-established, the plankton community may take weeks to months to recover (ITOPF, 2011), due to fast population turnover. The potential consequences to plankton are considered to be '*Minor (II)*', as they would involve short-term and localised impacts.
Sharks, Rays and Fish	The behaviours and habitat preferences of shark and fish species determine their potential or exposure to hydrocarbons and the resulting impacts. Since fish and elasmobranchs (sharks and rays) do not normally break the sea surface, exposure to surface hydrocarbons is unlikely to occur, with species more likely to encounter in-water hydrocarbons. Entrained hydrocarbon droplets can physically affect fish and sharks exposed for an extended duration (weeks to months). Effects will be greatest in the upper 10 m of the water column and areas close to the spill source where hydrocarbon concentrations are likely to be highest and with greater time exposure. Generally, fish are able to detect and avoid contact with surface slicks; mid-pelagic, free-swimming fish species are highly mobile and as such are not likely to suffer extended exposure to concentrations that would lead to chronic effects. Pelagic fish species are therefore generally not highly susceptible to impacts from hydrocarbon spills. As a result, mortality rarely occurs in open waters from surface spills (Kennish, 1997; Scholz et al.1992). However, shallow inshore species are less likely to be able	Most fish and shark species found in the areas of elevated hydrocarbons above low thresholds have extensive distributions across the NWMR and SWMR, or further. However, the contours delineating the moderate thresholds of surface, dissolved and total submerged oil overly the distributions of several shark and fish species listed as threatened and/or migratory under the EPBC Act (**Appendix D**). The MEZ also overlaps BIAs for several species of shark and sawfish as described in **Appendix D**. These species may encounter and are at risk of impact from surface (floating) oil, and in-water hydrocarbons. However, the majority of studies from laboratory trials or fish collected after spill events found evidence of elimination of PAHs in fish tissues and returning to

	to move away from in-water hydrocarbons and hence may be exposed for longer periods. Demersal species may be susceptible to oiled sediments, but are not expected to be greatly impacted, given the presence of in-water hydrocarbons in primarily in the surface layers of the water column. Sharks and fish can be exposed to oil through a variety of pathways, including: • Direct dermal contact (e.g. swimming through oil, with direct diffusion across their gills (Hook et al. 2016)); • Ingestion (e.g. directly or via oil-affected prey/foods); and • Inhalation (e.g. elevated dissolved contaminant concentrations in water passing over the gills). Of the potential toxicants, monocyclic and polycyclic aromatic hydrocarbons (MAHs and PAHs) are generally regarded as the most toxic to fish. Studies have shown a range of impacts including changes in abundance, decreased size, inhibited swimming ability, changes to oxygen consumption and respiration, changes to reproduction, immune system responses, DNA damage, visible skin and organ lesions, and increased parasitism. However, many fish species can metabolize toxic hydrocarbons, which reduces the risk of bioaccumulation (NRDA, 2012). Comparatively high concentrations of dissolved hydrocarbons are required to cause outright mortality of fish. No reports of oil spills in open water systems causing fish kills (e.g. mass fish mortality events attributable to oiling) have been reported (Hook et al. 2016). Fish are most vulnerable to hydrocarbon discharges during their embryonic, larval and juvenile life stages. Unlike adult fish that can move away from oiled waters, pelagic eggs and larvae are largely transported by wind and water currents. Those that come into contact with surface oil could be injured or killed through smothering or an accumulation of oil on the gills. Sharks and rays are not as well studied from a toxicological standpoint as bony fish, and the impact of oil exposure on these organisms is largely unknown. Hydrocarbon contact may affect whale sharks through direct physical coating (surface slicks) and ingestion (surface slicks and entrained/dissolved hydrocarbons), particularly if feeding. Whale sharks are vulnerable to surface, entrained and dissolved aromatic hydrocarbon spill impacts, as they filter large amounts of water over their gills, catching planktonic and nektonic organisms (Jarman and Wilson, 2004). Large fish have been shown to avoid oiled areas (Rooker et al. 2013), but it is not known whether sharks and rays would exhibit the same behaviour. Following the Deep Water Horizon incident, whale sharks were observed in the oil-impacted area, increasing the likelihood of exposure to surface slicks and elevated hydrocarbon concentrations beneath slicks.	reference levels within two months of exposure (Challenger and Mauseth, 2011; Davis et al. 2002; Gagnon and Rawson, 2011; Gohlke et al. 2011; Jung et al. 2011; Law and Hellou 1999). This is likely due to vertebrates ability to rapidly metabolise and excrete hydrocarbons (Hook et al. 2016). Recovery of shark and fish assemblages depends on the intensity and duration of an unplanned release, the composition of the oil released and whether dispersants are used, as each of these factors influences the level of exposure to potential toxicants. Recovery would also depend on the life cycle attributes of fishes. Species that are abundant, short-lived and highly fecund may recover rapidly. However, less abundant, long-lived species may take longer to recover. The range of movement of fishes will also influence recovery. The nature of the receiving environment also influences the level of impact on fishes. Large-scale population level effects following a LOWC on fish species, abundances or assemblage composition would be unlikely due to the wide geographical distribution of many fishes and the potential for rapid re-colonisation. Pelagic free-swimming fish and sharks are unlikely to suffer long-term damage from oil spill exposure because dissolved/entrained hydrocarbons in water are not expected to be sufficient to cause harm (ITOPF, 2011). There is the potential for short-term impacts to fish communities and shark populations; the consequences are ranked as ‘*Moderate (III)*’.
**Marine Mammals - **Cetaceans	Whales and dolphins can be exposed to the chemicals in oil through:	Several cetacean species were identified as having the potential to occur within the MEZ (**Appendix D)** and may

	• Internal exposure by consuming oil or contaminated prey; • Inhaling volatile oil compounds when surfacing to breathe; • Dermal contact by swimming in oil and having oil directly on the skin and body; and • Maternal transfer of contaminants to embryos (NRDA, 2012; Hook et al. 2016). French-McCay (2009) identifies that a 10-25 μm oil thickness threshold has the potential to impart a lethal dose on marine species, however the author also estimates a probability of 0.1% mortality to cetaceans if they encounter these thresholds based on the proportion of the time spent at surface. Direct surface oil contact with hydrocarbons is considered to have a low deleterious effect on whales, possibly due to the skin's effectiveness as a barrier to toxicity, so the effect of oil on cetacean skin is probably minor and temporary (Geraci and St. Aubin, 1988). Cetaceans in particular have mostly smooth skins with limited areas of pelage (hair covered skin) or rough surfaces such as barnacled skin to retain oil. The physical impacts from ingested hydrocarbons with subsequent lethal or sub-lethal impacts are both applicable to entrained oil. However, the susceptibility of cetaceans varies with feeding habits. Baleen whales (such as pygmy blue and humpback whales) are not particularly susceptible to ingestion of oil in the water column, but are susceptible to oil at the sea surface as they feed by skimming the surface. Oil may stick to the baleen while they filter feed near slicks. Toothed whales and dolphins may be susceptible to ingestion of dissolved and entrained oil as they gulp feed at depth. The inhalation of oil droplets, vapours and fumes is a distinct possibility if whales surface in slicks to breathe. Exposure to hydrocarbons in this way could damage mucous membranes, damage airways, accumulate in blood and other tissues, leading to possible liver damage and neaurological disorders, or even cause death. Several authors suggest that the threat of most immediate concern to cetaceans is inhalation of volatile toxic fractions at the air:water surface, rather than from ingestion or absorption through skin (Helm, et al. 2015). As highly mobile species, in general it is very unlikely that cetaceans will be constantly exposed to concentrations of hydrocarbons in the water column for continuous durations (e.g. >96 hours) that would lead to chronic toxicity effects. However, continued exposure to oil was documented for several species of cetaceans in Prince William Sound after the *Exxon Valdez* vessel spill (heavy oil) (Matkin et al. 2008) and in the Gulf of Mexico after the *Deepwater Horizon* LOWC in 2010 (Dias et al. 2017). Geraci and St. Aubin (1988) found little evidence of cetacean mortality from hydrocarbon spills; however, long-term individual effects (e.g. impaired health and reproduction) have been documented for two populations of killer whales (a toothed whale species) in Prince William Sound attributed to the *Exxon Valdez* vessel spill (Matkin et al. 2008). There is also evidence that the *Deepwater Horizon* oil spill has	be susceptible to impacts from spilled hydrocarbons; however, impacts will depend on the extent of the oil footprint, presence of habitat, exposure pathway and behaviour. Many cetacean species inhabiting offshore waters are highly mobile and range widely, so their contact with an oil spill may be brief and impacts from physical contact with hydrocarbons are likely to be in the form of sub-lethal effects (e.g. skin irritation, irritation from ingestion or inhalation). Nevertheless, some species have been identified as vulnerable to anthropogenic disasters such as oil spills (e.g. killer whales), and may take decades to recover from impacts or disturbance (Matkin et al. 2008). Humpback and pygmy blue whales are known to migrate seasonally through the MEZ. A LOWC in May to November would coincide with humpback whale migration and one in April to August or October to January would coincide with pygmy blue whale migration. Humpback whales primarily feed in Antarctic waters, and there are no recognised feeding areas on the west coast of Australia (TSSC, 2015c). The closest foraging BIA for pygmy blue whales (Ningaloo; DAWE, 2020a) is approximately 21 km south-east from the predicted moderate contact threshold for surface oil. Feeding during migrations is generally low level and opportunistic, reducing the potential for ingestion of hydrocarbons; therefore, sub-lethal impacts from external exposure are more likely for these species. Migrations of both humpback and pygmy blue whales are protracted through time and space (i.e. the whole population will not be within the MEZ), and as such, a spill from a LOWC is unlikely to affect an entire population. Cetacean populations that are resident within the MEZ may be susceptible to impacts from spilled hydrocarbons and are more likely to occupy coastal waters. However, spilled hydrocarbons are expected to weather quickly beyond the release location, thereby reducing the potential for impact with increasing distance. Therefore, impacts from physical contact with hydrocarbons are likely to be sub-lethal effects. If whales are foraging at the time of the spill, a greater number of individuals may be present in the area where sea surface oil is present; however, no foraging BIAs occur

	impacted reproduction and health of coastal bottlenose dolphins in the northern Gulf of Mexico (NOAA, 2012). Some behaviour disturbance (including avoidance of the area) may also occur. While this reduces the potential for physiological impacts from contact with hydrocarbons, active avoidance of an area may displace individuals or aggregations from important habitat, such as foraging.	within the area predicted to be exposed to surface hydrocarbons at moderate contact thresholds. Therefore, potential surface hydrocarbon exposure is unlikely to affect aggregations of foraging whale species. Several threatened, migratory and/or listed marine species have the potential to be migrating, resting or foraging within an area predicted to be exposed to in-water hydrocarbons. Based on the assessment above, a LOWC could disrupt a considerable number of migrating humpback or pygmy blue whales, or other cetaceans. Such disruption could include behavioural impacts (e.g. avoidance of impacted areas), sub-lethal biological effects (e.g. skin irritation, irritation from ingestion or inhalation) and, in rare circumstances, death. Given that impacts are expected to be largely sub-lethal, and the discontinuous, patchy and transient nature of exposure beyond the immediate vicinity of the well, any impact that did occur would be at an individual and not a population level. For those species where aggregations may occur (e.g. in BIAs), they are typically seasonal. Displacement behaviours and sub-lethal biological effects could result in temporary short-term impacts to formally managed species of recognised conservation value (see **Appendix D**). However, given that some species may experience ongoing effects and slow recovery (e.g. killer whales), potential consequences are considered '*Major (IV)*'.
Marine Mammals - Dugongs	No studies specifically dealing with the impact of oil on dugong populations are available, but risk assessments for manatees (a related organism found in the Americas) do exist (Geraci and St Aubin, 1988). Dugongs can be exposed to oil via dermal contact (especially as they cross the air:water interface to breathe), aspiration of oil at the surface, and ingestion of contaminated seagrass. They may also ingest oil from sediments as they forage for seagrass (Hook et al. 2016). Depending on the amount and type of oil, the effects could be short-term to long-term/chronic (e.g. organ damage).	Dugongs are unlikely to be in the area where surface or dissolved hydrocarbons are predicted to occur (**Figure 8-3**); therefore, aspiration and to a lesser extent, dermal contact, are considered unlikely. However, they have been recorded where total submerged oil is predicted to occur. In particular, the MEZ partially overlaps the BIA for foraging, breeding, calving and nursing area within the Exmouth Gulf. Hydrocarbons in the water column or consumption of contaminated seagrass may cause sub-lethal impacts to dugongs. However, impacts are assessed as short-term and localised; therefore, the potential consequence to dugongs is assessed as '*Moderate (III)*'.
Marine Mammals - Pinnipeds	Pinnipeds are potentially impacted by surface, in-water and shoreline hydrocarbons.	Pinnipeds are unlikely to be in the area where surface or dissolved hydrocarbons are predicted to occur (**Figure**

	Pinnipeds are vulnerable to sea surface exposures given they spend much of their time on or near the surface of the water, as they need to surface every few minutes to breathe and regularly haul out on to beaches. Exposure to surface oil can result in skin and eye irritations and disruptions to thermal regulation. Law et al. (2011) reports that seals appear not to be very sensitive to contact with oil, but instead to toxic impact from the inhalation of volatile components. Ingested hydrocarbons can irritate or destroy epithelial cells that line the stomach and intestine, thereby affecting motility, digestion and absorption. However, pinnipeds have been found to have the enzyme systems necessary to convert absorbed hydrocarbons into polar metabolites, which can be excreted in urine (Engelhardt, 1982; Addison and Brodie, 1984; Addison et al. 1986). Breeding colonies are particularly sensitive to hydrocarbon spills (Higgins and Gass, 1993). Pinnipeds are further at risk because of their tendency to stay near established colonies and haul-out areas and consequently are unlikely to practice oil avoidance behaviours. This is corroborated by Geraci and St. Aubins (1988) who suggest seals, sea lions and fur-seals have been observed swimming in oil slicks during a number of documented spills.	**8-3**). However, the MEZ overlaps foraging BIAs for male and female Australian sea lions (see **Appendix D**). These BIAs would be exposed to total submerged oil, and accumulation of oil at the moderate threshold may occur on shorelines of the foraging BIAs. Given the mobility of pinnipeds, there may be small numbers of seals and sea lions in the areas predicted to be temporarily exposed to moderate concentrations of in-water hydrocarbons in the water column, noting that in-water exposure (total submerged oil) is only predicted to occur within the upper layers of the water column. Hydrocarbons in the water column or consumption of prey affected by the oil may cause sub-lethal impacts to pinnipeds; however, their widespread nature and with no known breeding areas within the predicted shoreline accumulation, impacts are assessed as temporary and localised and are considered '*Moderate (III)*'.
Marine Reptiles	Marine reptiles can be exposed to chemicals in oil through: • Internal exposure by consuming oil or contaminated prey; • Inhaling volatile oil compounds; and • External exposure by swimming in oil. In addition, marine turtles can also be exposed through: • External exposure to adults or eggs from oiled nesting beaches; and • Maternal transfer of contaminants to embryos and eggs. Marine turtles are vulnerable to the effects of oil at all life stages; eggs, hatchlings, juveniles, and adults. Oil exposure affects different turtle life stages in varying ways; and each turtle life stage frequents a habitat with varied potential to be impacted during an oil spill. Several aspects of turtle biology and behaviour place them at particular risk, including a lack of avoidance, indiscriminate feeding in convergence zones, and large pre-dive inhalations. There is well documented evidence of the detrimental effects from encountering oil either via external contact, ingestion or inhalation, resulting in breathing, sight or gastro-intestinal injuries. Experiments on physiological and clinical pathological effects of hydrocarbons on loggerhead turtles (~15–18 months old) showed that the turtles' major physiological systems were adversely affected by both chronic and acute exposures (96 hour exposure to a 0.05 cm layer of South Louisiana crude oil versus 0.5 cm for 48 hours) (Lutcavage et al. 1995). Recovery from the sloughing skin and mucosa took up to 21 days, increasing the turtle's susceptibility to infection or other diseases (Lutcavage et al. 1995).	Marine reptiles are known to occur in the area potentially exposed to oil above surface and in-water (dissolved and total submerged) moderate exposure thresholds. This area includes recognised BIAs for threatened and migratory marine turtles (see **Appendix D**) where they are known to reside or aggregate in significant numbers, including nesting beaches and internesting areas. Significant areas include Muiron Islands, Barrow Island and Montebello Islands. Therefore, impacts to turtles from shoreline oiling may occur depending on the time of year an incident occurred and the success of response efforts to protect priority areas. Effects of hydrocarbons on marine reptiles, specifically turtles, can be severe. The presence of BIAs and aggregation areas within the area potentially exposed to oil at moderate exposure thresholds suggests that a LOWC would affect individuals with possible population-level responses if it occurred at critical life stages (e.g. if a spill occurred during turtle hatchling season). The staggered nature of reproductive activity in many of the species potentially affected, where only a portion of the population nests in any given year, would reduce the extent of effects on populations. The impacts of an oil spill will have implications for the immediate health of marine

	Records of oiled wildlife during spills rarely include marine turtles, even from areas where they are known to be relatively abundant (Short, 2011). An exception to this was the large number of marine turtles collected (613 dead and 536 live) during the Deep Water Horizon incident in the Gulf of Mexico; although many of these animals did not show any sign of oil exposure (NOAA, 2013). Of the dead turtles found, 3.4% were visibly oiled and 85% of the live turtles found were oiled (NOAA, 2013). Of the captured animals, 88% of the live turtles were later released, suggesting that oiling does not inevitably lead to mortality. Turtles may experience oiling impacts on nesting beaches and eggs through chemical exposure resulting in decreased survival to hatching and developmental defects in hatchlings. Whilst turtle nesting beaches may be contacted by weathered oil, turtles will always nest above the high tide mark and any oil moving through the beach profile should not contact nests. However, adult females crossing an oiled beach could result in external oiling of the skin and carapace. Turtle hatchlings may be more vulnerable to smothering as they emerge from the nests and make their way over the intertidal area to the water (AMSA, 2015). Hatchlings that contact oil residues while crossing a beach can exhibit a range of effects including impaired movement and bodily functions (Shigenaka, 2003). Hatchlings sticky with oily residues may also have more difficulty crawling and swimming, rendering them more vulnerable to predation. According to the Recovery Plan for Marine Turtles in Australia (DoEE, 2017a), oil pollution (chemical and terrestrial discharge –acute and chronic) is generally ranked as a high threat to most species and populations.	turtles and their nesting, future nesting activities, water quality and general turtle health. Two species of listed sea snakes were identified that may occur in, or have habitat in the MEZ, short-nosed sea snake and leaf-scaled sea snake, both critically endangered. Based on a recent survey, there is thought to be very little gene flow of sea snakes between reefs, implying that if a species is lost from a reef, recolonisation may take several years (Guinea, 2013). Consequently, the potential consequences to marine reptiles are considered to be '*Major (IV)*'.
Seabirds and Shorebirds	Seabirds and shorebirds are sensitive to the impacts of oiling, with their vulnerability arising when they cross the air-water interface to feed, as well as oiling from their shoreline habitats (Hook et al. 2016). The life history characteristics will determine the vulnerability of each species and life stage. Seasonal conditions may also affect their vulnerability (e.g. birds may be most vulnerable following the winter when their energy reserves are low or following moulting) (reviewed in Law et al. 2011). Species that raft together in large flocks on the sea surface are particularly at risk (ITOPF, 2011). Birds foraging at sea have the potential to directly interact with oil on the sea surface, at a considerable distance from breeding sites in the course of normal foraging activities (e.g. albatrosses and petrels). The greatest vulnerability for external exposure of oil, and the species most at risk include those that readily rest on the sea surface (such as shearwaters) and surface plunging species such as terns and boobies (Peakall et al. 1987). As seabirds are top order predators, any impact on other marine life (e.g. pelagic fish) may disrupt and limit food supply both for the maintenance of adults and the provisioning of young. In the case of seabirds, direct contact with hydrocarbons is likely to foul plumage. Oiled birds can lose the ability to fly, dive for food or float on the water, which can lead to drowning. Oil also interferes with the weatherproofing of feathers, which may result in hypothermia due to a reduction in the ability of the bird to thermo-regulate (ITOPF,	Many seabird and shorebird species listed as threatened and/or migratory under the EPBC Act, and those with BIAs within the area, may be affected by sea surface oil and shoreline loadings above moderate threshold levels (i.e. 10 g/m^2 and 100 g/m^2, respectively). These species are described in **Appendix D**. In the event of a LOWC, seabirds rafting, resting, diving or feeding at sea have the potential to come into contact with oil. Given the extensive ocean foraging habitat available to species, the temporary area impacted by a spill event is unlikely to limit their ability to forage for unaffected prey. There are no foraging BIAs within the area potentially exposed to surface oil at moderate to high exposure thresholds. Surface oil is therefore unlikely to affect species at a population level. Birds are not likely to be significantly affected by in-water concentrations of hydrocarbons due to their limited exposure time in the water column. Indirect effects through the ingestion of prey

	2011). A bird suffering from cold, exhaustion and a loss of buoyancy (resulting from fouling of plumage) may dehydrate, drown or starve (ITOPF, 2011; DSEWPaC, 2011c). It may also result in impaired navigation and flight performance (Hook et al. 2016). Toxic effects of hydrocarbons on birds may result where the oil is ingested as the bird attempts to preen its feathers to remove oil, and the preening process may spread the oil over otherwise clean areas of the body (ITOPF, 2011; Hook et al. 2016). Whether this toxicity ultimately results in mortality will depend on the amount of hydrocarbons consumed and other factors relating to the health and sensitivity of the bird. Birds that are coated in oil also suffer from damage to external tissues including skin and eyes, as well as internal tissue irritation in their lungs and stomachs. Engelhardt (1982), Clark (1984), Geraci and St Aubin (1988) and Jenssen (1994) indicated that the threshold thickness of oil that could impart a lethal dose to some intersecting wildlife individuals is 10 µm (~10 g/m^2). Scholten et al. (1996) indicates that a layer 25 µm thick would be harmful for most birds that contact the slick. In a review of 45 marine hydrocarbon spills, there was no correlation between the numbers of bird deaths and the volume of the spill (Burger, 1993). Seabirds may also be susceptible to chronic exposure to PAHs and other oil constituents accumulated through trophic transfer because they are long-lived upper trophic level consumers (Velando et al. 2010), which can cause delayed mortality. Due to their feeding habits, shorebirds are likely to be exposed to oil when it directly impacts the intertidal zone. Shorebird species foraging for invertebrates on exposed sand and mud flats at lower tides will be at potential risk of both direct impacts through contamination of individual birds (ingestion or soiling of feathers) and indirect impacts through the contamination of foraging areas that may result in a reduction in available prey items (Clarke, 2010). Breeding seabirds may be directly exposed to oil via a number of potential pathways. Any direct impact of oil on terrestrial habitats has the potential to contaminate birds present at the breeding sites (Clarke, 2010). Exposure also can reduce the hatching of eggs and survival of hatchlings. Therefore, impacts can be identified through acute mortality, productivity loss, decrease in reproductive success, sublethal effects and loss of prey resources.	contaminated by entrained and dissolved oil may affect individual birds. The WA coastline and neighbouring islands provide feeding, resting and nesting habitats for many coastal and migratory bird species. Accumulation of oil at the moderate threshold may occur on the shoreline of Muiron Islands, Barrow Island and Montebello Islands where important nesting, foraging and resting areas occur. Shorebirds foraging in the intertidal zone, or roosting or nesting on beaches and dunes along the WA coastline may also be exposed to accumulated oil. Most species of seabird and shorebird are abundant and have wide distributions throughout Australia, meaning that impacts to individuals or a population at one location will not necessarily extend to populations at other un-impacted locations. The potential consequence to seabirds and shorebirds from a LOWC is considered to be '*Moderate (III)*'.
Subtidal Communities Macrophytes (Macroalgae and Seagrass)	In-water hydrocarbons have the potential to affect macrophytes (macroalgae and seagrasses) through toxicity impacts. Smothering, fouling and asphyxiation are some of the physical effects that have been documented from oil contamination in marine plants (Blumer, 1971; Cintron et al. 1981). Macroalgae are generally limited to growing on intertidal and subtidal rocky substrata in shallow waters of up to 50 m depth (DAWE, 2020a). Similarly, seagrasses generally grow in sediments in intertidal and shallow subtidal waters where there is sufficient light, and are common in sheltered coastal areas such as bays, lees of islands and fringing coastal reefs. As such, macrophytes may be exposed to both surface and	Locations within the MEZ that have macroalgae and seagrass beds (e.g. Muiron Islands, refer to **Appendix D**) may be exposed to hydrocarbons above the threshold that could cause impacts, in the unlikely event of a LOWC. There was negligible (<2%) probability of any nearshore areas being exposed to dissolved oils at moderate contact thresholds. Exposure to in-water (total submerged) hydrocarbons is typically restricted to within 30 m below the surface and therefore any potential impact to benthic habitats will only occur in shallower nearshore waters.

	subsurface hydrocarbons. The toxicity of hydrocarbons however, is largely dependent on the degree of direct exposure and the different life stages of the macrophytes. In macroalgae, oil can act as a physical barrier for the diffusion of carbon dioxide across cell walls (O'Brian and Dixon, 1976). The morphological features of macroalgae, 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. Although seagrass and macroalgae may be subject to lethal or sublethal toxic effects, including mortality, reduced growth rates, and impacts to seagrass flowering, several studies have indicated rapid recovery rates may occur even in cases of heavy oil contamination (Connell et al. 1981; Burns et al. 1993; Dean et al. 1998; Runcie and Riddle, 2006). For algae, this could be attributed to new growth being produced from near the base of the plant while the distal parts (which would be exposed to the oil contamination) are lost. For seagrasses this may be because 50–80% of their biomass is in their rhizomes, which are buried in sediments, thus less likely to be adversely impacted by hydrocarbons (Zieman et al. 1984). It has been reported by Taylor and Rasheed (2011) that seagrass meadows were not significantly affected by an oil spill when compared to a non-impacted reference seagrass meadow. In addition, Edgar and Barrett (1995) reported that macroalgal species possess a relatively high resistance to oil spills and are expected to recover from spills within a short period of time. Macroalgal systems are an important source of food and shelter for many ocean species, and fauna associated with macroalgae may be more sensitive to oil exposure than the macroalgae itself (Hook et al. 2016). Following the *Exxon Valdez* oil spill, the abundance of some macrobenthic invertebrates associated with the kelp forests were found to decline in the year following the spill, even though the macroalgae were unchanged (Dean et al. 1998). However, Edgar and Barrett (1995) conclude in their study regarding the impacts on and recovery of subtidal reefs affected by the *Iron Baron* fuel spill in northern Tasmania in 1995 that the release of large quantities of fuel oil did not substantially affect populations of subtidal reef-associated organisms, with no significant change in number of species on reefs nor in the densities of the most abundant animal and plant species. Seagrass beds are considered to be important dugong habitat and feeding grounds. Marine turtles are also known to forage in areas with seagrass beds. The susceptibility of seagrasses to hydrocarbons will depend largely on their distribution, with communities in deeper waters less likely to be affected in comparison with those in shallower waters from entrained and dispersed oil droplets or, in the case of emergent seagrasses, by direct oiling.	There was low to moderate probabilities (>5%) of total submerged oil exposure at the moderate contact threshold at the following islands and reef features: • Dampier Archipelago (5.0%) • Mermaid Reef (5.8%) • Muiron Islands (13.3%) • Ningaloo Region (13.3%) • Imperiuse Reef (18.3%) • Montebello Islands (30.0%) • Barrow Island (30.8%) • Onslow Region (35.8%) These shallow nearshore areas are known to have a variety of benthic habitats and communities including macroalgae and seagrass. Based on the impact assessment and expected recovery, the consequence is considered to be '*Moderate (III)*'.
Subtidal Communities Coral Reefs	Corals are generally located in shallow and intertidal regions, where there is the potential for exposure to surface and in-water hydrocarbons. Experimental studies and field observations indicate all coral species are sensitive to the effects of oil, although there are considerable differences in the degree of tolerance between	Intertidal coral reefs may be exposed to hydrocarbons above the threshold that could cause impacts, in the unlikely event of a LOWC. The effect of the toxic fractions of total submerged oil on intertidal coral include partial

	species (Jackson et al. 1989). 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. Direct contact of coral by hydrocarbons may impair respiration and also photosynthesis by symbiotic zooanthellae (IPIECA, 1992). Physical oiling of coral tissue can cause a decline in metabolic rate and may cause varying degrees of tissue decomposition and death (Negri and Heyward, 2000). A range of impacts is reported to result from toxicity including partial mortality of colonies, reduced growth rates, bleaching and reduced photosynthesis. Laboratory and field studies have demonstrated that branching corals appear to have a higher susceptibility to hydrocarbon exposure than massive corals or corals with large polyps. Chronic effects of oil exposure have been consistently noted in corals and, ultimately, can kill the entire colony. Chronic impacts include histological, biochemical, behavioural, reproductive and developmental effects. Field studies of chronically polluted areas and manipulative studies in which corals are artificially exposed to oil show that some coral species tolerate oil better than other species (NOAA, 2010). Reproductive stages of corals have been found to be more sensitive to oil toxicity. Studies undertaken after the Montara incident included diver surveys to assess the status of Ashmore, Cartier and Seringapatam coral reefs. These found that other than a region-wide coral bleaching event caused by thermal stress (i.e. caused by sea water exceeding 32°C), the condition of the reefs was consistent with previous surveys, suggesting that any effects of hydrocarbons reaching these reefs was minor, transitory or sub-lethal and not detectable (Heyward et al. 2010). This is despite AMSA observations of surface slicks or sheen nears these shallow reefs during the spill (Heyward et al. 2010). Surveys in 2011 indicated that the corals exhibiting bleaching in 2010 had largely survived and recovered (Heyward et al. 2012), indicating that potential exposure to hydrocarbons while in an already stressed state did not have any impact on the healthy recovery of the coral. In addition, surveys undertaken after the Montara blowout on the plateau areas of Barracouta and Vulcan shoals (Heyward et al. 2010), which occur about 20-30 m below the water line in otherwise deep waters (generally >150 m water depth), and contain algae, hard coral and seagrass, found no obvious visual signs of major disturbance.	mortality of colonies, reduced growth rates, bleaching, reduced photosynthesis, interruption of chemical communication necessary for mass spawning, premature explosion of larvae, decreased growth rates, decreased lipid content, decreased survival of larvae, decreased gonadal development, negative impacts to coral settlement, increased susceptibility to algae colonisation, epidemic diseases, localised tissue rupture, reduced reef resilience and mortality (Hayes et al. 1992; Peters et al. 1997; Negri and Heyward 2000; Shigenaka, 2001; Hook et al. 2016). There was negligible (<2%) probability of any nearshore areas being exposed to dissolved oils at moderate contact thresholds. Exposure to in-water (total submerged) hydrocarbons is typically restricted to 30 m below the surface and therefore any potential impact to benthic habitats will only occur in shallower nearshore waters. There was low to moderate probabilities of total submerged oil exposure (moderate contact threshold) with some islands and reef features. Those with >5% contact probability include: • Dampier Archipelago (5.0%); • Mermaid Reef (5.8%); • Muiron Islands (13.3%); • Ningaloo Region (13.3%); • Imperiuse Reef (18.3%); • Montebello Islands (30.0%); and • Barrow Island (30.8%). These shallow nearshore areas are known to have a variety of benthic habitats and communities including corals. As spills disperse, intertidal communities are expected to recover (Dean et al. 1998), though the rate of recovery of coral reefs depends on the level or intensity of the disturbance, with recovery rates ranging from 1 or 2 years, to decades (Fucik et al. 1984; French McCay, 2009). The potential consequence of a LOWC on corals is assessed to be '*Major (IV)*', given recovery times could be up to decades.

Subtidal Communities Benthic Invertebrates	Benthic marine invertebrates are an extremely diverse group, comprised of many different taxonomic groups, with different life histories and ecological niches. Benthic invertebrates inhabit the seabed and are potentially at risk of toxic effects of exposure to in-water hydrocarbons, as well as toxicity and physical oiling resulting in smothering from surface hydrocarbons in intertidal areas. These organisms could take up oil via diffusion from the dissolved phase, ingestion of contaminated food items, and contact with contaminated sediments (Hook et al. 2016). Acute or chronic exposure through surface contact, respiration and/or ingestion can result in toxicological risks. The presence of an exoskeleton (e.g. crustaceans) will reduce the effect of hydrocarbon absorption through the surface membrane, except for respiratory membranes. Other invertebrates with no exoskeleton and larval forms may be more prone to effects from in-water hydrocarbons. Small invertebrates (micro- and meiofauna) will be very susceptible to the narcotic effects of oil because of their high surface area to volume ratio. As a consequence, disappearance of benthic crustaceans from sediments is often considered an indicator of impact (Gomez Gesteria and Dauvin, 2005). These narcotic impacts can not only cause outright mortality of organisms, but also decreases in rates of reproduction (Hook et al. 2014). The ecological implications of potential reduction in diversity and abundance of benthic invertebrates will be dependent on the habitat affected. Areas of highly mobile sediment, where diversity and abundance are relatively low, will likely recover quickly. Complex assemblages (e.g. sponge habitat) or deep-water slow-growing sessile invertebrates (e.g. deep-water coral) are likely to recover much more slowly, and loss of these epibiota could change seabed habitat complexity.	Benthic invertebrates may be exposed to hydrocarbons above the threshold that could cause impacts, in the unlikely event of a LOWC. There was negligible (<2%) probability of any nearshore areas being exposed to dissolved oils at moderate contact thresholds. Exposure to in-water (total submerged) hydrocarbons is typically restricted to 30 m below the surface and therefore any potential impact to benthic habitats will only occur in shallower nearshore waters. There was low to moderate probabilities of total submerged oil exposure (moderate contact threshold) with some islands and reef features. Those with >5% contact probability include: • Dampier Archipelago (5.0%); • Mermaid Reef (5.8%); • Muiron Islands (13.3%); • Ningaloo Region (13.3%); • Imperiuse Reef (18.3%); • Montebello Islands (30.0%); • Barrow Island (30.8%); and • Onslow Region (35.8%). These shallow nearshore areas are known to have variety of benthic habitats and communities. As spills disperse, intertidal communities are expected to recover (Dean et al. 1998), though the rate of recovery depends on the level or intensity of the disturbance. Benthic marine invertebrates provide a food source for a number of inshore fish (WA DoT, 2018) and EPBC listed species such as marine turtles. Consequently, the potential consequence of risks to benthic marine invertebrates from a LOWC are considered to be '*Moderate (III)*'.
Subtidal Communities Subtidal Rocky Reefs	Nearshore and offshore subtidal reef habitats are dominated by seaweeds, mobile invertebrates and fish. Potential impacts to sensitive receptors related to these reefs are discussed above. It was observed that the release of large quantities of fuel oil during the grounding of the *Iron Baron* did not substantially affect populations of subtidal reef associated organisms (Edgar and Barrett, 1995).	Recovery of subtidal rocky reefs exposed to in-water hydrocarbons and experiencing impacts would be expected within weeks to months of return to normal water quality conditions. Several studies have indicated that rapid recovery rates may occur even in cases of heavy oiling (Burns et al. 1993; Dean et al. 1998). The potential consequence of risks to subtidal rocky reefs from a LOWC

		are considered to be '*Moderate (III)*', given recovery may take months, depending on the degree of exposure.
Coastal Environments Rocky Shores	Exposed rocky shores are typically less sensitive to oil spills than beaches, with the exception of when wildlife habitats or breeding grounds (see also potential impacts to pinnipeds above) are present. Because the rocks do not absorb much oil, the spilled material is mostly held offshore and any oil that is deposited remains on the rock surface where it is subject to weathering. The rate of such weathering is dependent on many factors, the wave exposure, weather conditions and the shore characteristics are most important (IPIECA, 1995). As the oil is weathered it becomes more viscous and less toxic, often leaving only a small residue of tar on upper shore rocks. This residue is unlikely to cause any more ecological damage. Oil is not normally retained on rocky shores in a form or quantity that causes long-term impacts and also because rocky shorelines generally have a diverse and productive intertidal community which are considered resilient to oil spills and short-term oil persistence (IPIECA, 2017).	WA DoT (2018) note that rocky shorelines are the least susceptible of shoreline types to long term impacts from a spill of both floating and dissolved oil. As such, this receptor is not expected to have issues relating to recovery from an oil spill. The impact of oil accumulating on rocky shorelines is considered to be a '*Minor (II)*' consequence.
Coastal Environments Beaches	Beaches are defined by intertidal sediments ranging from muds finer than 0.06 mm diameter to pebbles and cobbles larger than 200 mm diameter. Where the grain size is between 2 and 64 mm, these beaches are not considered to be especially sensitive to the impacts of oil spills because they are regularly cleaned by wave action and have low sediment total organic carbon (TOC), and consequently, low abundances of marine life (Law et al. 2011). This low concentration of TOC and large particle size suggests that any oil that is deposited on such beaches would not be retained. Generally, beaches are vital both ecologically and economically. Ecologically, beaches are an important element of shoreline stabilization that helps protect against erosion. They also provide habitat for numerous invertebrates that helps maintain shoreline health through sediment drainage and facilitating nutrient transport as well as providing food source for numerous shoreline and migratory birds. Finally, beaches also provide critical ecological habitat for nesting sea turtles and shorebirds (NRDA, 2012) Oil will be deposited along the high-water mark or strandline, and the highest hydrocarbon concentrations and impacts would be expected there (Hook et al. 2016). Results of exposure to oil may be acute (e.g. die off of amphipods and replacement by more tolerant species such as worms) or chronic (e.g. gradual accumulation of oil and genetic damage leading to increased prevalence of tumours) (Hook et al. 2016). Shoreline-accumulated hydrocarbons are predicted to result in temporary declines in infauna and epifauna populations. Any decline in infauna and epifauna populations may have an indirect effect on feeding shorebirds, seabirds and migratory wading birds. De La Huz et al. (2005) investigated the impacts of the *Prestige* oil tanker spill off the Galician coast on 17 exposed sandy beaches. The study investigated species richness of polychaetes, molluscs, marine crustaceans, semi-terrestrial crustaceans and insects on the affected beaches, by comparing the total number of species in	Stranded oil was predicted to contact sandy beaches along the WA and Indonesian coastlines (**Figure 4-1**, **Figure 8-3**, **Figure 8-4**). Many of these locations have the potential to provide habitat for EPBC Act listed reptiles and seabirds, but also habitat for invertebrates including polychaetes, molluscs, marine crustaceans, semi-terrestrial crustaceans and insects. In particular, the Montebello Islands (contact probability >100 g/m^2 of 60%, maximum accumulated shoreline load of 401 tonnes), Barrow Island (68%, 511 tonnes), Imperieuse Reef (366 tonnes, 37%), Ningaloo Region (69% 76 tonnes) and Muiron Islands (58%, 49 tonnes) have the predicted highest probabilities of substantial loading. French-McCay (2009) reported recovery of invertebrates after three years on sandy beaches oiled by the 1970 *Arrow* spill of Bunker Oil. WA DoT (2018) assessed Kimberley sandy beaches and concluded that they are moderately ecologically sensitive and are moderately difficult to rehabilitate from an oil spill. Other beaches are likely to be similar. Given that recovery could take years, the potential consequence is considered to be '*Moderate (III)*'.

	each group before and after the oil spill. The investigation identified that the most affected beaches lost up to 66.7% of the total species richness after the oil spill and dry sand areas received the highest volumes of hydrocarbons ashore.	
Coastal Environments Mangroves and Salt Marshes	Mangrove ecosystems are dominated by flowering trees that are specially adapted to marine and estuarine conditions (Duke et al. 2000). Mangrove ecosystems are ecologically important, because intact mangroves can decrease the severity of storm impact, prevent sediment from reaching coral reefs and act as a nursery for fish (Peters et al. 1997). These systems provide habitat for both aquatic and terrestrial organisms, and, consequently, a variety of fish and invertebrate species would likely be exposed to oil if it were entrained in mangrove sediments. Mangrove ecosystems can be exposed to oil when it is transported into the system via waves or currents and is stranded by receding tides. This oil then covers the pneumatophores of some types of mangrove trees, smothering them, and reducing oxygen flow to the roots of the plant (Lewis et al. 2011). Oil also inhibits germination of seedlings, increases rates of defoliation, leaf senescence and wilting, reduces numbers of pneumatophores, increases mutation rate and reduces photosynthetic efficiency (Naidoo et al. 2010; Lewis et al. 2011). Oil entrained within mangrove sediments can be available to invertebrates and fish inhabiting these systems, causing toxic impacts and changes in community structure (Hook et al. 2016). Mangrove ecosystems typically have fine sediment grain sizes and low wave energy, meaning that oil stranded in these areas is likely to remain. These sediments are also anoxic, which means the degradation of oil within the sediments is likely to be slow (Peters et al. 1997). Mangrove forests do not recover quickly from spills, with effects having been measured over decades (Peters et al. 1997), and mortality that occurs as a result of the oiling can be delayed (Naidoo et al. 2010). As a consequence of the sensitivity of mangroves to oil exposure and the long recovery times, mangrove ecosystems are considered among the most sensitive to oiling (Duke et al. 2000). Salt marshes are tidally inundated grassland habitats found in low-energy coastal environments. These areas typically provide nursery areas for many commercially important fish and invertebrate species. Salt marshes typically consist of fine grain, often anoxic, sediments, held in place by the rhizomes of plants. The dominant marine residents are benthic invertebrates, including molluscs and crabs that rely on the sediments, vascular plants, and algae, as providers of food and habitat across the intertidal landscape (Ross et al. 2009). Damage to or die back of the plants often causes erosion of the habitat as a whole (Law et al. 2011). Once oil is deposited into salt marsh habitats, it is very persistent. The low energy of the environment means that stranded oil is not readily washed away, and oil does not degrade quickly in anoxic environments. The invertebrates, in particular, that inhabit salt marsh environments may be very susceptible to oil, and there may be a loss of species and productivity in oiled environments (Hook et al. 2016).	There was no exposure of mangroves (any shorelines) to surface oil above the moderate threshold predicted by the quantitative spill modelling, but moderately high (60-69%) probabilities of shoreline accumulation (moderate contact threshold) of areas known to have mangrove and salt marsh habitat. In particular, worst case shoreline loadings in the unlikely event of a LOWC were predicted at up to 400.5 t maximum total accumulated oil ashore for the Montebello Islands and 511.2 t for Barrow Island. Much lower (75.5 t maximum total accumulated oil ashore) potential loadings were predicted for the Ningaloo Region. The modelling indicates no exposure to dissolved hydrocarbons at concentrations (moderate or low contact thresholds) that may cause sub-lethal to lethal effects from toxicity at these locations. Nevertheless, accumulated oil could coat mangrove and salt marsh areas and, depending upon the level of impact, recovery to affected mangrove areas can be on the scale of years to decades (NOAA, 2010). The mangrove communities at the Montebello Islands are made up of six species and are considered to be globally unique as they occur in lagoons of offshore islands (DEC, 2007).Therefore, the consequence of a LOWC event on mangroves and saltmarsh ecosystems is considered to be 'Critical (V)'.

Coastal Environments Wetlands	Wetlands support marine biological productivity levels that are among the highest in coastal waters and are part of the ecological continuity that exists between the land and the open ocean (NRDA, 2012). Wetland habitat can be of particular importance for some species of birds, fish and invertebrates. Wetlands also provide the important functions of storm surge protection and water quality improvement. Sediments in these areas often have a small grain size and are high in TOC and, as a consequence, they are frequently anoxic. Any oil that is deposited into these areas is likely to be persistent, due to low wave energy and slow rates of biodegradation (Hook et al. 2016). In addition to direct impacts on wetland vegetation communities, oil that reaches wetlands may also affect fauna utilising wetlands during their life cycle.	Sensitive receptors found in Ramsar and nationally important sites connected to the sea could include mangroves, salt marshes, fishes, shorebirds and seabirds. The consequences of oil to these specific receptors have been described above. There are predicted low probabilities of moderate threshold level shoreline and in-water hydrocarbon contact to some wetlands (including both internationally important (Ramsar) and national important sites) and their adjacent marine waters (see **Appendix D**). Specifically, there is potential for a temporary decline in water quality and for direct impacts on wetland vegetation communities that may impact on the ecological character of the Eighty-mile Beach Ramsar site (predicted shoreline accumulation probability >100 g/m^2 of 2%, maximum accumulated shoreline load of 36 tonnes), but not that of the other Ramsar site at Ashmore Reef National Nature Reserve (no shoreline accumulation, no surface oil or dissolved oil contact above low thresholds, 1% probability of total submerged oil contact above low threshold). In addition to direct impacts, oil that reaches the wetlands may also affect fauna utilising wetlands during their life cycle. Refer also to receptor evaluations for: • Seagrass; • Fish; and • Marine invertebrates. If oil was to enter a Ramsar site or Nationally Important Wetland, the level of effect would be dependent on the type of receptors exposed to oil, the proportion of the site exposed, as well as the nature of the oil (fresh versus weathered). The consequence of a LOWC event on wetlands is considered to be '*Moderate (III)*', given the cultural significance and International (Ramsar-listed) and National importance.
World, National and Commonwealth Heritage Places	Several World, National and Commonwealth heritage places were identified to occur within the MEZ see **Appendix D**). Values and sensitivities of heritage listed places are a combination of quality, habitat, marine fauna and flora, and human use. As such, the impact pathways are varied. A	The Ningaloo Coast and Shark Bay World and National Heritage Properties have a 69.2% and 11.7% probability of shoreline contact at the moderate threshold, respectively, with a maximum oiled shoreline length of 84.1 and 9.3 km, respectively. Impacts to different receptor

	LOWC has the potential to result in impacts through a reduction in aesthetic value and impacts to ecological receptors within each place. Impacts to different receptor types are described above.	types that underlie the values of these heritage properties are described above. Given the potential extent and receptors within properties potentially exposed to oil, the consequence to heritage properties is considered to be '*Major (IV)*'.
Threatened Ecological Communities	One threatened ecological community was identified to occur in the MEZ – the Subtropical and Temperate Coastal Salt Marsh (see **Appendix D**). Receptors within this area include saltmarshes and associated fauna that may be impacted. Impacts to shoreline habitats and fauna are described above.	If oil was to enter a threatened ecological community, the level of effect would be dependent on the type of receptors exposed to oil, the proportion of the site exposed as well as the nature of the oil (fresh versus weathered). The consequence of a LOWC event on a coastal salt marsh may be catastrophic as it has the potential to eliminate significant areas and significantly impact fauna such as birds and fish (DSEWPaC, 2013d). Given the distribution of the Subtropical and Temperate Coastal Salt Marsh and the relatively low mainland shoreline loading, the consequence to threatened ecological communities is considered to be '*Moderate (III)*'.
Australian Marine Parks	Australian Marine Parks (AMPs) in the MEZ are described in **Appendix D**. AMPs vary in their conservation objectives, but all are designed to conserve fauna, habitats and water quality over the long-term. A temporary deterioration of water quality could have negative effects on organisms, such as plankton, seabirds, marine mammals and fisheries resources. These effects are discussed individually in Sections above. In-water hydrocarbons may also cause negative effects to benthic sediments and habitats through deposition and sedimentation. Accumulation of hydrocarbons in sediments can have deleterious effects on marine benthic infauna and can be bioaccumulated through food webs. Sensitive receptors within AMPs, whicht may comprise part of the justification for their designation, may also use the air:water interface, at which point they may be exposed to surface hydrocarbons and volatile organic compounds in the air.	The consequences of oil to specific receptors within these protected areas have been described above. Surface and in-water oil entering these AMPs will compromise water quality until the oil is broken down and/or currents shift the weathering oil outside the boundaries of the AMPs. Thus, water quality effects are predicted to persist only over the short to medium term in the AMPs. Quantitative spill modelling (GHD, 2020a) indicated that there were low to moderate probabilities that three AMPs could be exposed to moderate thresholds of sea surface oil: • Gascoyne AMP (0.8%); • Argo-Rowley Terrace AMP (5.8%); and • Montebello AMP (31%) A number of AMPs were predicted to experience exposure to total submerged oil at moderate thresholds, with minimum time to contact ranging from 3 to 64 days. The following AMPs have the highest contact probabilities (>5%): • Perth Canyon AMP 5.0%); • Mermaid Reef AMP (5.8%);

		• Dampier AMP (10.0%); • Kimberley AMP (10.8%); • Carnarvon Canyon AMP (30.0%); • Shark Bay AMP (45.0%); • Abrolhos AMP (48.3%); • Ningaloo AMP (67.5%); • Argo-Rowley Terrace AMP (85.0%); • Montebello AMP (95.8%); and • Gascoyne AMP (98.3%). There are possible long-term impacts to these areas of regional significance; therefore, the consequence of a LOWC event on AMPs is considered to be '*Major (IV)*'.
State Protected Areas	Conservation values for State protected areas include high marine fauna and flora diversity, including fish and invertebrate assemblages, coastal environments (e.g. mangroves) and benthic coverage (e.g. corals, seagrass etc).	Seven State marine protected areas occur within the area predicted to be exposed to moderate threshold in-water (total submerged oil) hydrocarbons. Contact probabilities range from 0.8% to 43.3%. The consequences of oil to specific receptors within these protected areas have been described above. The consequence to conservation values in these protected marine areas is assessed as *'Critical (V)'* given the predicted recovery of some receptors (e.g. mangroves).
Key Ecological Features	Key Ecological Features (KEFs) are the parts of the marine ecosystem that are important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area. KEFs present within or overlapping the MEZ are listed in **Appendix D**.	The only KEFs where surface oil exposure was predicted at moderate threshold levels are recognised for benthic habitats associated with seafloor features (e.g. Ancient Coastline at 125 m depth contour), and therefore these habitats would not be contacted by surface oil. A number of KEFs were predicted to experience exposure to total submerged oil at moderate thresholds. The KEFs that may be associated or have receptors (e.g. whales) associated with surface water layers (<30 m depth) with the highest contact probabilities (>5%) have a minimum time to contact ranging from 7 to 67.2 days and include: • Seringapatam Reef and Commonwealth waters in the Scott Reef Complex (5.0%); • Perth Canyon and adjacent shelf break and other west coast canyons (19.2%); • Western rock lobster (7.5%);

		• Mermaid Reef and Commonwealth waters surrounding Rowley Shoals (31.7%); • Commonwealth waters adjacent to Ningaloo Reef (67.5%); and • Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula (91.7%). The spatial boundary of an additional seven KEFs (>5% contact probability) also intersect the moderate exposure area (dissolved and total submerged); however, these KEFs are primarily defined by their deeper water and/or seabed geomorphological features, with the potential for increased biological productivity. They are not predicted to be affected by in-water hydrocarbons since exposure to in-water (total submerged) hydrocarbons is restricted to 30 m below the surface. The consequence of a LOWC event on the values of KEFs was assessed as *'Major (IV)'* given that some habitats within KEFs (e.g. corals) may have longer recovery times.
Commercial Fisheries	Exposure to in-water hydrocarbons may result in a reduction in commercially targeted marine species, resulting in impacts to commercial fishing and aquaculture. Actual or potential contamination of seafood can affect commercial fishing and can impact seafood markets long after any actual risk to seafood from a spill has subsided (NOAA, 2002) which can have economic impacts to the industry. Commercial fishing also has the potential to be impacted through exclusion zones associated with the spill, the spill response and subsequent reduction in fishing effort. Fishing areas may be closed for fishing for shorter or longer periods because of the risks of the catch being tainted by oil. Concentrations of petroleum contaminants in fish, crustacean and mollusc tissues could pose a significant potential for adverse human health effects. Davis et al. (2002) report detectable tainting of fish flesh after a 24-hour exposure at crude concentrations of 0.1 ppm, marine fuel oil concentrations of 0.33 ppm and diesel concentrations of 0.25 ppm. The Montara spill (as the most recent [2009] example of a large hydrocarbon spill in Australian waters) occurred over an area fished by the Northern Demersal Scalefish Managed Fishery (with 11 licences held by 7 operators), with goldband snapper, red emperor, saddletail snapper and yellow spotted rock cod being the key species fished (PTTEP, 2013). As a precautionary measure, the WA Department of Fisheries advised the commercial fishing fleet to avoid fishing in oil-affected waters. Testing of fish caught in areas of visible oil slick (November 2009) found that there were no detectable petroleum hydrocarbons in fish muscle samples, suggesting fish were safe for human consumption. In the short-term, fish had metabolised petroleum	Several commercial fisheries may operate within the area potentially exposed in the event of a LOWC (see **Appendix D**), and a temporary fisheries closures may be put in place. Oil may also foul the hulls of fishing vessels and associated equipment, such as nets. A temporary fisheries closure, combined with oil tainting of target species (actual or perceived), may lead to financial losses to fisheries and economic losses for individual licence holders. The fishing areas for most fisheries are larger than the area that may be closed to fishing following a LOWC. Nevertheless, closures and the flow on losses from the lack of income derived from affected fisheries, such as temporarily reduced employment (in fisheries service industries), are considered to potentially have '*Moderate (III)*' consequences.

	hydrocarbons. No consistent effects of exposure on fish health could be detected within two weeks following the end of the well release. Follow up sampling in areas affected by the spill during 2010 and 2011 (PTTEP, 2013) found negligible ongoing environmental impacts from the spill. Since testing began in the month after the Deep Water Horizon blowout in the Gulf of Mexico (2010), levels of oil contamination residue in seafood consistently tested 100 to 1,000 times lower than safety thresholds established by the USA Food and Drug Administration (FDA), and every sample tested was found to be far below the FDA's safety threshold for dispersant compounds (BP, 2015). Several commercial fisheries operate in the MEZ (see **Appendix D**) and overlap the spatial extent of the in-water (total submerged) moderate threshold hydrocarbon exposure predictions.	
Recreation and Tourism (including recreational fisheries)	Tourism and recreation are large contributors to the economy. Potential oil exposure can cause beaches and fishing to be closed to protect the environment and public health. In addition, visible surface hydrocarbons (i.e. a rainbow sheen) have the potential to reduce the visual aesthetic of the area for tourism and discourage recreational activities. Tourism and recreation are also linked to the presence of marine fauna (e.g. whales), and particular habitats and locations. Direct impacts to marine fauna such as whales, birds, and pinnipeds can result in indirect impacts to recreational values. If this occurs, economic losses to marine-based tourism are likely. The extent of these losses would be dependent on the level of impact and time to recovery. Refer also to Sections on fish, birds, pinnipeds, cetaceans and coastal habitats above.	Based on the stochastic modelling results, areas of WA could be at risk of accumulating material volumes of shoreline oil. In addition, a large area (offshore and inshore waters) is predicted to be reached by a surface slick above the visible threshold of 1 g/m^2 (**Figure 8-3**). Some of these areas support locally, regionally and nationally important tourism activities at risk of oiling. A major loss of hydrocarbons from a LOWC may also lead to temporary prohibition on recreational fishing and exclusion of marine nature-based tourist activities, resulting in a loss of revenue for operators. As such, the consequence level for impact on recreation and tourism is assessed as '*Moderate (III)*'. Section 4.3 and Section 4.4 of the Kanga-1 Exploration Well OPEP for a Crude Oil Spill (AU-HSE-KG1-EX-PLN-037) discusses the role of dispersants applied offshore to minimise effects of oiling on nearshore and shoreline environments (see **Appendix F**).
Cultural Heritage	Impacts on and recovery of Aboriginal heritage values are linked to beaches, coastal vegetation and marine life as assessed individually above. Exposure to in-water hydrocarbons may impact on preservation of shipwrecks. Shipwrecks serve as artificial reefs and become hotspots of biodiversity. Marine biofilms on submerged structures support settlement of micro- and macro-biota and may enhance and protect against corrosion (Mugge et al. 2019). Disruption in the local environment, including oil spills, may impact the role biofilms play in reef preservation.	There are Native Title claims over shorelines of WA within the EMBA and within these claims there are sites of cultural significance that may be affected if exposed to shoreline accumulations of oil. Sites of significance are likely to be above the high tide mark; however, impacts from degraded aesthetics of sites along the coast may take time to recover and loss of access to sites during a response will be temporary. Submerged historic shipwrecks are not predicted to be affected by in-water hydrocarbons since exposure to in-

		water (total submerged) hydrocarbons is typically restricted to 30 m below the surface. The consequence level for impact on cultural heritage is assessed as '*Moderate (III)*'.
Industry (Shipping; Oil and Gas)	In the unlikely event of a LOWC, surface hydrocarbons may affect production from existing industrial facilities, including petroleum platforms and FPSOs. Exclusion zones established to manage the spill could also prohibit activity, support vessel access and shipping fairways.	Shipping and industrial (including oil and gas) activities are potentially affected in the event of a worst case LOWC. The impact on operations would be determined by the nature and scale of the spill and metocean conditions, but is likely to be short-term. The consequence level for impact on industry is assessed as '*Moderate (III)*'.

Assessment of Likelihood and Inherent Risk Ranking

The likelihood of an LOWC event occurring during the Activity is extremely low when considering industry statistics and standard preventive control measures in place. Wells are designed with essential engineering and safety control measures to prevent a loss of containment occurring. Blowout and well release frequencies for international exploration drilling has been reported at 1.2 x 10^{-3} to 1.3 x 10^{-4} per well drilled (based on exploration drilling deep, normal oil wells to the North Sea Standard) (IOGP, 2019).

A review of historical loss of well control data from the SINTEF database (Exprosoft 2017) noted that for the period from 1970 to 2015, there have been only 2 blowouts worldwide during exploration (wildcat and appraisal) drilling involving "large" (defined as >500 bbls of oil) spill volumes – the Macondo incident in the US Gulf of Mexico and an incident in Brazil that involved a 3,700 bbl (588 m^3) release of oil. Neither of these incidents are considered to reflect drilling operations of comparable well control and regulatory standards as the Kanga-1 well. There has never been a blow out scenario resulting in the loss of a large volume of liquid hydrocarbons during drilling of an offshore exploration well in Australia.

For large volumes of oil to be released to the environment, there needs to be a LOWC coupled with multiple failures of well containment barriers, followed by failure of the highly effective intervention systems that close the well. For the worst case consequences to occur, response actions would need to be ineffective. Considering the advances in technology and drilling practices, the very low historical probabilities of a blowout and the history within the Australian industry, the likelihood of an uncontrolled blow out during drilling of the Kanga-1 well causing *'Critical (V)'* consequences was assessed as '*Remote (E)*', in line with the SapuraOMV risk matrix. Less severe LOWC incidents may have a higher probability of occurrence, although these would generally be expected to have lower consequences. However, to provide further conservatism to the assessment, a likelihood ranking of '*Unlikely (D)*' has been assigned based on the probability of a LOWC event occurring, rather than the probability of the event occurring and causing the defined consequences.

Therefore, the inherent risk ranking is considered '*Medium (3)*'.

Additional Control Measures Considered (ALARP Evaluation)

Control Measure	Environmental Benefit	Evaluation of Decision	Decision

Dedicated resources (e.g. dedicated spill response facilities on location) in the event of a LOWC to allow rapid response.	The availability of dedicated resources would enable rapid response to a spill incident (on MODU and from sensitive sites/shorelines) that may reduce potential environmental impacts from highly unlikely LOWC event.	Dedicated spill response resources on location deemed grossly disproportionate given extremely low likelihood of LOWC incident and the lack of certainty around which receptors (sites/shorelines) would be affected first in prevailing weather conditions at the time of the LOWC.	**Reject**
A dedicated second MODU on standby throughout the drilling campaign for the purpose of relief well drilling.	The immediate availability of a MODU would potentially reduce the mobilisation time in the event that drilling a relief well was required to regain well control. The extent of benefit would depend on availability of suitable MODUs in the region via an MOU and other restrictions on commencing drilling of relief well, but it is likely to reduce total period/ volume of release.	There will be significant costs associated with maintaining a dedicated MODU on standby and this is considered to be grossly disproportionate to the benefit given the extremely low likelihood that a relief well would be required and that the likely presence of other MODUs in the region means any time benefit may be minimal.	**Reject**
Adjust the Activity schedule to occur entirely outside of sensitive periods (e.g. peak whale shark season).	Reduce risk of impacts from highly unlikely LOWC during environmentally sensitive periods for listed marine fauna.	Cost disproportionate to the environmental benefit. Variation of timing of Activity may not be logistically feasible as Activity is subject to schedule constraints and MODU/vessel availability. Risks are already low with standard controls in place. Significant cost and schedule	**Reject**

		impacts if the Activity avoids specific timeframes. Differences in lifecycle events and peak activity times between species complicates selection of the least sensitive period.	
Casing and wellhead equipment available to expedite relief well.	The availability of contingency well equipment will minimise the response time associated with drilling a relief well.	Investment is considered appropriate for the potential environmental benefit.	**Accept**
Monitor market for installation vessels suitable for capping stack deployment and MODU suitable for relief well drilling.	Benefit for rapid tertiary source control.	Costs associated with monitoring market, but benefit considered to outweigh costs.	**Accept**

ALARP Assessment

Wells are designed with essential engineering and safety controls to prevent a LOWC incident occurring. Industry standard controls to reduce the likelihood and consequences of a LOWC have also been implemented including (but not limited to) procedures such as the WOMP, Safety Case and well management practices, crew training and awareness, and an accepted Kanga-1 Exploration Well OPEP for a Crude Oil Spill (AU-HSE-KG1-EX-PLN-037) that demonstrates capability to respond to a worst case loss of well control incident. Two additional control measures were identified that would offer a net environmental benefit during an unplanned LOWC event. These standard and additional controls are considered to reduce the environmental risks to ALARP.

Based on a LOWC scenario, the consequence for all hydrocarbon exposure as surface, dissolved, total submerged and/or shoreline was assessed as '*Critical (V)*' and the likelihood as '*Unlikely (D)*' with a resultant residual risk ranking of '*Medium (3)*'. SapuraOMV considers that through the selection of appropriate control measures the residual spill risk ranking is ALARP.

Residual Risk Summary

Consequence	Likelihood	Residual risk
Critical (V)	Unlikely (D)	Medium (3)

Demonstration of Acceptability

Are environmental impacts and risks reduced to ALARP, and the residual risk ranking between '*Very Low (1)*' to '*Medium (3)*'?	Yes – risks are reduced to ALARP, and the residual risk ranking is '*Medium (3)*'.
Is the Activity carried out in a manner consistent with the principles of ESD?	Yes – although the event was considered extremely unlikely to occur and there is considerable uncertainty associated with the actual extent of impacts, the development/implementation of measures to prevent environmental degradation has not been postponed and comprehensive management is in place to address a worst case scenario, consistent with the precautionary principle. The level of impact and risk to the environment has been considered with regard to the principles of ESD; and risks and impacts from a worst case LOWC scenario were assessed in detail. All oil spill response activities are implemented with the aim of reducing the overall environmental impact, and the control measures described consider the conservation of biological and ecological diversity, through both the selection of control measures and the management of their performance (see Kanga-1 Exploration Well OPEP for a Crude Oil Spill (AU-HSE-KG1-EX-PLN-037); **Appendix F**).
Are the potential risks and hazards consistent with SapuraOMV's policy and standards?	Yes – aligns with SapuraOMV's HSE Policy and HSEMS.
Have legislative and other requirements been met? Industry codes, standards and guidelines applied?	Yes – the proposed activities align with the requirements of the OPGGS Act 2006: • Schedule 3 Occupational health and safety and OPGGS (Safety) Regulations 2009 (OPGGS(S)R). The OPGGS(S)R requires the operator of each offshore facility to prepare a safety case for submission to NOPSEMA. Activities at a facility must be conducted in accordance with a safety case that has been accepted by NOPSEMA; and • Part 5, OPGGS (Resource Management and Administration) Regulations 2011 which require NOPSEMA to accept a WOMP to enable well activities to be undertaken.

	SapuraOMV has considered the values and sensitivities of the receiving environment, including but not limited to: • Relevant species recovery plans, management plans and conservation advice (see Table 4-3); • NW and SW AMP management plans; and • Marine bioregional plan for the North-West and South-West Marine Regions. SapuraOMV has incorporated good industry practices and standards: • Well control equipment systems managed in accordance with American Petroleum Institute (API) Standard 53; and • The minimum functional and performance requirements and guidelines for well design, planning and execution are compliant with NORSOK D-010 Well integrity in drilling and well operations standard (2013); • Well Containment Plan developed consistent with IOGP 594: Source Control Planning Guide for Subsea Wells (2019).
Have stakeholder expectations been addressed?	Yes – stakeholder expectations have been addressed.

Loss of well control is an inherent, but very low probability hazard associated with all exploration drilling, and there are well established practices and regulation to ensure the risk is reduced to acceptable levels through appropriate engineering and drilling controls. Numerous exploration drilling campaigns have previously been approved on the NWS and elsewhere in Australia, and the proposed Activity does not involve a sensitive location or new or different drilling practices that introduce greater environmental risk. The likelihood of a LOWC event during the Activity is extremely low (remote) when considering industry statistics and the preventative controls in place. Wells are designed with essential engineering and safety control measures to prevent a LOWC incident occurring. Additional control measures to reduce the potential impacts have also been implemented.

In the highly unlikely event of a LOWC, the Kanga-1 Exploration Well OPEP for a Crude Oil Spill (AU-HSE-KG1-EX-PLN-037) (**Appendix F**) will be activated that includes response strategies to minimise and mitigate the potential impacts on oiled wildlife and habitats, and further reduce the likelihood and/ or extent of adverse environmental consequences. Implementation of these measures is prioritised based on the relative sensitivities and conservation significance of

the fauna/habitats involved. While impacts may be widespread in the event of a worst case hydrocarbon spill, subsequent recovery is anticipated to preclude a material threat of irreversible environmental harm or reduction in the quality of the environment available to future generations. The Activity has been evaluated in accordance with SapuraOMV's HSE Policy objectives and SapuraOMV is satisfied that when the proposed control measures are implemented that the residual risk will be ALARP. Stakeholders have been informed of the proposed Activity, and concerns have been addressed (**Section 5)**. On this basis, it is considered that adherence to the performance standards will manage the impacts and risks of a LOWC to an acceptable level.			
Environmental Performance Outcomes, Standards and Measurement Criteria			
Environmental Performance Outcome	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
No loss of hydrocarbons to the marine environment as a result of LOWC.	Well integrity maintained in accordance with NOPSEMA accepted Well Operations Management Plan (WOMP).	NOPSEMA accepted WOMP in place.	SapuraOMV Drilling Manager
	NOPSEMA accepted Safety Case in place for MODU operations.	MODU inspection records.	SapuraOMV Drilling Manager
	Meet API 53 Subsea BOP requirements	MODU design documents and certifications.	SapuraOMV Drilling Manager MODU OIM
	All offshore personnel pass competency assessment as per WEMS	Training records.	SapuraOMV Drilling Manager
	Barrier verification process completed	As per WOMP Well Barrier Verification	SapuraOMV Drilling Manager MODU OIM
	Well Containment Plan consistent with IOGP 594 (2019) and endorsed by WWC in place at least 3 months prior to commencement of the Activity.	Well Containment Plan endorsed by WWC at least 3 months prior to commencement of the Activity.	SapuraOMV Drilling Manager

	WCP details arrangements that ensure source control tasks completed within timeframes in OPEP Figure 3-3, including: • Initiation of emergency BOP intervention by ROV within 7 days of LOWC • SSDI capability available onsite (if required) within 16 days • Mobilisation of debris clearance equipment to site within 21 days • Deployable capping stack (with suitable vessel) available on site within 28 days • Relief well drilled and dynamic kill, within 77 days	WCP demonstrates capability to meet required timelines per OPEP Figure 3-3 for well containment activities.	SapuraOMV Drilling Manager
	BOP routinely function and pressure tested in accordance with drilling contractors PMS.	BOP maintenance records.	MODU OIM
	MODU has current MARPOL-compliant SOPEP/SMPEP (as appropriate to vessel class) and tested in accordance with the training matrix.	MODU inspection records confirm valid SOPEP/SMPEP.	MODU OIM
		MODU inspection records confirm SOPEP/SMPEP tested as per schedule.	MODU OIM
	MODU mooring limited to that specified in the project-specific mooring design analysis and as required to ensure adequate MODU station keeping capacity	Records demonstrate Mooring Design Analysis completed and implemented during anchor deployment.	MODU OIM
	Well Control Bridging document will be in place and available onboard the MODU.	MODU inspection records.	SapuraOMV Drilling Manager
	Casing and wellhead equipment available to expedite relief well.	Contracts in place	SapuraOMV Drilling Manager

	MOU with other operators for equipment access in the event of a loss of well control incident.	MOU database.	SapuraOMV Senior HSE Specialist
	Mutual Aid agreement MoU in place with other operators to allow use of their MODU, where available, for drilling relief well.	Signed APPEA Mutual Aid MoU.	SapuraOMV Drilling Manager
	Regular vessel/MODU availability forecasting is in place at least four months prior to the commencement of the Activity.	Monthly vessel/MODU availability forecasts for Activity period commence at least four months prior to commencement of the Activity.	SapuraOMV Drilling Manager
	In the event that no MoU-MODUs are forecast to be in Australia during Activity, MODU Mobilisation Plan developed at least 3 months prior to the Activity, that: • Identifies suitable alternative MODU(s) • Evaluates reactivation/mobilisation requirements, including tow or heavy lift vessel availability and associated Safety Case and IMS approvals • Demonstrates capability to meet WCP timelines for relief well drilling.	MODU Mobilisation Plan identifies suitable MODU, and associated Safety Case requirements, importation/reactivation requirements and anticipated timelines.	SapuraOMV Drilling Manager
	Operational and scientific monitoring capability shall be maintained in accordance with OSMP.	Internal audits and tests demonstrate preparedness.	SapuraOMV Senior HSE Specialist
	Emergency spill response capability shall be maintained in accordance with the Kanga-1 Exploration Well OPEP for a Crude Oil Spill (AU-HSE-KG1-EX-PLN-037).	Internal audits and tests demonstrate preparedness.	SapuraOMV Senior HSE Specialist
	Market monitored for installation vessels suitable for capping stack deployment.	Vessel broker records.	SapuraOMV Drilling Manager

8.2 Hydrocarbon Spill – Vessel Collision

Activity
The following events were identified as having the potential to result in a hydrocarbon spill from a vessel collision: • Vessel operations – equipment failure, navigational error or poor weather conditions.
Hazard Identification
During the Activity, a hydrocarbon spill of marine gas oil (MGO) or marine diesel oil (MDO) from a ruptured fuel tank could occur in the event of an unplanned collision of the support vessels, or between a support vessel and the MODU or passing third-party vessel. Fuel is typically stored within tanks aft of collision bulkheads on the MODU; the rupturing of these as a result of a supply vessel collision is not considered credible (e.g. slow approach speeds when supply vessel moves alongside the MODU, standard marine communications, typical MODU design) and therefore the credible spill scenarios referred to in this Section are related to the release of MDO from vessel fuel tanks only. Given the water depths (~147 m), the offshore location of the operational area and the lack of emergent features nearby, vessel grounding is not considered a credible risk. While highly unlikely, a vessel collision resulting in a vessel fuel tank rupture is considered a credible scenario due to factors such as human error, poor navigation, vessel equipment failure or poor weather conditions. The maximum credible spill volume was determined based on AMSA's *Technical Guidelines for Preparing Contingency Plans for Marine and Coastal Facilities* (AMSA, 2015). The guidance states that for a vessel other than an oil tanker, the maximum credible spill from a vessel collision can be determined from the volume of the largest single fuel tank. The loss of a full tank is most likely an overestimate as hydrostatic pressure would limit the release and pumping of material to another tank could also restrict the amount lost. In reviewing the general arrangements and fuel tank capacities of typical vessels likely to be utilised for this Activity, a conservative value for the largest single fuel tank capacity was determined to be no greater than 200 m^3. As MDO has greater persistence in the marine environment than MGO, it provides a more conservative indication of the areas that may be exposed to hydrocarbons in the event of such a spill. Therefore, the extent of possible exposure to hydrocarbons is based upon a hypothetical worst case 200 m^3 (Level 2 spill) surface release of MDO. The rate at which MDO could spill to the marine environment is largely dependent upon the position of the fuel tanks and the extent of tank damage. For the purpose of the environmental impact and risk assessment it was assumed that the MDO discharge following a fuel tank rupture will be a rapid discharge over 0.5 hours.
Stochastic Modelling
Oil spill modelling is used to determine the total area that could be exposed to hydrocarbons, including trace concentrations in the water column. Modelling is also used to inform impact assessments by understanding the location and extent of oil at concentrations likely to result in environmental consequences. There is no agreed exposure level below which environmental impacts will not occur so outputs should not be interpreted as a boundary. However, mapping

areas that could be exposed by a spill is a useful tool for impact or consequence assessment. The areas contacted by the moderate threshold values in **Table 4-1** are used to inform the risk assessments in this Section and **Section 8.1**.

Marine Diesel Oil

MDO Characteristics

Diesel oils are generally considered to be readily degraded by naturally occurring microbes. Marine diesel is a medium-grade, moderately-persistent oil (classified as a Group II oil) used in the maritime industry. It is a mixture of volatile and persistent hydrocarbons with low percentages of highly volatile and residual components. When exposed to the atmosphere, around 40% of the mass would be expected to readily evaporate (volatiles and semi-volatiles) (**Table 8-9**). In the marine environment, MDO is expected:

- To spread rapidly in the direction of the prevailing wind and waves;
- To evaporate from the sea surface (~25-50% of the net spill balance); and
- Disperse as oil droplets in the upper layers of the water column and undergo microbial degradation.

Table 8-9 Marine diesel characteristics

Density (kg/m^3)	Volatiles (%) <180°C C4-C10	Semi-volatiles (%) 180-265°C C11-C15	Low volatility (%) 265-380°C C16-C20	Residual (%) >380°C >C20	Aromatics (%) Of whole oil <380°C
	Non-Persistent			Persistent	
836.8 @ 15°C	6	34.6	54.4	<5	3

Prevailing wind speeds can and do influence the weathering and fate of diesel. Due to its chemical composition, a substantive portion (~25-50%) of the MDO spill will generally evaporate between 12 hours and 5 days, depending on prevailing conditions (see modelling results below; GHD, 2020).

Modelling Inputs

Stochastic modelling was performed on a surface release of 200 m^3 of MDO over a 0.5 hour duration with 120 replicate simulations (or realisations) at any time of year staggered over a five-year extent of environmental data to represent the seasonal and inter-annual variability in environmental conditions. Contact thresholds applied for shoreline, surface (floating) hydrocarbons, total submerged oil and dissolved oil are summarised in **Table 4-1** The extent of potential hydrocarbon contact at the moderate (MEZ) and low (EMBA) thresholds is presented in **Figure 8-10**.

Marine Diesel (IKU) was selected from SINTEF's oil library as a suitable analogue to represent MDO for the oil spill modelling. The key parameters and the bulk properties of the MDO analogue (SINTEF's *Marine Diesel IKU*) used for the spill modelling are listed below:

- API gravity: 0.843;
- Pour point: -36 °C;
- Specific gravity: 36.4
- Wax Content: 0.05%
- Viscosity @ 20 °C: 3.9 cP
- Duration of spill: 0.5 hour release;
- Depth of release: surface;
- Water depth at release location: 147 m;
- Volume of hydrocarbon: 200 m^3; and
- Time of year: any month of the year.

Weathering Assessment

Figure 8-9 provides the simulated weathering results (GHD, 2020b) for a MDO spill released instantaneously onto the sea surface under constant 1 m/s (low winds), 5 m/s (moderate winds) and 10 m/s (high winds). With 1 m/s winds, 60% of the surface slick is predicted to remain after 120 hours (5 days). Under moderate winds, 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 have been almost entirely evaporated and dispersed after 12 hours. The hydrocarbon 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.

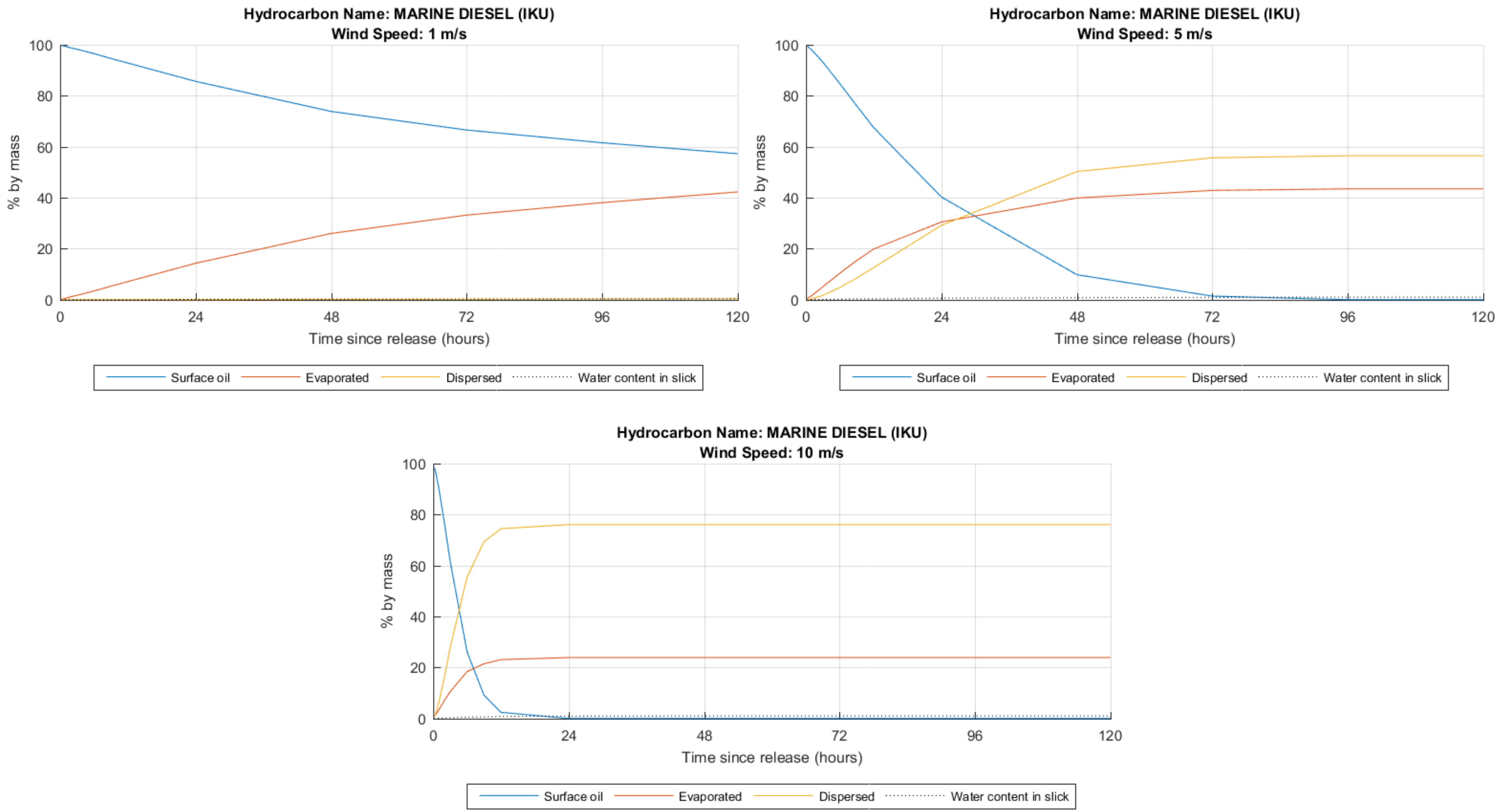


Figure 8-9 Simulated weathering assessment of the SINTEF Marine Diesel (IKU) hydrocarbon for constant wind speeds of 1 m/s (upper left), 5 m/s (upper right) and 10 m/s (bottom)

Stochastic Spill Modelling Results
The oil spill modelling predicted no shoreline accumulation of hydrocarbons above any thresholds under any conditions modelled. **Figure 8-10** shows the extent of potential area of hydrocarbon contact for each of the three oil phases (surface, dissolved, total submerged; note no shoreline accumulation) at the moderate thresholds that define the spatial extent of the MEZ as at least one exceedance for one time step across any of the 120 stochastic simulations. The MEZ is primarily defined by surface oil, though the spatial exent of both the dissolved and total submerged oil components are similar. The low contact thresholds for each of the three oil phases (note no shoreline accumulation) are also illustrated in **Figure 8-10**, which shows that the EMBA is primarily defined by the total submerged oil component. Lastly, the high contact threshold for surface oil and dissolved oil (as described in **Table 4-1**, note no NOPSEMA (2019a) high threshold for entrained [total submerged] oil, and no shoreline accumulation) are illustrated in **Figure 8-4**, which shows these are only exceeded in close proximity to the well location. The oil spill modelling results are described below at the moderate contact threshold values defined in **Table 4-1** for the MEZ, which are adopted to rank the impact (or consequence) of a potential MDO spill. **Figure 8-10** shows the extent of potential hydrocarbon contact at the low (EMBA) and moderate (MEZ) thresholds. **<u>Sea Surface Hydrocarbons above 10 g/m^2 (lower limit for potential ecological impacts)</u>** Surface oil above the MEZ contact threshold (10 g/m^2) was predicted to extend up to ~150 km from the spill location, primarily travelling westerly to southwesterly, northerly and easterly with minimal transport to the south (towards the mainland). No geographic features (i.e. shorelines), State or Australian Marine Parks were predicted to be contacted by floating oil at the MEZ threshold (10 g/m^2). Low to moderate probability (24%) of the spill reaching the KEF of the Ancient coastline at 125 m depth contour (Ancient Coastline) was predicted, though this is recognised for benthic habitats associated with seafloor features that would not be contacted by surface oil. The maximum time-averaged oil concentration at the Ancient Coastline is 296 g/m^2 with a minimum arrival time of 0.1 days (2 hours). A low contact probability of 8% was also predicted at the Continental Slope Demersal Fish Communities (also a seafloor feature) with a maximum time-averaged concentration of 29 g/m^2 and minimum arrival time of 3.2 days. **<u>Total Submerged Oil above 100 ppb (as appropriate given oil characteristics for informing risk evaluation)</u>** Total submerged oil above the MEZ contact threshold (100 ppb) was predicted up to ~130 km from the spill location. At the moderate contact threshold of the MEZ (100 ppb), a moderately low contact probability of 25% was predicted for the Ancient Coastline KEF with a maximum time-averaged concentration of 1,050 ppb and a minimum arrival time of 0.1 days (2 hours). Low contact probabilities were predicted at two other KEFs, namely Continental Slope Demersal Fish Communities (2%) and Glomar Shoals (1%) with maximum time-averaged concentrations of 235 and 110 ppb, respectively, and minimum arrival times of 2.3 and 4.4 days, respectively. These KEFs are recognised for benthic habitats associated with their seafloor features. Exceedances of the MEZ contact threshold occurs in the upper portions of the water column. **<u>Dissolved Oil above 50 ppb (potential sub-lethal toxic effects)</u>**

Dissolved hydrocarbons at the MEZ contact threshold (50 ppb) were predicted up to ~130 km to the southwest and ~80 km to the northeast.

At the moderate contact threshold of the MEZ (50 ppb), moderately low contact probability was predicted at the Ancient Coastline KEF (25%) with a maximum time-averaged concentration of 396 ppb and minimum arrival time of 0.1 days (2 hours). A very low contact probability (2%) was also predicted at the Continental Slope Demersal Fish Communities KEF with a maximum time-averaged concentration of 100 ppb and a minimum arrival time of 2.3 days. These KEFs are recognised for benthic habitats associated with their seafloor features. Exceedances of the MEZ contact threshold occurs in the upper portions of the water column.

Hydrocarbons Ashore above 100 g/m^2 (generally requiring consideration of clean-up effort)

There were no instances of shoreline oiling predicted at any threshold (including that of the 10 g/m^2 for the EMBA 100 g/m^2 for the MEZ) during any of the 120 stochastic realisations.

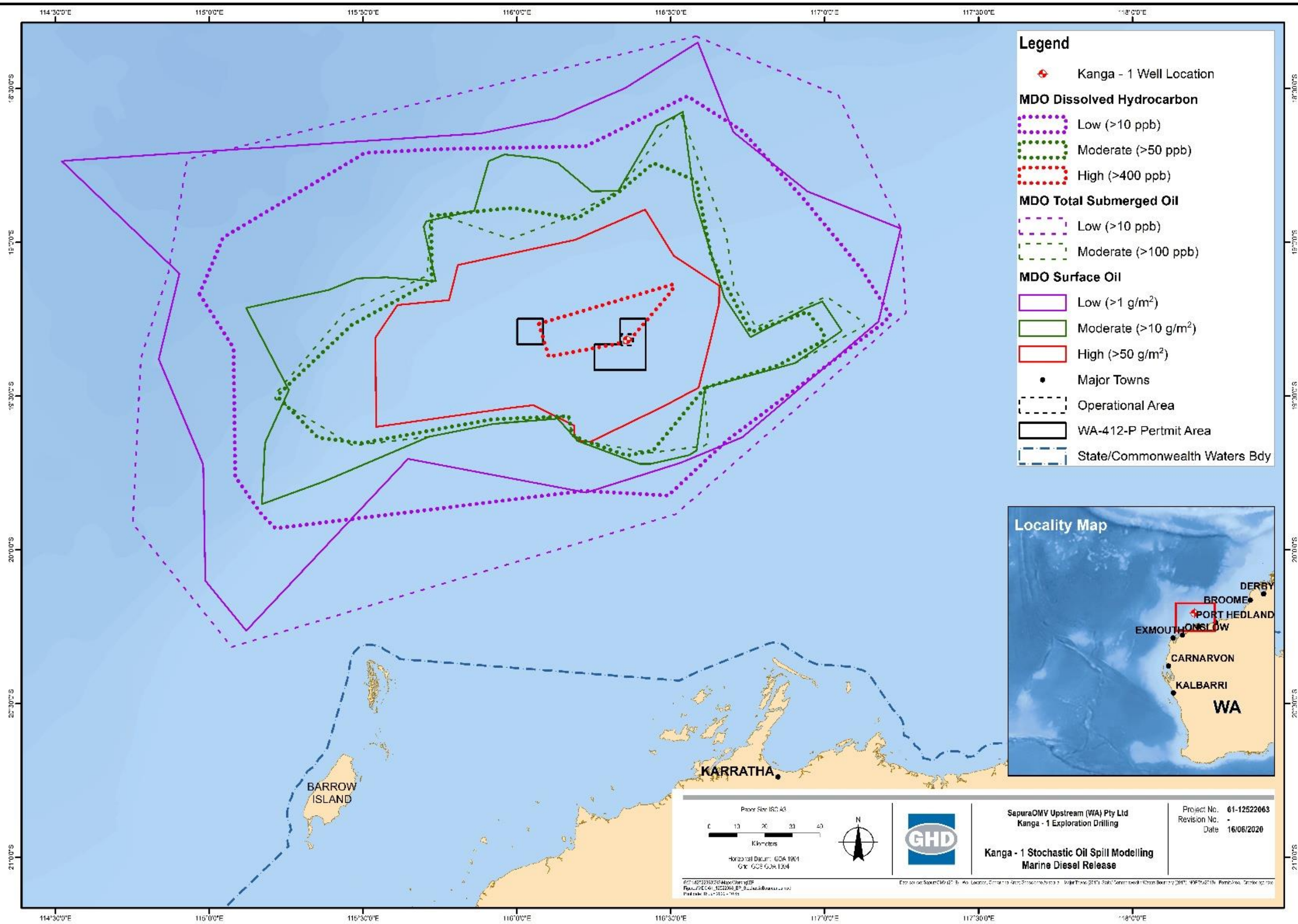


Figure 8-10 Predicted boundaries from MDO stochastic spill modelling of each of the low, moderate and high thresholds for surface, dissolved and total submerged oil

Standard Control Measures			
Control Measure	**Environmental Benefit**	**Evaluation of Decision**	**Decision**
MODU and vessels will be fitted with lights, signals, AIS transponders and navigation and communications equipment, as required by the *Navigation Act 2012*.	MODU and vessel navigational aids and communication equipment will enable other marine users to be aware of their presence and position, and reduces likelihood of a collision.	Benefit outweighs the cost. Control is standard practice.	**Accept**
AHO will be informed of the proposed MODU location prior to the Activity commencing.	Notification to AHO will enable them to generate navigation warnings (i.e. Notice to Mariners).	Benefit outweighs the cost. Control is standard practice.	**Accept**
Notification to AMSA's JRCC.	Notification to AMSA JRCC will enable promulgation of radio-navigation warnings.	Benefit outweighs the cost. Control is standard practice.	**Accept**
Consultation with relevant stakeholders.	Communicating information about the Activity to other marine users ensures they are informed and aware, thereby reducing the likelihood of interference occurring.	Benefit outweighs the cost. Control is standard practice.	**Accept**
MODU will be attended by at least one support vessel, who will monitor the 500 m PSZ around the MODU.	Presence of at least one support vessel increase chances of early detection and warning vessels approaching the exclusion zone and reduces likelihood of a collision with a third party vessel.	Benefit outweighs the cost. Control is standard practice.	**Accept**

Constant bridge watch	Crew will maintain constant bridge watch resulting in early detection of approaching vessels and reducing likelihood of a collision with a third party vessel.	No additional costs. Control is standard practice.	**Accept**
Vessel spill response plans (SOPEP/SMPEP, appropriate to class).	Potential impacts to the environment are reduced through effective management of an accidental spill (discharge to sea).	Personnel cost associated with ongoing management (spill response exercises) and implementation of plans. Benefits of ensuring response plans in place, are followed and implemented outweighs costs.	**Accept**
Kanga-1 Exploration Well OPEP for a MDO Spill (AU-HSE-KG1-EX-PLN-039)	Demonstrates the capability and planned response strategies to spills in the marine environment. May help to reduce the potential impact on the environment.	Under the OPGGS(E)R, NOPSEMA require that the petroleum activity have an accepted OPEP. Benefits of ensuring procedures are developed outweigh administration and preparation costs. Control is a legislated requirement and must be adopted.	**Accept**

Environmental Impact Assessment

An accidental MDO release to the marine environment has the potential to impact:

- Water quality;
- Marine fauna; and
- Socio-economic receptors.

Hydrocarbon spills will cause a decline in water quality and may cause chemical (e.g. toxic) and physical (e.g. oiling of wildlife at sea surface) impacts to marine species. The severity of the impact of a hydrocarbon spill depends on the magnitude of the spill (i.e. extent, duration) and sensitivity of the receptors.

Weathering will also be an important factor in determining impacts on wildlife. Individuals oiled early in a spill may be exposed to the more toxic components of the oil by direct contact and ingestion and suffer greater toxicity than those affected by a more weathered oil. However, the thermoregulatory effects for oiled wildlife would be similar.

A surface release of diesel to the marine environment would result in a localised reduction in water quality in the upper surface waters of the water column near the location of the spill, and waters below 10 m water depth are unlikely to be affected by entrained and dissolved hydrocarbons (NERA, 2018b). Based on modelling predictions, no oil will reach shorelines; however, transient marine fauna traversing the area may be potentially impacted by a spill.

Table 8-10 Exposure and consequence evaluation to ecological receptors within the MDO MEZ

Receptor	Sensitivity	Consequence Evaluation
Plankton	See **Table 8-8** for description.	There is potential for localised mortality of plankton due to reduced water quality and toxicity from dissolved and entrained hydrocarbons. Effects will be greatest in the upper 10 m of the water column and areas close to the spill source where hydrocarbon concentrations are likely to be highest. The actual area affected by any single spill event would be considerably smaller than the area represented by the MDO MEZ or MDO EMBA. But, given the relatively small MDO MEZ and the fast population turnover of open water planktonic populations, it is considered that any potential impacts will be low and temporary in nature. Plankton are numerous and widespread, meaning that an oil spill in any one location is unlikely to have long-lasting impacts on plankton populations at a regional level. Once background water quality conditions have been re-established, the plankton community may take weeks to months to recover (ITOPF, 2011), due to fast population turnover. The potential consequences to plankton are considered to be '*Minor (II)*', as they would be expected to involve short-term and localised impacts.
Sharks, Rays and Fish	See **Table 8-8** for description.	The NWS supports a diverse assemblage of fish, particularly in shallower water near the mainland and islands, which are not present in the MDO MEZ. The EPBC Protected Matters search identified a number of shark, ray and sawfish species that may be present in the MDO MEZ (**Appendix C**). However, given the absence of critical habitat for all of these species, significant numbers are not expected to be impacted. Fish populations are likely to be distributed over a wide geographical area so impacts on populations or species level are considered to be negligible. While a whale shark BIA overlaps the MDO MEZ, it is not for high density foraging where congregations are expected, so impacts would be limited to transient migrating individuals and significant impacts to whale sharks are not expected. Individuals that have direct contact with hydrocarbons within the spill affected area may be impacted, but the consequences to migratory whale shark populations will be '*Minor (II)*'.

		There is the potential for localised and short-term impacts to fish communities and shark populations; the consequences are ranked as '*Minor (II)*'.
Marine Mammals - Cetaceans	See **Table 8-8** for description.	No critical habitats or aggregation areas (feeding, breeding, resting) for cetaceans have been identified within the MDO MEZ or adjacent waters. The MDO MEZ overlaps with the distribution and migration BIA for pygmy blue whales; however, it is expected that their presence will be in low numbers, as individuals transit through the area, with possible higher numbers during peak migration times. There is the potential for volatile hydrocarbons to be inhaled if cetaceans were to surface within a MDO surface slick especially if this occurred close to the spill area where the hydrocarbons would be relatively fresh (i.e. have a greater concentration of volatile MAHs such as benzene, toluene, ethylbenzene and xylene). As the zone of sea surface contact above the 10 g/m^2 ecological impact threshold is relatively small and MDO undergoes rapid dispersion and evaporation, impacts to marine mammals as a result of hydrocarbon exposure are unlikely to lead to long-term consequences to populations, and potential impacts would be limited to individuals transiting the area. The Blue Whale Conservation Management Plan 2015-2025 (DoE, 2015a) assesses exposure to acute chemical discharge, such as from accidental oil or condensate spills from oil rigs and other at sea operations, as a minor consequence, which is defined as individuals are affected but no affect at population level. As such, potential consequences are considered '*Minor (II)*'.
Marine Reptiles	See **Table 8-8** for description.	The MDO MEZ overlaps an internesting buffer for flatback turtles. However, given the internesting buffer is 60 km from the nesting beach, the number of marine turtles that may be exposed to surface diesel is expected to be low. A study that investigated flatback turtle internesting behaviour found that the 30 m depth contour encompassed the vast majority of internesting activities (i.e. resting on the seabed) (Pendoley, 2017). Another study by Whittock et al. (2016) identified suitable internesting habitat for flatbacks to be between 0 and 16 m deep and within 5 to 10 km off the coastline. These studies demonstrate that, while marine turtles may be present in offshore waters during the internesting period, they are typically freely moving through these areas before they return to shallow waters to rest in the days leading up to renesting activity. The Recovery Plan for Marine Turtles in Australia (DoEE, 2017a) highlights acute chemical discharge as one of several threats to marine turtles. Given the small predicted spill area, the weathering characteristics of marine diesel and the mobile nature of turtles, this is unlikely to affect significant numbers, and potential impact would be limited to individuals. Impacts to sea snakes from direct contact with surface hydrocarbons are likely to result in similar physical effects to those recorded for marine turtles. In general, sea snakes frequent the waters of the continental shelf area, around offshore islands and potentially submerged shoals (water depths <100 m) and while individuals may be present in the MDO MEZ, their abundance is not expected to be high, given the deep water and offshore location of the Activity.

		The potential consequence to marine reptiles from an MDO spill is considered to be '*Minor (II)*'.
Seabirds and Shorebirds	See **Table 8-8** for description.	Eleven threatened and/or migratory species, as identified by the EPBC Protected Matters database search, may be present in the MDO MEZ (**Appendix C**). The only BIA identified was the Wedge-tailed shearwater breeding BIA. In the unlikely event of a large diesel spill, there is the potential for seabirds foraging in the MDO MEZ to be exposed to surface, entrained and dissolved hydrocarbons. This could result in lethal or sub-lethal effects. Acute or chronic toxicity impacts (death or long-term poor health) to birds are possible, but unlikely for a diesel spill as the number of birds would be limited due to the small area and brief period of exposure above 10 g/m^2. Therefore, potential impact would be limited to individuals and not at a population level. The potential consequence to seabirds and shorebirds from an MDO spill is considered to be '*Minor (II)*'.
Key Ecological Features	See **Table 8-8** for description.	KEFs overlapping the MDO MEZ include: • Ancient Coastline at 125 m Depth Contour; • Continental Slope Demersal Fish Communities; and • Glomar Shoals. The values and sensitivities of these KEFs are generally related to benthic habitats and communities that support areas of enhanced diversity and productivity. A loss of MDO to the marine environment would result in a localised reduction in water quality in the upper water column and therefore impacts to the habitats of the KEFs are considered unlikely. The consequence of an MDO spill event on the values of KEFs was assessed as '*Negligible (I)*'.
Commercial Fisheries	See **Table 8-8** for description.	One additional Commonwealth-managed fishery to those in the operational area overlaps the MDO MEZ and EMBA: • Northwest Slope Trawl Fishery. One additional State managed fishery to those in the operational area overlaps the MDO MEZ and EMBA: • Nickol Bay Prawn managed Fishery. The relatively small MDO MEZ and temporary nature of the predicted marine diesel spill in the upper layers of the water column would not likely lead to significant exposure of pelagic fish to contamination. Given these pelagic species are distributed over a wide geographical area, the impacts at the population or species level are considered very minor in the unlikely event of a marine diesel spill. However, temporary fisheries closure, combined with oil tainting of target species (actual or perceived), may lead to financial losses to fisheries and economic losses for individual licence holders.

		Fisheries closures and the flow on losses from the lack of income derived from affected fisheries, such as temporarily reduced employment (in fisheries service industries) are considered to have a consequence ranking of '*Moderate (III)*'.
Recreation and Tourism (including recreational fisheries)	See **Table 8-8** for description.	In the waters within the MDO MEZ, tourism and recreational activities are not expected, hence impacts would likely be very low. As such, the consequence level for impact on recreation and tourism is assessed as '*Negligible (I)*'.
Industry (Shipping; Oil and Gas)	See **Table 8-8** for description.	Vessels and other proximal oil and gas operators may be present in the area where MDO surface oil is present; however, the short duration of the surface exposure and associated response activities would unlikely materially reduce access or potentially lead to delays to shipping or work schedules. Deviation of shipping traffic or any material impacts to other oil and gas operators are considered unlikely. The consequence level for impact on industry is assessed as '*Minor (II)'*.

Assessment of Likelihood and Inherent Risk Ranking

For a vessel collision to result in the worst case scenario of a hydrocarbon spill potentially impacting an environmental receptor, several factors must align as follows:

- The vessel interaction must result in a collision;
- The collision must have enough force to penetrate the vessel hull;
- The penetration must be in the exact location of the fuel tank;
- The fuel tank must be full, or at least of volume which is higher than the point of penetration; and
- The full volume of the tank must be released to the marine environment (i.e. no effective source control).

Det Norske Veritas (DNV) (AMSA, 2011) indicates that for the period 1982–2010, there were no spills over one tonne (1 m^3) for offshore vessels caused by collisions. The DNV (AMSA, 2011) report also states that the total oil spill frequency (per ship year) due to ship collision of small vessels (similar to support vessels) is 1.2×10^{-4} (0.00012). The closest shipping fairway is ~48 km to the east. The likelihood of a collision and the loss an entire tank volume of fuel is '*Remote (E)*' given that the incident has occurred rarely in the industry.

The highest consequence ranking above in the impact assessment Section was '*Moderate (III)*' for commercial fisheries which coupled with the '*Remote (E)*' likelihood yields an inherent risk ranking of '*Low (2)*'.

Additional Control Measures Considered (ALARP Evaluation)

Control Measure	Environmental Benefit	Evaluation of Decision	Decision

Adjust the Activity schedule to occur entirely outside of sensitive periods (e.g. whale or whale shark migrations).	Adjusting the Activity schedule to avoid sensitive periods for marine fauna adjacent to the operational area may reduce risk of impacts from exposure to MDO in the event of a vessel collision.	Cost disproportionate to the environmental benefit. Variation of timing of Activity may not be logistically feasible as Activity is subject to schedule constraints and MODU/vessel availability. Risks are already low with standard controls in place. Significant cost and schedule impacts if activities avoid specific timeframes. Differences in lifecycle events and peak activity times between species complicates selection of least sensitive period.	**Reject**
Require all support vessels to be double hulled.	Reduces the likelihood of a loss of MDO in the highly unlikely event of a vessel collision, minimising potential environmental impact.	Vessels are subject to availability and are required to meet SapuraOMV's standards during activities; requirement for a double hull on vessels would limit the number available. Given the low probability of a collision event, the costs are grossly disproportionate to the benefit.	**Reject**
Only MGO or MDO used on support vessels (no heavy fuel oil (HFO) or intermediate fuel oil (IFO)).	In the unlikely occurrence of a vessel collision, MDO is a less persistent hydrocarbon than HFO or IFO. Potential consequences reduced due to increased volatility and smaller area potentially	Provides environmental benefit that is not disproportionate to the cost.	**Accept**

	affected by a less persistent hydrocarbon.		
Support vessels individual tanks will contain no more than 200 m^3 of MDO each at any one time.	Limits the potential extent of impacts in the event of release of entire tank. Reduces response resource requirements to effectively implement measures to reduce impacts in the event of a spill.	Possibly restricts vessel availability and increases costs due to reduced competitive pressures. Additional costs associated with ensuring vessels are compliant. Benefits considered to outweigh the costs.	**Accept**

ALARP Assessment

There are no alternatives to the use of support vessels to undertake the Activity. Vessel activities are well regulated, and control measures implemented across the offshore industry. The probability of the events aligning to result in a breach of vessel fuel tank resulting in a spill that could potentially affect the marine environment is considered '*Remote (E)*'.

The greatest impacts to environmental and socio-economic receptors that could potentially result from a spill of this size would be '*Moderate (III)*' for commercial fisheries. Further opportunities to reduce impacts have been investigated with two additional controls accepted. The residual (and inherent) risk ranking was assessed as '*Low (2)*' and classified as Type A decision. Therefore, SapuraOMV considers the adopted control measures appropriate to manage the risk of an MDO spill from a vessel collision to the marine environment; the impacts and risks are considered to be ALARP.

Residual Risk Summary

Consequence	Likelihood	Residual risk
Moderate (III)	Remote (E)	Low (2)

Demonstration of Acceptability

Are environmental impacts and risks reduced to ALARP, and the residual risk ranking between '*Very Low (1)*' (1) to '*Medium (3)'*?	Yes – risks are reduced to ALARP, and the residual risk ranking is '*Low (2)*'.
Is the Activity carried out in a manner consistent with the principles of ecologically sustainable development (ESD)?	Yes – the Activity was evaluated as having the potential to result in '*Moderate (III)*' consequence and is not considered as

	having the potential to result in serious or irreversible environmental damage. Two additional controls will be implemented to further reduce the risk of impact. Therefore, the Activity does not compromise the relevant principles of ESD.
Are the potential risks and hazards consistent with SapuraOMV's policy and standards?	Yes – aligns with SapuraOMV's HSE Policy and HSEMS.
Have legislative and other requirements been met? Industry codes, standards and guidelines applied?	Yes – management consistent with: • Marine Order 21 (Safety and emergency procedures); • Marine Order 30 (Prevention of collisions); • Marine Order 91 (Marine pollution prevention – oil); and • *Navigation Act 2012* Oil spill impacts are not predicted to: • Impact the recovery of pygmy blue whales as per the Blue Whale Conservation Management Plan 2015 – 2025 (DoE, 2015b); • Impact the recovery of whale sharks as per the Conservation Advice (*Rhincodon typus*) whale shark (TSSC, 2015d); and • Impact the recovery of marine turtles as per the Recovery Plan for Marine Turtles in Australia (DoEE, 2017a). See **Appendix D** for all relevant species conservation management and recovery plans.
Have stakeholder expectations been addressed?	N/A – no concerns raised.

Several conservation management and recovery plans (see **Appendix D**) identify oil or chemical spills as key threatening processes, through both direct/acute impacts, as well as indirect impacts through habitat degradation. The prevention of vessel collision events and reducing impacts to the marine environment through the preventative controls in place and spill response preparedness, demonstrates alignment with the various plans. The proposed spill response strategies, see **Section 8.8** (Spill Response Operations), consider relevant values and include completion of a NEBA (Appendix A in the Kanga-1 Exploration Well OPEP for a MDO Spill (AU-HSE-KG1-EX-PLN-037)) in the event of a spill, which includes the relevant values and receptors present in the area.

Vessel collision is an inherent risk common to all maritime activities; however, vessel activities are well regulated, standard controls well established, and are implemented across the offshore industry. The proposed control measures are considered to be consistent with legislation, standard oilfield practice/ professional judgement and environmental best practice. The Activity has been evaluated in accordance with SapuraOMV's HSE Policy objectives and SapuraOMV is satisfied that with the implementation of industry-standard and activity-specific control measures to reduce the likelihood of a diesel spill event (and minimise impacts), and the residual risk is assessed to be '*Low (2)*'. Stakeholders have been informed of the proposed Activity, and no concerns have been raised (**Section 5)**. On this basis, it is considered that adherence to the performance standards will manage the impacts and risks of an MDO spill to an acceptable level.			
Environmental Performance Outcomes, Standards and Measurement Criteria			
Environmental Performance Outcome	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
No release of hydrocarbons to the marine environment.	The AHO will be notified no less than 4 working weeks before operations commence for the promulgation of related notices to mariners.	Email records confirm AHO notified in the required timeframe prior to commencement of operations.	SapuraOMV Senior HSE Specialist
	Notification will be provided to AMSA JRCC for promulgation of radio-navigation warnings 24-48 hours before operations commence, including following information: • Vessel details, including name, call sign and Maritime Mobile Service Identity (MMSI) ; • Satellite communications details, including INMARSAT-C and satellite telephone; • Area of operation; • Requested clearance from other Vessels; and • Notification of operations start and end.	Consultation records confirm AMSA notified in the required timeframe prior to commencement of operations.	SapuraOMV Senior HSE Specialist
	MODU will be attended by at least one support vessel, who will monitor the 500 m PSZ around the MODU.	Daily drilling reports demonstrate at least one support vessel in	MODU OIM Vessel Masters

		Operational Area to enforce exclusion zone.	
	MODU and vessels will be fitted with lights, signals, AIS transponders and navigation and communications equipment, as required by the *Navigation Act 2012*.	Records (e.g. VSC, OVID/CMID) confirm that required navigation equipment is fitted to MODU and vessels to ensure compliance with the *Navigation Act 2012*.	MODU OIM Vessel Masters
	Consultation ongoing with all relevant persons on an as required basis during the Activity.	Ongoing consultation records maintained in SapuraOMV Stakeholder Database, including assessment of feedback and SapuraOMV response.	SapuraOMV Senior HSE Specialist
	A 24-hour visual, radio and radar watch maintained on MODU and support vessels.	MODU/Vessel Bridge Logbook	MODU OIM Vessel Masters
	Vessels have current MARPOL-compliant SOPEP/SMPEP (as appropriate to vessel class) and tested in accordance with the training matrix.	Vessel inspection records confirm valid SOPEP/SMPEP.	Vessel Masters
		Vessel inspection records confirm SOPEP/SMPEP tested as per schedule.	
	Support vessels only use MDO or MGO.	Bunkering records confirm MDO or MGO used on vessels.	Chief Engineers
	In the event of a hydrocarbon spill to sea, Kanga-1 Exploration Well OPEP for an MDO Spill (AU-HSE-KG1-EX-PLN-039) requirements implemented to mitigate environmental impacts.	Incident report	Incident Commander

8.3 Hydrocarbon Spill – Refuelling Spill

Activity			
The following activities were identified as having the potential to result in a refuelling spill: • MODU bunkering operations.			
Hazard Identification			
Bunkering of MDO between the support vessel(s) and the MODU will occur at the drilling location. There will be no helicopter refuelling on the MODU and no vessel refuelling within the operational area during the Activity. During refuelling operations, MDO may be spilled to the marine environment as a result of: • Partial or total failure of a bulk transfer hose from damage, loss of connection, or leaking flanges, valves or hose connections; and • Tank overfilling. Bunkering would need to be stopped manually. Fuel released prior to the cessation of pumping as well as fuel remaining in the transfer line may escape to the environment. AMSA's *Technical Guidelines for Preparing Contingency Plans for Marine and Coastal Facilities* (AMSA, 2015) provides guidance for calculating a maximum credible spill volume for a refuelling spill, during continuous supervision. This is considered appropriate given refuelling will be constantly supervised. The maximum credible spill volume is calculated as the transfer rate x 15 minutes of flow. The 15 minutes detection time is considered to be conservative, allowing for failure of barriers plus time to initiate isolation of the fuel supply. On the basis of an expected pumping rate of 130 m^3/hour and 15 minutes of flow, this equates to an instantaneous spill of ~32 m^3 (Level 2 spill) and is taken as the worst case credible volume from a MODU refuelling incident. See **Section 8.2** for a description of the characteristics of MDO, including detail on the predicted fate and weathering of a spill to the marine environment.			
Standard Control Measures			
Control Measure	**Environmental Benefit**	**Evaluation of Decision**	**Decision**
Bunkering procedure	Bulk liquid (hydrocarbons) transferred in accordance with bunkering procedure to reduce the risk of an unintentional release to the marine environment.	Cost of maintaining and inspecting equipment (e.g. bulk hoses and connections). Benefits of ensuring procedure in place and followed outweigh costs.	**Accept**

Planned Maintenance System (PMS)	Maintenance of hoses and lifting gear - ensures equipment certified, inspected and replaced if necessary. Minimises risk of leaks occurring during operations.	Standard industry practice, environmental benefit outweighs costs of implementing procedure.	**Accept**
MODU and vessel spill response plans (SOPEP/SMPEP, appropriate to class)	Potential impacts to the environment are reduced through effective management of an accidental spill (discharge to sea).	Personnel cost associated with ongoing management (spill response exercises) and implementation of plans. Benefits of ensuring response plans in place, are followed and implemented outweighs costs.	**Accept**
Secondary containment of bulk liquid transfer points	Containment of hydrocarbons to prevent spills overboard.	Good industry practice that hydrocarbons are adequately contained. Costs outweigh the benefits.	**Accept**
Spill kits and scupper plugs available on board the MODU and support vessels.	Should a spill occur on deck, spill kits and scupper plugs can prevent the spill from entering the marine environment.	Good industry practice. Minimal cost. Benefits outweigh costs.	**Accept**
Kanga-1 Exploration Well OPEP for a MDO Spill (AU-HSE-KG1-EX-PLN-039)	Demonstrates the capability and planned response strategies to spills in the marine environment. May help to reduce the potential impact on the environment.	Under the OPGGS(E)R, NOPSEMA require that the petroleum activity have an accepted OPEP. Benefits of ensuring procedures are developed outweigh administration and preparation costs. Control is a legislated requirement and must be adopted.	**Accept**

Environmental Impact Assessment
A hydrocarbon spill from refuelling has the potential to impact: • Water quality; and • Pelafic marine fauna; and • Plankton. A refuelling spill of up to 32 m^3 of MDO to the marine environment may result in temporary and localised reduction in water quality, restricted to the immediate area close to the source of the spill. MDO has the potential to result in toxicity effects to marine fauna from surface and entrained hydrocarbons, in the immediate vicinity of the spill release location, through direct contact or accidental ingestion. The behaviour, weathering and fates of the spilled MDO are expected to be the similar to those described for a vessel collision (**Section 8.2**), with the majority of the MDO forming a film on the surface and rapidly evaporating and dispersing following release, with a proportion becoming entrained in the upper water column by wind and wave action. Potential impacts are expected to be limited both temporally and spatially due to the expected small volumes spilled and rapid evaporation and dilution of the spill in the offshore marine environment. Potential exposures to spilled surface oil ≥10 g/m^2 is considered representative of potential lethal and sub-lethal impacts to marine fauna such as turtles, cetaceans and birds (NOPSEMA, 2019a). However, surface exposures for such an unplanned event are expected to rapidly fall below the 10 g/m^2 threshold, with the greatest concentrations occurring for a brief period in the immediate vicinity of the spill in the operational area (e.g. a few hours or less than a day). Entrained concentrations are also expected to be low, resulting in limited interactions with small numbers of fish and plankton in the upper water column that are largely incidental in nature. The biological consequences that are predicted to occur as a result of such a small and localised spill, relate to the potential for minor impacts to megafauna, plankton and fish populations (surface and water column biota) that are within the spill affected area, following weathering, dispersion and degradation of the spilled MDO. No impacts to commercial fisheries are expected. Several threatened and/or migratory species under the EPBC Act have the potential to occur within the operational area (**Table 4-2**). Deteriorating water quality and marine pollution are identified as potential threats to a number of marine fauna species in relevant Recovery Plans and Conservation Advice (see **Appendix D**). The operational area overlaps the distribution BIA for pygmy blue whales **(Figure 4-6**) and the foraging BIA for whale sharks (**Figure 4-7**). The Blue Whale Conservation Management Plan 2015-2025 (DoE, 2015a) assesses exposure to acute chemical discharge, such as from accidental oil or condensate spills from oil rigs and other at sea operations, as a minor consequence, which is defined as individuals are affected but no affect at population level. As such, potential impacts are considered '*Minor (II)*'.

The Conservation Advice for whale sharks (*Rhincodon typus*) (TCCS, 2015a) does not identify chemical pollution as a threat to the species. However, given the rapid dilution (and negligible exposure to hydrocarbon concentrations above impact thresholds), acute or chronic effects to MNES (e.g. pygmy blue whales and whale sharks) and transient marine fauna are not expected, although a potential change to fauna behaviour within surface waters affected by the spill, such as avoidance, may occur. Hence, individuals that have direct contact with hydrocarbons within the spill affected area may be impacted, but the consequences to migratory whale shark populations will be '*Minor (II)*'. Direct impacts are limited to planktonic organisms that are unable to avoid or move through the small spill area. In view of the high level of natural mortality and the rapid replacement rate of many plankton species (UNEP, 1985), the potential consequence on planktonic communities is a temporary and localised impact on plankton abundance in the vicinity of source of the spill, with '*Negligible (I)*' ecological significance. No impacts on socio-economic receptors are expected due to the lack of fishing activity in the operational area, the distance from land (closest being Legendre Island at 122.5 km), the small volumes of hydrocarbons that could be accidentally spilled, and the localised and temporary nature of the impacts. Given the adopted controls, it is considered that hydrocarbon spill to the marine environment as a result of refuelling, will not result in a potential impact greater than a localised effect, with no significant impact to environmental receptors or as having the potential to result in serious or irreversible environmental damage with an overall consequence rating of '*Minor (II)*'.
Assessment of Likelihood and Inherent Risk Ranking
The likelihood of a diesel release occurring due to bunkering is '*Possible (C)*' given the set of standard control measures in place. The highest consequence ranking above in the impact assessment Section was '*Minor (II)*' which coupled with the '*Possible (C)*' likelihood yields an inherent risk ranking of '*Low (2)*'.
Additional Control Measures Considered (ALARP Evaluation)

Control Measure	Environmental Benefit	Evaluation of Decision	Decision
No MODU refuelling via hose throughout the Activity.	Eliminating MODU refuelling via hose throughout the Activity would eliminate the risk of a hydrocarbon spill from hose operations.	The MODU requires a constant supply of fuel to be able to operate and complete the Activity as planned. Eliminating refuelling of the MODU via hose would require refuelling of the MODU through the transfer of fuel drums from support vessels or through the storage of	**Reject**

		extensive supplies of fuel on-board the MODU. This is not a feasible option given the limitations of fuel/storage capacity on the MODU, and the additional OHS risks that could result from this. The costs associated with this control are considered grossly disproportionate to the benefit given the risk of a hydrocarbon spill from transferring fuel to the MODU via fuel drums is an additional risk that needs to be considered.	
Use of new hoses for bunkering operations.	May reduce the risk of partial or total hose failure during bunkering operations.	Maintenance of bunkering hoses/equipment in accordance with Contractor's PMS provides assurance of integrity and risk of failure is low. New hoses would pose a disproportionate cost for benefit gained over inspections prior to refuelling (standard practice).	**Reject**

ALARP Assessment

MODU refuelling at sea will be necessary. Offshore refuelling is standard industry practice; and oil pollution legislation, including the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* and Marine Order 91 (Marine pollution prevention – oil), have been developed to safeguard against the risk of an unplanned hydrocarbon spill occurring during refuelling. The activity-specific control measures proposed to reduce the risk of an unplanned hydrocarbon spill occurring during refuelling are compliant with maritime legislation and standards.

Through implementation of the above controls, the consequence of a MDO refuelling spill, resulting in a reduction in water quality and toxicity to marine fauna and fish/plankton assemblages, was evaluated as '*Minor (II)*'. The likelihood of occurrence is considered to be '*Possible (C)*', and the overall inherent and

residual risk is assessed to be '*Low (2)*' and classified as a Type A decision. With no reasonable additional or alternative control measures identified that would offer a net environmental benefit, the impacts and risks are considered ALARP.		
Residual Risk Summary		
Consequence	**Likelihood**	**Residual risk**
Minor (II)	Possible (C)	Low (2)
Demonstration of Acceptability		
Are environmental impacts and risks reduced to ALARP, and the residual risk ranking between '*Very Low (1)*' to '*Medium (3)'*?		Yes – risks are reduced to ALARP, and the residual risk ranking is *Low* (2).
Is the Activity carried out in a manner consistent with the principles of ESD?		Yes – the Activity was evaluated as having the potential to result in minor consequence, and not result in serious or irreversible environmental damage.
Are the potential risks and hazards consistent with SapuraOMV's policy and standards?		Yes – aligns with SapuraOMV's HSE Policy and HSEMS.
Have legislative and other requirements been met? Industry codes, standards and guidelines applied?		Yes – management consistent with Marine Order 91 (Marine pollution prevention – oil) and with relevant species recovery plans, conservation management plans and management actions (**Appendix D**), including but not limited to the: • Blue Whale Conservation Management Plan 2015 – 2025 (DoE, 2015b); and • Conservation Advice (*Rhincodon typus*) whale shark (TSSC, 2015a).
Have stakeholder expectations been addressed?		N/A – no concerns raised.
Loss of hydrocarbons to the marine environment during bunkering has been evaluated as having a '*Low (2)*' risk ranking that is unlikely to result in greater than 'Minor (II)' consequences to megafauna, plankton and fish populations that are within the spill-affected area, and no impacts to commercial fisheries. Relevant conservation management and recovery plans (**Appendix D**) identify oil or chemical spills as key threatening processes, through both direct/acute impacts, as well as indirect impacts through habitat degradation. The prevention of refuelling spills and reducing impacts to the marine environment through the preventative controls and spill response preparedness, demonstrates alignment with these plans. Given the low abundance of MNES expected in the operational area, potential risks are at an individual level rather than regional population or ecosystem level.		

The Activity has been evaluated in accordance with SapuraOMV's HSE Policy objectives and SapuraOMV is satisfied that when the proposed control measures are implemented that the residual risk ranking of a refuelling spill will be *`Low (2)'*. Stakeholders have been informed of the proposed Activity, and no concerns have been raised regarding refuelling activities (**Section 5**). On this basis, it is considered that adherence to the performance standards will manage the impacts and risks of a refuelling spill to an acceptable level.

Environmental Performance Outcomes, Standards and Measurement Criteria

Environmental Performance Outcome	Environmental Performance Standard	Measurement Criteria	Responsibility
No hydrocarbon spills to marine environment during MODU refuelling.	Bulk liquid transfer points will have secondary bunding.	MODU and vessel inspection records confirm that bulk transfer points have secondary bunding.	MODU OIM Vessel Masters
	MODU/vessel will implement procedures to ensure deck drainage systems are in place and maintained (e.g. scupper plugs), to reduce the potential for spills reaching the marine environment.	MODU and vessel inspection records.	MODU OIM Vessel Masters
	MODU and vessels have current MARPOL-compliant SOPEP/SMPEP (as appropriate to vessel class) and tested in accordance with the training matrix.	MODU and vessel inspection records confirm valid SOPEP/SMPEP.	MODU OIM Vessel Masters
		MODU and vessel inspection records confirm SOPEP/SMPEP tested as per schedule.	
	Spill kits available at relevant locations (e.g. near potential spill points) and fully stocked on MODU and vessels.	MODU and vessel inspection records confirm spill kits available and maintained.	MODU OIM Vessel Masters
	Bunkering will be in accordance with MODU and vessel procedure that will include as a minimum:	Maintenance records confirm bulk transfer hoses are certified and maintained according to the PMS	MODU OIM Vessel Masters

	• All transfer hoses in PMS to ensure integrity of hydraulic equipment and verified prior to use. • Refuelling will only be undertaken in suitable weather conditions and sufficient lighting will be provided or bunkering will start during daylight hours (may continue into the night). • Dry-break couplings will be in place and floatation devices on fuel hoses. • Continuous supervision during refuelling with hose watch.	MODU and vessel inspection confirm presence of dry break of couplings and flotation on fuel hoses. Completed and approved PTW and JSA records. Bunkering records.	Chief Engineers

8.4 Minor Hydrocarbon or Chemical Spills

Activity
The following activities were identified as having the potential to result in minor hydrocarbon or chemical spills (Level 1): • MODU and vessel operations; and • ROV operations (if required).
Hazard Identification
The Activity will require the handling, use and storage of chemicals and hydrocarbon materials, which may include, but are not limited to hydraulic fluids, lubricant oils, waste oils, cleaning and cooling agents, and solvents. Unplanned releases may occur from the following: • Mechanical failure of equipment (e.g. cranes and lifting equipment on deck); • Container/ tank/ pipework leak, hose or connection failure or rupture either on deck or from subsea equipment (e.g. ROV, drilling equipment etc.); • Incorrect storage or inadequate bunding of hydrocarbons and chemicals; and • Poor handling or human error (e.g. dropped containers). The MODU and support vessels will contain and store hydrocarbons/chemicals in various volumes. Storage areas are typically set up with effective primary and secondary bunding to contain any deck spills. Releases from equipment are predominantly from the failure of hydraulic hoses, which can either be located within bunded areas or outside of bunded or deck areas (e.g. over water on cranes or subsea during installation activities). The maximum worst case surface spill of hydrocarbons/chemicals is limited to the volume of individual containers, which is unlikely to be greater than 0.21 m^3. Equipment deployed overboard during drilling (e.g. ROV operations) can result in unplanned discharges (of hydraulic fluids) directly to the marine environment due to equipment failure, equipment interactions with the vessel thrusters and/or accidental contact with subsea infrastructure. The largest credible hydrocarbon spill from ROV operations would be an accidental release of approximately 0.03 m^3 (30 L) of hydraulic fluid from the deployed ROV. The duration of a spill may last several minutes for small deck-based spills, or longer for a leak from subsea equipment, based on detection time plus time to initiate isolation of the spill/leak source. The susceptibility of marine fauna to hydrocarbons is dependent on hydrocarbon type and exposure duration; however, given that exposures would be limited in extent and duration, exposure to marine fauna from this hazard is considered to be low. The small volumes of worst case discharges are such that the impacts to receptors will decline rapidly with time and distance at the sea surface. Rapid dilution at depth would also result in the impacts to receptors declining rapidly with time and distance.

For environmental impacts of planned discharges, refer to **Sections 7.6** and **7.7**; and for impacts from dropped objects refer to **Section 8.5**			
Standard Control Measures			
Control Measure	**Environmental Benefit**	**Evaluation of Decision**	**Decision**
Chemical management procedures.	Aids in the process of chemical management to reduce the impact of discharges to sea.	Cost associated with implementation of procedure. Environmental benefit of using lower toxicity chemicals outweigh procedural implementation costs.	**Accept**
MODU and vessel spill response plans (SOPEP/SMPEP, appropriate to class).	Potential impacts to the environment are reduced through effective management of an accidental spill (discharge to sea).	Personnel cost associated with ongoing management (spill response exercises) and implementation of plans. Benefits of ensuring response plans in place, are followed and implemented outweighs costs.	**Accept**
Secondary containment for hazardous materials.	Containment of hydrocarbons and chemicals to prevent spills overboard.	Good industry practice that storage of hydrocarbons and chemicals are adequately contained. Benefits outweigh costs.	**Accept**
Spill kits and scupper plugs available on board the MODU and support vessels.	Should a spill occur on deck, spill kits and scupper plugs can prevent the spill from entering the marine environment.	Good industry practice. Minimal cost. Benefits outweigh costs.	**Accept**
General chemical handling procedures – SDS.	Potential impacts to the environment are reduced through following correct procedures for the	Standard industry practice. Personnel costs associated with ensuring procedures are in place	**Accept**

	safe handling and storage of chemicals.	and implemented. Benefits outweigh the costs of personnel time.	
Planned Maintenance System (PMS).	Maintenance of hoses and lifting gear - ensures equipment certified, inspected and replaced if necessary. Minimises risk of leaks occurring during operations.	Standard industry practice, environmental benefit outweighs costs of implementing procedure.	**Accept**
Lifting management procedures.	Minimise the risk of dropped objects.	Standard industry practice, environmental benefit outweighs costs of implementing procedure.	**Accept**

Environmental Impact Assessment

Minor hydrocarbon or chemical spills have the potential to impact:

- Water quality;
- Pelagic marine fauna; and
- Plankton.

The accidental minor release of hydraulic fluids or chemicals to the marine environment may result in a localised reduction in water quality, restricted to the immediate area close to the source of the spill or leak. Hydraulic fluids or chemicals spilt overboard have the potential to result in toxicity effects to marine fauna in the immediate vicinity of the spill release location, through direct contact or accidental ingestion. However, given the small potential release volumes and rapid dispersion that will occur in the offshore open ocean environment (and negligible exposure to hydrocarbon concentrations above impact thresholds), acute or chronic effects to MNES (e.g. pygmy blue whales and whale sharks) and transient marine fauna are not expected with direct impacts limited to planktonic organisms that are unable to avoid or move through the small spill area. In view of the high level of natural mortality and the rapid replacement rate of many plankton species (UNEP, 1985), the potential consequence on planktonic communities is a localised impact on plankton abundance in the vicinity of source of the spill or leak, with negligible ecological significance. No definitive evidence of long-term effects on marina fauna has been identified (Dicks, 1998).

No impacts on socio-economic receptors are expected due to the lack of fishing activity in the operational area, the small volumes of hydrocarbons/chemicals that could be accidentally spilled, and the localised and temporary nature of the impacts.

Given the adopted controls, it is considered that minor hydrocarbon or chemical spills to the marine environment will not result in a potential impact greater than a localised effect with no significant impact to environmental receptors or as having the potential to result in serious or irreversible environmental damage, and thereby have a consequence ranking of '*Minor (II)*'.

Assessment of Likelihood and Inherent Risk Ranking

The likelihood of minor hydrocarbon or chemical spills is '*Possible (C)*' given the set of standard control measures in place.

The highest consequence ranking above in the impact assessment Section was '*Minor (II)*' which coupled with the '*Possible (C)*' likelihood yields an inherent risk ranking of '*Low (2)*'.

Additional Control Measures Considered (ALARP Evaluation)

Control Measure	Environmental Benefit	Evaluation of Decision	Decision
No hydraulic fluids or chemicals to be used during the Activity	Reduces the potential risk of unplanned surface or subsea releases of hydrocarbons and chemicals to the marine environment.	It is not possible to eliminate chemical and hazardous material inventories. Chemical selection process in place to ensure that chemicals planned to be discharged downhole are evaluated and approved for use. Control measures are in place to reduce risk of unplanned spills.	**Reject**

ALARP Assessment

The transfer, storage and handling of hydrocarbons and chemicals offshore are commonly practised activities. There is a good understanding of potential spill sources, and the control measures required to manage these. The resulting impacts to marine fauna that could potential result from a spill of this size would be minor, with impacts restricted to a small number of individuals within a localised area over a short period of time. The assessed inherent and residual risk ranking for this impact is '*Low*' (2) and classified as a Type A decision. With no reasonable additional or alternative control measures identified that would offer a net environmental benefit, the impacts and risks are considered ALARP.

Residual Risk Summary		
Consequence	**Likelihood**	**Residual risk**
Minor (II)	Possible (C)	Low (2)

Demonstration of Acceptability	
Are environmental impacts and risks reduced to ALARP, and the residual risk ranking between '*Very Low*' (1) to '*Medium*' (3)?	Yes – risks are reduced to ALARP, and the residual risk ranking is *Low* (2).
Is the Activity carried out in a manner consistent with the principles of ESD?	Yes – the Activity was evaluated as having the potential to result in minor consequence, and not result in serious or irreversible environmental damage.
Are the potential risks and hazards consistent with SapuraOMV's policy and standards?	Yes – aligns with SapuraOMV's HSE Policy and HSEMS.
Have legislative and other requirements been met? Industry codes, standards and guidelines applied?	Yes – management consistent with Marine Order 94 (Marine pollution prevention – packaged harmful substances), Marine Order 91 (Marine pollution prevention – oil) and with relevant species recovery plans and conservation management plans (**Appendix D**), including but not limited to the: • Blue Whale Conservation Management Plan 2015 – 2025 (DoE, 2015b); and • Conservation Advice (*Rhincodon typus*) whale shark (TSSC, 2015a).
Have stakeholder expectations been addressed?	N/A – no concerns raised.

Relevant conservation management and recovery plans (**Appendix D**) identify oil or chemical spills as key threatening processes, through both direct/acute impacts, as well as indirect impacts through habitat degradation. The prevention of loss of containment events and reducing impacts to the marine environment through the preventative controls in place and spill response preparedness, demonstrates alignment with the various plans.

The proposed control measures are considered to be consistent with legislation, good oilfield practice/ professional judgement and environmental best practice. The Activity has been evaluated in accordance with SapuraOMV's HSE Policy objectives and SapuraOMV is satisfied that when the proposed control measures are implemented that the residual risk of chemical and small hydrocarbon spills was assessed as `*Low'* (2). Stakeholders have been informed of the proposed Activity, and no concerns have been raised (**Section 5)**. On this basis, it is considered that adherence to the performance standards will manage the impacts and risks of small hydrocarbon or chemical spills to an acceptable level.

Environmental Performance Outcomes, Standards and Measurement Criteria			
Environmental Performance Outcome	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
No unplanned release of chemicals/ hydrocarbons to the marine environment.	Bulk liquid transfer points and equipment located on deck utilising hydraulic fluids (e.g. cranes, winches or other hydraulic equipment) will have primary bunding.	MODU and vessel inspection records confirm that: • Bulk transfer points and equipment located on deck utilising hydraulic fluids have primary bunding or sheathing; and • All storage areas are bunded or secondarily contained.	MODU OIM Vessel Masters
	Hydrocarbon and chemical storage areas are bunded or secondarily contained.		
	MODU/vessel will implement procedures to ensure deck drainage systems are in place and maintained (e.g. scupper plugs), to reduce the potential for deck spills reaching the marine environment.	MODU and vessel inspection records.	MODU OIM Vessel Masters
	MODU and vessels have current MARPOL-compliant SOPEP/ SMPEP (as appropriate to vessel class) and tested in accordance with the training matrix.	MODU and vessel inspection records confirm valid SOPEP/SMPEP.	MODU OIM Vessel Masters
		MODU and vessel inspection records confirm SOPEP/SMPEP tested as per schedule.	
	Spill kits available at relevant locations (e.g. near potential spill points) and fully stocked on MODU and vessels.	MODU and vessel inspection records confirm spill kits available and maintained.	MODU OIM Vessel Masters

		Incident reports record that spill(s) cleaned up using SOPEP/SMPEP resources.	
	Drilling and cementing chemicals are selected in accordance with the Chemical Risk Assessment Procedure (AU-HS-PRO-010-1.0) and will be selected to have the lowest environmental toxicity possible whilst meeting operational performance requirements.	Chemical Risk Assessment Report	SapuraOMV Senior HSE Specialist
	Engines/ machinery/ equipment (including in-water equipment) are certified and maintained in accordance with the Contractor's PMS.	Maintenance records confirm engines/ machinery/ equipment/ critical hoses are certified and maintained according to the PMS.	MODU OIM Vessel Masters Chief Engineers
	Regular inspection/ maintenance of critical hoses (including those for in-water equipment) according to the PMS.		
	Storage, handling and use of hazardous substances (including hydraulic fluids and chemicals) are in accordance with the product's Safety Data Sheet (SDS)	MODU and vessel inspection records confirm SDS for all chemicals available onboard.	MODU OIM Vessel Masters
		Induction records include requirement to follow SDS when storing, handling and clean-up of hazardous chemicals.	SapuraOMV Senior HSE Specialist
	Lifting management procedures for MODU and support vessels.	Records (e.g. PTW, JSA) show all lifts conducted in accordance with lifting management procedures.	MODU OIM Vessel Masters

8.5 Solid Releases (Loss Overboard)

Activity

The following activities were identified as having the potential to result in solid releases overboard:

- MODU and vessel operations.

Hazard Identification

During the Activity, non-hazardous solid materials and wastes stored onboard the MODU and vessels (e.g. paper, plastics and packaging), and hazardous solid wastes (e.g. batteries, fluorescent tubes, medical wastes, and aerosol cans) may be released unintentionally to the marine environment. This may occur due to inappropriate waste storage (e.g. overfull and/ or uncovered bins) resulting in materials being blown overboard or from being dropped accidentally overboard (e.g. as a result of lifting errors, lifting equipment failure, human error, or unsecure and unbalanced loads). Dropped objects or solid releases of significant weight could fall through the water column and settle on the seabed within the operational area. Buoyant material could potentially drift beyond the operational area and may result in injury or entanglement of marine fauna.

Standard Control Measures

Control Measure	Environmental Benefit	Evaluation of Decision	Decision
Compliance with MARPOL 73/78 Annex V and Marine Order 95 (Marine pollution prevention – garbage)	Reduces the likelihood of accidental loss of waste overboard.	Sets out the requirements for garbage management plans and garbage record books. Benefits of ensuring MODU/vessel is compliant outweigh the minimal costs of personnel time and it is a legislated requirement.	**Accept**
Segregation and securing waste.	Correct management of waste and reduction in the likelihood of accidental loss of waste overboard.	Reduces probability of garbage being discharged to sea, reducing potential impacts to marine fauna. Good industry practice.	**Accept**

		Environmental benefit outweighs costs.	
Planned Maintenance System.	Maintenance of lifting gear - ensures lifting equipment certified and inspected. Minimises drop risk during MODU lifting operations.	Standard industry practice, environmental benefit outweighs costs of implementing procedure.	**Accept**
Lifting management procedures.	Minimise the risk of dropped objects.	Standard industry practice, environmental benefit outweighs costs of implementing procedure.	**Accept**
Inductions include requirements for wastes management and training for crew in dropped object prevention.	Minimise risk of losses overboard by making personnel aware of the requirements for dropped objects prevention and waste management during the Activity.	Good industry practice, environmental benefit outweighs costs of implementing procedure.	**Accept**
Attempt recovery of solid wastes overboard, where it is safe and practical to do so.	Reduces the consequence and/or duration of potential adverse effects.	Benefit outweighs cost if recovery is safe and practicable to do.	**Accept**

Environmental Impact Assessment

Dropped objects have the potential to impact:

- Benthic habitats;
- Marine fauna; and
- Water quality.

Accidental loss overboard of solid waste/ materials may impact the environment through localised reduction in water quality, disturbance to benthic habitats, or present a hazard to marine fauna, depending on the waste/ objects involved. Improper or ineffective management of solid wastes may result in pollution and contamination of the environment. Secondary impacts (ingestion and/ or entanglement) to marine fauna that may interact with buoyant waste material such as packaging and binding materials, may occur should these be lost overboard.

Non-hazardous solid wastes such as plastics have the potential to smother benthic environments. Effects will be limited to localised physical disturbance to benthic communities within the operational area. The operational area does not overlap any KEFs, and benthic habitats within the operational area are considered to generally be comprised of unconsolidated soft sediments with relatively little seabed structure (**Section 4.4.5**). This habitat type is widely distributed and well represented in the NWS region. Any impact associated with this risk would be highly localised, proportional to the size of the solid waste, and would be mitigated by ubiquitous distribution of similar habitat in the region. Impacts to benthic communities from dropped object disturbance are expected to be short term in duration due to the ability for such communities to recover.

Release of hazardous solids (e.g. wastes such as batteries) would settle on the seabed if dropped overboard and may result in the pollution of the immediate receiving environment, leading to very localised detrimental health impacts to marine flora and fauna.

Windblown waste is likely to be a rare event as wastes will be stored in closed/covered containers; but in the event of waste being blown overboard attempts would be made to recover it, where it is safe and practical to do so. There is the potential for windblown wastes to not be recovered from the marine environment, which may impact fauna via ingestion or entanglement. Marine turtles and seabirds are particularly at risk from entanglement, with marine turtles often mistaking floating debris for food. Given the Kanga-1 operational area is located approximately 122 km away from the nearest turtle nesting beach (Legendre Island), and the nearest BIA boundary for marine turtles (flatback turtle) is ~46 km to the south-east of the operational area, the presence of turtles in the operational area is considered unlikely, and would only be transitory individuals. The operational area may be occasionally visited by migratory and oceanic birds, but does not contain any emergent land and contains no known BIAs (including feeding), for any species.

Once ingested, debris such as plastics can damage internal tissues and inhibit physiological processes, both of which can potentially result in fatality. Floating non-biodegradable marine debris has been highlighted as a threat to blue whales and whale sharks in relevant Conservation Plans and Approved Conservation Advice (refer to **Appendix D**). These as well as the *Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia's Coasts and Oceans* (DoEE, 2018) have specified a number of management actions to prevent and mitigate the impacts of harmful debris on vertebrate marine life. Of relevance to this Activity is the legislation for the prevention of garbage disposal from vessels, which will be implemented through adherence to MARPOL and relevant Marine Orders.

Given the short-term nature of the Activity (~40 days), and the small volumes of solids expected to be generated during the Activity, it is expected that any effects from inadvertent marine pollution would not have a detrimental effect on any fauna population levels, including pygmy blue whales and whale sharks, suggesting this event could, at worst, result in a limited local degradation of the environment with potential individual effects and is not expected to result in a decrease of the local population size; therefore, the overall consequence was assessed as Negligible (I).

Assessment of Likelihood and Inherent Risk Ranking

The likelihood of a solid releases (loss overboard) resulting in adverse consequences is '*Possible (C)*' given the set of standard control measures in place.

The highest consequence ranking above in the impact assessment Section was '*Negligible (I)*', which coupled with the '*Possible (C)*' likelihood yields an inherent risk ranking of '*Low (2)*'.			
Additional Control Measures Considered (ALARP Evaluation)			
Control Measure	**Environmental Benefit**	**Evaluation of Decision**	**Decision**
None identified.			
ALARP Assessment			
Small amounts of solid non-biodegradable and hazardous wastes will be unavoidably generated during the Activity. The risk assessment and evaluation has identified a range of control measures that when implemented are considered to manage onboard storage of waste generated during the Activity. Waste management measures on the MODU and vessels will minimise the risk of solid waste material being accidentally lost overboard. The use of cranes and other lifting equipment offshore is well practiced and required as part of the Activity. The risk assessment and evaluation has identified a range of standard control measures that minimise the risk of dropped objects. The commitment to recover dropped objects where practicable and safe to do so, ensures impacts and risks are reduced to ALARP. Control measures proposed ensure that the risk of dropped objects, lost equipment or release of non-hydrocarbon solid waste to the environment has been minimised. Given the controls in place, the residual (and inherent) risk of releasing non-hydrocarbon solids to the environment was assessed as '*Low*' (2) and classified as a Type A decision. With no reasonable additional or alternative control measures identified that would offer a net environmental benefit, the impacts and risks are considered ALARP.			

Residual Risk Summary		
Consequence	**Likelihood**	**Residual risk**
Negligible (I)	Possible (C)	Low (2)

Demonstration of Acceptability	
Are environmental impacts and risks reduced to ALARP, and the residual risk ranking between '*Very Low (1)*' to '*Medium (3)*'?	Yes – risks are reduced to ALARP, and the residual risk ranking is '*Low* (2)'.
Is the Activity carried out in a manner consistent with the principles of ESD?	Yes – the Activity was evaluated as having the potential to result in negligible consequence, and not result in serious or irreversible environmental damage.

Are the potential risks and hazards consistent with SapuraOMV's policy and standards?	Yes – aligns with SapuraOMV's HSE Policy and HSEMS.
Have legislative and other requirements been met? Industry codes, standards and guidelines applied?	Yes – management consistent with *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* and relevant requirements under MARPOL Annex V and Marine Order 95 (Marine pollution prevention – garbage). Controls implemented will minimise the potential impacts from the Activity to species identified in recovery plans and approved conservation advices as having the potential to be impacted by solid objects (**Appendix D**). Specific actions that contribute to the long-term prevention of marine debris (*Objective 1* of the Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia's Coasts and Oceans (DoEE, 2018)) have been adopted, including compliance with applicable legislation in relation to the improvement of waste management practices.
Have stakeholder expectations been addressed?	N/A – no concerns raised.

The existing preventative and mitigation measures outlined to prevent accidental release of hazardous and non-hazardous wastes are consistent with, and typical of industry best practice. Procedures for managing waste (i.e. handling, storage, transfer and disposal) meet legislative requirements under MARPOL Annex V and Marine Order 95. The potential impacts and risks are considered broadly acceptable with the adopted controls implemented.

The potential impact associated with this aspect is limited to a localised and likely short-term impact, which is not considered as having the potential to affect biological diversity and ecological integrity and is not considered as having the potential to result in serious or irreversible environmental damage.

The Activity has been evaluated in accordance with SapuraOMV's HSE Policy objectives. Stakeholders have been informed of the proposed Activity, and no concerns have been raised (**Section 5)**. With the adopted control measures, the residual risk associated with solid materials – loss overboard was assessed to be '*Low*' (2). On this basis, it is considered that adherence to the environmental performance standards will manage the impacts and risks to an acceptable level.

Environmental Performance Outcomes, Standards and Measurement Criteria

Environmental Performance Outcome	Environmental Performance Standard	Measurement Criteria	Responsibility

No unplanned solid releases or dropped objects to the marine environment	Compliance with MARPOL 73/78 Annex V, including: • Garbage Management Plan on board; • Records of all waste to be disposed of or recycled; • Placards to notify of disposal requirements.	MODU and vessel inspection records confirm Garbage Management Plan onboard	MODU OIM Vessel Masters
		Garbage Record Book	
		MODU and vessel inspection records confirm placards display disposal requirements.	
	Bins are available for the segregation of waste in accordance with the vessel Waste Management Plan, and bins are fitted with lids/cargo nets for waste with potential to be wind-blown (e.g. paper, cardboard).	MODU and vessel inspection records confirm bins available and suitably covered.	MODU OIM Vessel Masters
	Crew inductions include waste management requirements.	Crew induction records include requirements for waste/garbage management.	SapuraOMV Senior HSE Specialist
	Lifting management procedures for MODU and support vessels.	Records show all lifts conducted in accordance with lifting management procedures.	MODU OIM Vessel Masters
	Lifting equipment is regularly inspected and maintained as per PMS.	PMS records.	MODU OIM Vessel Masters
	Equipment and materials dropped to the marine environment are recovered where safe and practicable to do so.	Daily records show attempts to recover items lost overboard were undertaken where safe and practical to do so and corrective actions identified and undertaken.	MODU OIM Vessel Masters

8.6 Marine Fauna Collision

Activity			
The following activities were identified as having the potential to result in marine fauna collision: • Physical presence and movement of vessels in the operational area.			
Hazard Identification			
Once onsite the MODU will be supported by two, but up to four support vessels at any given time. Vessels will operate 24-hours per day, seven days a week for the duration of the Activity. Support vessels are typically stationary or moving at low speeds (<6 knots) in the operational area when supporting drilling operations, typically involved in resupply between two and four times per week. The support vessels operating in the operational area may present a potential hazard to protected marine fauna, including cetaceans (e.g. pygmy blue whales), whale sharks and marine turtles. Collision (vessel strike) with marine fauna has the potential to result in injury or mortality. Factors contributing to the frequency and severity of effects from collisions vary greatly due to vessel type, vessel operation (specific activity, speed), physical environment (e.g. water depth) and the type of animal potentially present and their behaviours. Helicopters also pose a risk of seabird and shorebird collision. This would affect individuals, but not have population-level effects. Given helicopter activity in the operational area is limited to landing/take off from the MODU and the well location is distant from any areas of importance to seabirds/shorebirds, this is not assessed further.			
Standard Control Measures			
Control Measure	**Environmental Benefit**	**Evaluation of Decision**	**Decision**
Vessels will comply with EPBC Regulations 2000 – Part 8 Division 8.1	Reduces risk of physical and behavioural impacts to cetaceans from vessels because if cetaceans are sighted, then vessels can slow down or move away.	Operational costs to adhere to marine fauna interaction restrictions, such as vessel speed and direction, are based on legislated requirements and must be accepted.	**Accept**

Vessel strikes with cetaceans reported to DAWE and in the National Ship Strike Database at: https://data.marinemammals.gov.au/report/shipstrike	Understanding when, where, how and why vessels collide with cetaceans is important in developing appropriate mitigation to reduce the occurrence of these events.	Negligible cost, control is a requirement.	**Accept**

Environmental Impact Assessment

The physical presence of vessels has the potential to result in:

- Injury or death of marine fauna.

Marine fauna in surface waters that would be most at risk from vessel strike includes marine mammals, whale sharks and turtle species. As summarised in **Section 4.6.1.1**, the operational area overlaps with the pygmy blue whale distribution BIA and the whale shark foraging BIA. However, there are no turtle BIAs within the operational area.

Research shows that vessel speed is a key factor in collisions with marine fauna, with faster vessels having a greater collision risk than slower vessels (Hazel et al. 2009; Laist et al. 2001; Lammers et al. 2003). For example, Laist et al. (2001) suggest that the most severe injuries would occur associated with vessel speeds greater than approximately 14 knots. Vessel speeds of 10 knots or less reduce the risk of vessel strike to low (Laist et al. 2014). The National Strategy for Reducing Vessel Strike on Cetaceans and Other Marine Megafauna 2017 (DoEE, 2017b) identifies that speed is a concern when considering collision risk, and that slower moving vessels provide greater opportunity for both fauna and vessel to avoid collision (DoEE, 2017b).

Cetaceans

Collisions between vessels and cetaceans occur more frequently where high vessel traffic and cetacean habitat overlap (Dolman and Williams-Grey, 2006). The reaction of whales to approaching ships is reported to be quite variable. While factors such as vessel speed are known to affect the incidence and severity of a collision, there is less knowledge on whale behaviour in the presence of vessels (McKenna et al. 2015). Laist et al. (2001) noted that individuals engaged in behaviours such as feeding, mating or nursing may be more vulnerable to vessel collision, when distracted by these activities. A study by McKenna et al. (2015) showed that blue whales demonstrated limited behavioural response when being approached by ships; while some animals responded by undertaking shallow dives at a slow descent, none showed signs of horizontal movement away from the approaching ship.

Blue whales accounted for 2% of documented vessel strikes in Australian waters from 1997 to 2015 (Peel et al. 2016), and since 2006 there have been only two records of likely ship strikes of blue whales in Australia (DoE, 2015b). While the operational area overlaps the distribution BIA for pygmy blue whales, it is not a core habitat or aggregation area and therefore is not considered an 'area of concern' for vessel strikes (DoEE, 2017b). The Blue Whale Conservation Management Plan (DoE, 2015b) highlights that minimising vessel collision is one of the top four priorities and that the risk of vessel strikes on blue whales should be considered when assessing actions that increase vessel traffic in areas where blue whales occur and, if required, appropriate mitigation measures implemented.

Marine Turtles

Turtles transiting the region are at risk from vessel strike when they periodically return to the surface to breathe and rest. However, only a small portion of their time is spent at the surface, as they typically spend more than 90% of their time underwater (Lutcavage and Lutz, 1997; Hochscheid et al. 2010). Turtles appear to be more vulnerable to boat strike in highly populated areas and in areas of marine development (DoEE, 2017a), and the effect of vessel speed can be significant on turtle flee response. A study by Hazel et al. (2007) recorded 60% of green turtles fleeing from vessels travelling at 4 km/h, while only 4% fled from vessels travelling at 19 km/h. The effect of vessel speed and turtle flee response can be significant.

Several marine turtle species may occur within the operational area (see **Table 4-2**); however, no critical habitat or BIAs for turtles have been identified. The closest turtle BIA is an internesting buffer for Flatback turtles (Dampier Archipelago), ~46 km to the south-southeast. Therefore, the number of turtles that might occur in the operational area is low and would only be transitory individuals.

Whale Sharks

Although the whale shark's skin is thicker and tougher than any other shark species, they are known to spend considerable time close to the surface increasing their vulnerability to vessel strike. Whale sharks tagged off Western Australia (Wilson et al. 2006; Gleiss et al. 2013) spent approximately 25% of their time less than two metres from the surface and greater than 40% of their time in the upper 15 m of the water column. Whale sharks migrate large distances and can be found in coastal offshore waters. Spending such considerable time within the 15 m of the surface leaves them vulnerable to collision with smaller vessels (DoEE, 2017b). The Approved Conservation Advice (TSSC, 2015a) notes that the threat to the recovery of the species includes strikes from vessels. Establishing vessel speed restrictions and 'no approach zones', will reduce the threat of vessel collisions.

Summary

The operational area is in an oceanic location that does not contain features that would support aggregations of fauna susceptible to vessel collision, Given the relatively short duration of the drilling activities and the limited extent of the operational area relative to adjacent areas of similar habitat, the number of any species of fauna that might be impacted is low. Nevertheless, turtles may occur and the area overlaps with the pygmy blue whale distribution BIA and the foraging BIA for whale sharks that migrate to and from Ningaloo. Therefore, there is the potential for injury or mortality to individual(s) of these fauna, representing a '*Minor (II)*' consequence at the population level for these mobile and broad-ranging species.

Assessment of Likelihood and Inherent Risk Ranking

It is considered unlikely that support vessel or MODU movements in the operational area will result in any fauna collisions given:

(1) the short duration of the Activity (~40 days);

(2) seasonal and/or transitory presence of susceptible fauna in the operational area;

(3) the low density of transiting individuals;

(4) avoidance behaviour commonly displayed to slow moving vessels by fauna;

(5) low operating speed of the support vessels (typically stationary or moving at low speeds when supporting drilling operations, unless operating in an emergency); and

(6) the implementation of the EPBC Regulations requiring separation distances and speed restrictions to observed cetaceans.

In addition, should a collision occur, low vessel operating speeds would reduce the likelihood of serious injury. Hence, the likelihood of marine fauna collision resulting in injury or mortality to whales is '*Unlikely (D)*' given the set of standard control measures in place. Therefore, the inherent risk is ranked as '*Low (2)*'.

Additional Control Measures Considered (ALARP Evaluation)

Control Measure	Environmental Benefit	Evaluation of Decision	Decision
Dedicated MFO onboard for duration of the Activity.	A dedicated MFO onboard for the duration of the Activity would improve the ability to spot and identify marine fauna at risk of harm from vessel strike.	The cost of a dedicated MFO onboard the vessels is considered grossly disproportionate to environmental benefit, given that the risk of vessel strike is already low. Bridge-watch will be maintained at all times, thereby assisting with the early detection of marine megafauna.	**Reject**
Adjust the Activity schedule to occur entirely outside of sensitive periods (e.g. peak whale shark migration period).	Adjusting the Activity schedule to avoid sensitive periods for marine fauna adjacent to the operational area may reduce the potential for collisions with marine megafauna.	Cost disproportionate to the environmental benefit. Variation of timing of Activity may not be logistically feasible as Activity is subject to schedule constraints and MODU/vessel availability. Risks are already low with standard controls in place.	**Reject**

		Significant cost and schedule impacts if activities avoid specific timeframes. Differences in lifecycle events and peak activity times between species complicates selection of least sensitive period.	
Restrict the Activity to daylight hours only.	Restrict the Activity to only allow daylight operations reduces the potential risk of vessel strike with marine fauna during periods of reduced visibility/ night-time.	Restricting the timing of the Activity to only during daylight hours would substantially lengthen the schedule resulting in increased risks and impacts from planned discharges (air and noise emissions, etc.), interaction with other marine users, etc. Costs associated with this control and subsequent extended schedule are considered grossly disproportionate to the overall environmental benefit.	**Reject**
Vessels will comply with Whale Shark Interaction Guidelines (DPaW, 2013).	Reduces risk of physical and behavioural impacts to whale sharks from vessels because if whale sharks are sighted, then vessels can slow down or move away.	Benefits in reducing impacts to whale sharks outweigh the minor costs incurred.	**Accept**

Vessel speed restrictions – 6 knots within the operational area.	Speed is a concern when considering collision risk and the outcome, and that slower moving vessels provide greater opportunity for both fauna and vessel to avoid collision.	Negligible costs associated with this control measure. Benefit outweighs the cost	**Accept**

ALARP Assessment

There are no alternatives to the use of vessels to undertake the Activity. Furthermore, vessel operations are not considered unusual in this area and the risks of fauna interaction are well understood. The inherent likelihood of encountering fauna in the operational area is limited by the short duration of the Activity and the separation from areas of high fauna density.

The impact and risk assessment and evaluation has identified a range of control measures that when implemented are considered to manage the risk and impact of collision with marine fauna. Further opportunities to reduce impacts have been investigated with two additional controls accepted: compliance with whale shark interaction guidelines and vessel speed restrictions of 6 knots within the operational area. The residual likelihood of a marine fauna collision also reduces with a 6 knot speed limit in the operational area (particularly at night), but not sufficiently to reduce the inherent likelihood from '*Unlikely (D)*'. This is consistent with *Objective 3* of the National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna (DoEE, 2017b).

With the proposed control measures in place, the residual (and inherent) risk of marine fauna collision was assessed as '*Low*' (2), classified as a Type A decision, and cannot be reduced further, and the impacts and risks are considered ALARP.

Residual Risk Summary

Consequence	Likelihood	Residual risk
Minor (II)	Unlikely (D)	Low (2)

Demonstration of Acceptability

Are environmental impacts and risks reduced to ALARP, and the residual risk ranking between '*Very Low (1)*' to '*Medium (3)*'?	Yes – risks are reduced to ALARP, and the residual risk ranking is *Low* (2).
Is the Activity carried out in a manner consistent with the principles of ESD?	Yes – the Activity was evaluated as having the potential to result in minor consequence, and not result in serious or irreversible environmental damage.

<table>
<tr><td colspan="2">Are the potential risks and hazards consistent with SapuraOMV’s policy and standards?</td><td colspan="2">Yes – aligns with SapuraOMV’s HSE Policy and HSEMS.</td></tr>
<tr><td colspan="2">Have legislative and other requirements been met? Industry codes, standards and guidelines applied?</td><td colspan="2">Yes – management consistent with EPBC Regulations 2000 – Part 8 Division 8.1, Whale Shark Interaction Guidelines and the National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna (DoEE, 2017b).

Controls implemented will minimise the potential impacts to species identified in recovery plans and conservation advices (Appendix D). Relevant species recovery plans, conservation management plans and management actions, include but are not limited to the:
Blue Whale Conservation Management Plan 2015 – 2025 (DoE, 2015b); and
Conservation Advice (Rhincodon typus) whale shark (TSSC, 2015a).</td></tr>
<tr><td colspan="2">Have stakeholder expectations been addressed?</td><td colspan="2">N/A – no concerns raised.</td></tr>
<tr><td colspan="4">Vessel movements are an accepted part of recreational and commercial activities in the region, and fauna collision is an inherent and well understood risk. Vessel movements will comply with all relevant maritime standards and regulations, including EPBC regulations and interaction guidelines, to minimise risks to marine fauna. The National Strategy for Reducing Vessel Strike on Cetaceans and Other Marine Megafauna 2017 (DoEE, 2017b) does not make any recommendations with respect to maximum vessel speed, but case studies within the strategy have implemented a 10 knot speed limit in sensitive areas. The impact assessment has determined that given the adopted controls, including restricting vessel speeds to 6 knots within the operational area, vessel collision with marine fauna represents a low risk rating that is unlikely to result in a potential consequence greater than minor.

The Activity has been evaluated in accordance with SapuraOMV’s HSE Policy objectives. Stakeholders have been informed of the proposed Activity, and no concerns have been raised (Section 5). With the adopted control measures, the potential impacts and risks of vessel collision with marine fauna will be managed consistent with relevant Recovery Plans and Approved Conservation Advice, and the residual risk ranking was assessed as ALARP. Therefore, SapuraOMV considers that adherence to the environmental performance standards will manage the impacts and risks to an acceptable level.</td></tr>
<tr><th colspan="4">Environmental Performance Outcomes, Standards and Measurement Criteria</th></tr>
<tr><th>Environmental Performance Outcome</th><th>Environmental Performance Standard</th><th>Measurement Criteria</th><th>Responsibility</th></tr>
</table>

No injury and/ or fatality to marine megafauna caused by vessel collision.	Compliance with EPBC Regulations 2000– Part 8 Division 8.1 Interacting with Cetaceans. • Within Caution Zone, vessels will not drift or approach closer than 100 m for a whale, 50 m for a dolphin known to be in the area; and • Vessels will not change course or speed suddenly and must move at a constant slow speed away from a whale if it approaches the vessel or comes within 150 m, 50 m for a dolphin.	Daily operations reports note when cetaceans were sighted in the caution zone and interaction management actions implemented.	Vessel Masters
	Vessels adopt measures consistent with the DPaW Whale Shark Management Program (2013), including: • Taking action to avoid approaching or drifting closer than 30 m of a whale shark.	Daily operations reports note when whale sharks were sighted in the caution zone and interaction management actions implemented.	Vessel Masters
	Support vessels will travel no faster than 6 knots within the operational area.	Bridge logbook.	Vessel Masters
	Environmental awareness induction provided to MODU and vessel crew, that includes marine fauna interaction requirements.	Induction presentation.	SapuraOMV Senior HSE Specialist
		Induction attendance records.	SapuraOMV Senior HSE Specialist
	All collisions with cetaceans will be reported to DAWE and the National Ship Strike Database.	Communication records confirming ship strikes have been reported to DAWE and the National Ship Strike Database.	Vessel Masters SapuraOMV Senior HSE Specialist

8.7 Introduction of Invasive Marine Species

Activity			
The following activities were identified as having the potential to result in introduction of invasive marine species: • MODU and vessel operations.			
Hazard Identification			
Invasive marine species (IMS) are marine plants, animals and algae that have been introduced into a region that is beyond their natural range, but that have the ability to survive and possibly thrive (DAWE, 2019). Some IMS pose a significant risk to environmental values, biodiversity, ecosystem health, human health, fisheries, aquaculture, shipping, ports and tourism (DAWE, 2019; Wells et al. 2009). IMS can cause a variety of adverse effects in a receiving environment, including: • Over predation of native flora and fauna; • Displacement or outcompeting native marine species; and • Depletion of viable fishing areas and aquaculture stock. Australian waters are subject to the risk of invasion by marine pests from two sources: introduction of species directly from overseas, and translocation from established populations elsewhere in Australia. If managed ineffectively, these pathways pose an unacceptable biosecurity risk to Australia's environment, economy, social and cultural values from the entry, establishment and spread of marine pests and associated diseases.			
Standard Control Measures			
Control Measure	**Environmental Benefit**	**Evaluation of Decision**	**Decision**
Adherence to Marine Order 98: (Marine pollution – antifouling systems) 2013 – anti-fouling system.	Reduces the potential risk of IMS translocated through biofouling.	Operational costs for inspection and certification of anti-fouling systems. Legislated requirement and must be accepted.	**Accept**
All MODU/vessels will comply with the following key requirements of the National Biofouling Management Guidance for the Petroleum Production and	Reduces the risk of introducing IMS through implementation of MODU/vessel assessments and	Costs involved in demonstrating MODU and vessel(s) are of 'low risk' of introducing IMS through completion of risk assessments as	**Accept**

Exploration Industry (Commonwealth of Australia, 2009) of which key requirements are: • Maintenance of a biofouling electronic records outlining marine fouling management actions; • Completion of an IMS risk assessment, which concludes a low risk of IMS presence; and • In-water equipment free of marine fouling prior to the commencement of the Activity.	requirement for immersible equipment to be cleaned.	well as the requirement for equipment to be cleaned could lead to potential delays in Activity schedule should additional cleaning and inspections be required. Good industry practice. Minimal costs to Activity are considered outweighed by the benefits of reducing the risk of IMS.	
The MODU and support vessels will manage their ballast water as specified in the Australian Ballast Water Management Requirements Version 8 (DAWE, 2020f).	Reduces the likelihood of transferring IMS to the operational area.	Minimal cost and controls based on legislative requirements under the *Biosecurity Act 2015*.	**Accept**
All MODU/vessels arriving from international locations will submit a Ballast Water Report.	Reduces the likelihood of transferring IMS to the operational area.	Minimal cost and controls based on legislative requirements under the *Biosecurity Act 2015*.	**Accept**
MODU/vessels will have: • An approved ballast water management plan; • A valid ballast water management certificate; and • A ballast water record system.	Reduces the risk of introducing IMS through procedures managing ballast water exchange.	Minimal cost and controls based on legislative requirements under the Ballast Water Management Convention and Resolution MEPC.127 (53)	**Accept**
Environmental Impact Assessment			
Introduction of IMS during the Activity has the potential to impact: • Ecosystem dynamics; and • Commercial and recreational fishing. All MODU/vessels are subject to some level of marine biofouling. Biofouling of vessels, marine equipment, and structures is recognised as an important vector for introduced pests. Vessels pose a high risk for the spread of IMS, by accumulating on the vessel hull, particularly in areas where organisms can find a			

good attachment surface (e.g. seams, strainers and unpainted surfaces), where turbulence is lowest (e.g. niches, sea chests) and in internal seawater systems. Submersible structures and equipment can also accumulate IMS, particularly after long periods stationary or at low speeds (DAWE, 2019). Commercial vessels typically maintain anti-fouling coatings to reduce the build-up of fouling organisms; but organisms can also be drawn into ballast tanks during onboarding of ballast water required to maintain safe operating conditions.

There is the potential for the MODU and support vessels to transfer IMS from either international waters or Australian waters into the operational area. The MODU and support vessels have the potential to introduce IMS through biofouling (containing IMS) on submersible structures, as well as ballast water exchange.

Unlike many other types of environmental impacts, eradication of IMS populations is difficult, making their prevention or early detection the most important aspects of marine pest management. Theory and experimental trials indicate that removing biological material, via ballast water exchange, ballast water treatment or increasingly stringent hull and niche area cleaning, will reduce inoculation pressure and therefore invasion risk (Bailey, 2015; Molina and Drake, 2016).

Given the deep water, offshore location of the operational area, if an IMS was introduced and colonised the operational area, it is expected that any colony would remain fragmented and isolated and would not be able to propagate to nearshore environments, and protected marine areas present in the wider region. . Therefore, there is the potential for a localised impact to habitat resulting in a '*Moderate (III)*' consequence severity.

Assessment of Likelihood and Inherent Risk Ranking

Potential IMS vary from one region to another depending on various environmental factors such as water temperature, salinity, nutrient levels and habitat type, which dictate their survival and invasive capabilities. Therefore, not all species that are introduced to an area outside of their natural range survive to become an IMS, with the majority of introduced species failing to establish (Williamson and Fitter, 1996).

IMS typically require hard substrate in the photic zone, therefore requiring shallow waters to become established. Highly-disturbed, shallow-water environments such as shallow coastal waters, ports and marinas are more susceptible to IMS colonisation, whereas IMS are generally unable to successfully establish in deep water ecosystems (Geiling, 2014) and open-water environments where the rate of dilution and the degree of dispersal are high (Paulay et al. 2002). Only a few species are known to extend into deeper waters of the continental shelf (Bax et al. 2003). The unconsolidated soft sediment, deep water (~147 m) and offshore location of the operational area is therefore unlikely to represent suitable habitat for the establishment of IMS.

Standard control measure to comply with regulatory requirements for the management of ballast water and ensuring all vessels are assessed as posing a low biofouling risk, in accordance with national guidelines, will significantly reduce the likelihood of translocation of an IMS. It is therefore considered '*Unlikely (D)*' that the Activity would result in the introduction and establishment of an IMS and any subsequent ecological impact.

The consequence ranking above in the impact assessment Section was '*Moderate (III)*', which coupled with the '*Unlikely (D)*' likelihood yields an inherent risk ranking of '*Low (2)*'.

Additional Control Measures Considered (ALARP Evaluation)			
Control Measure	**Environmental Benefit**	**Evaluation of Decision**	**Decision**
No ballasting during the Activity.	Reduces the potential risk of IMS translocated through ballast waters.	Ballast water exchange/discharge may be necessary to ensure safety of the MODU/vessels. With appropriate management in accordance with Australian Ballast Water Management Requirements, the risk of IMS establishment is low.	**Reject**
Only use MODU and vessels that are based in Australian waters and have not been mobilised from international waters.	Reduces the potential risk of IMS translocated from high-risk international waters.	With appropriate management in accordance with prevailing biosecurity requirements and noting the environmental characteristics of the operational area, the likelihood of IMS establishment is low. There could be significant cost and time implications to the Activity by limiting MODU/vessel contracting to those that are stationed and work only in Australian waters.	**Reject**

ALARP Assessment
There are no alternatives to the use of a MODU and support vessels in order to undertake the Activity. The introduction pathways for IMS via ballast water and biofouling are well understood in the marine industry and managed by both national and international regulations and industry guidance. Legislation and guidance are in place to manage this specific risk, which all vessels and MODU are required to comply with prior to entering Australian waters or moving from one jurisdiction to another.

The residual (and inherent) risk was assessed as '*Low*' (2) and classified as a Type A decision. SapuraOMV considers the adopted standard control measures appropriate to manage the risk of introduction of IMS to the marine environment. With no reasonable additional or alternative control measures identified that would further reduce impacts and risks, the impacts and risks are considered to be ALARP.

Residual Risk Summary

Consequence	Likelihood	Residual risk
Moderate (III)	Unlikely (D)	Low (2)

Demonstration of Acceptability

Are environmental impacts and risks reduced to ALARP, and the residual risk ranking between '*Very Low (1)*' to '*Medium (3)*'?	Yes – risks are reduced to ALARP, and the residual risk ranking is *Low* (2).
Is the Activity carried out in a manner consistent with the principles of ESD?	Yes – measures have been adopted even though there is little scientific uncertainty associated with this aspect. The activities are well known, the pathways for introducing IMS are well understood, well regulated, and managed. No additional controls, beyond those identified during the detailed ALARP assessment can reasonably be implemented to further reduce the risk of impact. Therefore, the Activity does not compromise the relevant principles of ESD.
Are the potential risks and hazards consistent with SapuraOMV's policy and standards?	Yes – aligns with SapuraOMV's HSE Policy and HSEMS.
Have legislative and other requirements been met? Industry codes, standards and guidelines applied?	Yes – the following legislative and other requirements are considered relevant: • *Biosecurity Act 2015*; • International Convention for the Control and Management of Ships' Ballast Water and Sediments (IMO, 2004); • 2011 Guidelines For The Control And Management Of Ships' Biofouling To Minimize The Transfer Of Invasive Aquatic Species (IMO, 2011);

	• National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (MPSC, 2018); • Marine Order 98 (Marine pollution prevention – anti-fouling systems) 2013; • Australian Ballast Water Management Requirements Version 8 (DAWE, 2020f); and • Aquatic Resources Management Act 2016.
Have stakeholder expectations been addressed?	N/A – no concerns raised.

IMS is an inherent risk to all vessel activities, but there is little uncertainty associated with the risk of IMS, the cause pathways are well known and are strictly regulated and managed to ensure the risk of introductions is reduced to acceptable levels. The location of the operational area is in a highly dispersive, open ocean environment with no adjacent shallow water environments, indicating that even in the unlikely event of an introduction there is limited potential for pests establishing and flourishing or translocating to another environment. Given the impacts to habitat from the introduction of an IMS would be limited to soft sediment communities (that are not associated with any particular value and sensitivity), and given the widespread homogenous nature of these habitats in the region, this event would not be considered as having the potential to affect biological diversity and ecological integrity.

IMS is identified as a key threat in several conservation management plans, with actions focusing on the prevention of their introduction. The proposed control measures are consistent with these actions.

The operational area is not located within any AMPs. However, the management of the introduction of IMS is in accordance with the requirements of MARPOL, which meets the management prescriptions for AMPs under the North-West Marine Parks Network Management Plan.

Stakeholders have been informed of the proposed Activity, and no concerns have been raised in regards IMS (**Section 5)**. With the vessels and the MODU complying with all legislative obligations and industry practices regarding ballast water and anti-fouling management, the residual risk associated with IMS was assessed as '*Low*' (2). Based on the criteria above, SapuraOMV considers the adopted control measures appropriate to manage the risk of IMS to an acceptable level.

Environmental Performance Outcomes, Standards and Measurement Criteria

Environmental Performance Outcome	Environmental Performance Standard	Measurement Criteria	Responsibility

No introduction of IMS.	MODU and all vessels (of appropriate class) maintain a current anti-fouling coating that complies with the requirements of Annex 1 of the International Convention on the Control of Harmful Anti-Fouling Systems on Ships (2001), the requirements of the *Protection of the Sea (Harmful Antifouling Systems) Act 2006*, and Marine Order 98 (Marine pollution – antifouling systems) 2013.	Audit verifies MODU and support vessels (of appropriate class) have a current International Anti-fouling Systems certificate or a Declaration on Anti-fouling Systems.	MODU OIM Vessel Masters
	Biofouling managed in accordance with requirements of the National Biofouling Management Guidelines for the Petroleum Production and Exploration Industry (MPSC, 2018) including: • Biofouling Record book outlining antifouling management actions consistent with IMO (2011) requirements; • Biofouling risk assessment shows low risk of IMS presence; and • Routine immersible equipment (e.g. ROV) cleaning and maintenance are sufficient to maintain low risk.	Biofouling Record Book	MODU OIM Vessel Masters
		Completed DPIRD Vessel Check report demonstrating MODU and vessels are low risk.	SapuraOMV Senior HSE Specialist
		Completed biofouling risk assessment(s) in accordance with SapuraOMV IMS Management Procedure (AU-HSE-ABU-IN-PRO-014) demonstrating MODU and vessels not entering State waters are low risk.	SapuraOMV Senior HSE Specialist
	MODU and vessel(s) arriving from an international location will obtain clearance from DAWE by submitting a Ballast Water Report through the Maritime Arrivals Reporting System (MARS).	Ballast Water Report	MODU OIM Vessel Masters
	MODU and vessels will have: • A valid Ballast Water Management Plan (BWMP); and	Audit verifies valid BWMP on MODU and vessels.	MODU OIM Vessel Masters

	• A valid Ballast Water Management Certificate (BWMC).	Audit verifies valid BWMC on MODU and vessels.	MODU OIM Vessel Masters
	MODU and vessels will maintain and complete records of all ballast water management in compliance with Regulation B-2 of the Annex to the Ballast Water Convention.	Ballast Water Record System (electronic or hard copy).	MODU OIM Vessel Masters
	MODU and vessels will manage ballast water exchange following approved methods of the Australian Ballast Water Management Requirements (DAWE, 2020f): • An approved ballast water management system (BWMS); or • Use of low risk ballast water, defined as – Fresh potable water; – Water taken up on the high seas (>12 nm from any land mass and >50 m deep); and – Water taken up and discharged in the same place. • Retention of high-risk ballast water; or • Discharge in an approved ballast water reception facility.	Audit verifies valid BWMS Type Approval Certificate available onboard (if applicable) Ballast Water Record System (electronic or hard copy).	MODU OIM Vessel Masters

8.8 Spill Response Operations

Activity

In the event of a hydrocarbon spill, response strategies will be implemented where possible to reduce environmental impacts to ALARP. Applicable response strategies were identified through a preliminary Net Environmental Benefit Analysis (NEBA) process for a LOWC event (**Section 8.1**) in Appendix A of the Kanga-1 Exploration Well OPEP for a Crude Oil Spill (AU-HSE-KG1-EX-PLN-037) and for a level 2 MDO spill (**Section 8.2**) in Appendix A of the Kanga-1 Exploration Well OPEP for a MDO Spill (AU-HSE-KG1-EX-PLN-039). The response strategies and supporting activities deemed potentially appropriate (subject to operational NEBA) for the worst case oil spill scenario identified for the Activity are detailed in Table 1.1 of both OPEPs (**Appendix F**), and comprise:
• For both Level 2 (Vessel Collision in **Section 8.2** and refuelling incident in **Section 8.3**) and Level 3 (LOWC in **Section 8.1**) unplanned events:
  ○ Source control plan;
  ○ Monitor and evaluate (operational monitoring) activities;
  ○ Scientific monitoring; and
  ○ Oiled wildlife response (OWR).
• Additionally for a Level 3 (LOWC in **Section 8.1**) unplanned event
  ○ Surface and subsea dispersant application;
  ○ Mechanical dispersion
  ○ Offshore containment and recovery;
  ○ Shoreline protection and deflection;
  ○ Shoreline clean-up; and
  ○ Waste management.

Hazard Identification
Spill response operations will be undertaken within offshore and nearshore waters using vessels, aircraft, personnel, use of dispersants and/or land-based operations. Depending on the emergency oil spill response strategies implemented, potential impacts may result from one or more of the following: • Interference with other users; • Seabed/ground disturbance; • Light emissions;

• Noise emissions; • Atmospheric emissions; • Operational discharges; • Waste management; • Introduction of invasive species; • Marine fauna interaction; • Marine spills; and • Dispersant toxicity/action.			
Standard Control Measures			
Control Measure	**Environmental Benefit**	**Evaluation of Decision**	**Decision**
Spill response activities selected on basis of operational NEBAs as described in the Kanga-1 Exploration Well OPEP for a Crude Oil Spill (AU-HSE-KG1-EX-PLN-037) and Kanga-1 Exploration Well OPEP for a MDO Spill (AU-HSE-KG1-EX-PLN-039).	Provides a systematic and repeatable process for evaluating strategies with net least environmental impact	Considered a standard spill response control.	**Accept**
Maintain capability of oil spill response strategies as described in Section 6.2 (External Services Contracting Strategy) of the Kanga-1 Exploration Well OPEP for a Crude Oil Spill (AU-HSE-KG1-EX-PLN-037) and Kanga-1 Exploration Well OPEP for a MDO Spill (AU-HSE-KG1-EX-PLN-039).	Maintaining the capability described in the relevant OPEP is key for ensuring that the any oil spill response strategy is implemented effectively and rapidly if utilised.	Considered a standard spill response control.	**Accept**
Spill response activities on shoreline or nearshore areas to consider sensitivity of habitats and fauna usage, and prioritise existing access.	Reduces risk of impacts to shoreline and nearshore habitats.	Considered a standard spill response control.	**Accept**
Establishment of shoreline staging areas in consultation with Control Agency (DoT),	Reduces risk of impacts to shoreline habitats.	Considered a standard spill response control.	**Accept**

Vehicles/plant/equipment undergo inspection and cleaning.	Reduces risk of invasive species introduction.	Considered a standard spill response control.	**Accept**
Spill response personnel inductions.	Reduces risk of inadvertent impacts during spill response operations.	Considered a standard spill response control.	**Accept**
No nighttime operations	Reduces risk of vessel collisions, marine fauna collision and inadvertent oiling of environment.	Considered a standard spill response control.	**Accept**
Shoreline / nearshore assessments	Reduces risk of net environmental impact from response operations.	Considered a standard spill response control.	**Accept**
AMSA maritime notifications	Reduces risk of collision with third party vessels.	Considered a standard spill response control.	**Accept**
SIMOPS Plan	Reduces risk of collision during multiple vessel activities.	Considered a standard spill response control.	**Accept**
Site refuelling procedure for vessels.	Reduces risk of minor hydrocarbon spills.	Considered a standard spill response control.	**Accept**
Vessels will be fitted with lights, signals, AIS transponders and navigation and communications equipment, as required by the *Navigation Act 2012*.	Vessel navigational aids and communication equipment will enable other marine users aware of their presence and position, to reduce the possibility of interaction.	Considered a standard spill response control (regulatory requirement).	**Accept**
Vessels and aircraft will comply with EPBC Regulations 2000 – Part 8 Division 8.1.	Reduces risk of physical and behavioural impacts to cetaceans.	Considered a standard spill response control (regulatory requirement).	**Accept**

Vessels operating in State waters will comply with Biodiversity Conservation Regulations (2018) – Part 5 Division 2 Interaction with Marine Fauna.	Reduces risk of physical and behavioural impacts to marine fauna.	Considered a standard spill response control (regulatory requirement).	**Accept**
Vessels meet applicable MARPOL garbage and putrescible waste disposal requirements.	Reduces potential for water quality impacts.	Considered a standard spill response control (regulatory requirement).	**Accept**
Vessels meet applicable MARPOL sewage disposal requirements as appropriate for vessel class.	Reduces potential for water quality impacts.	Considered a standard spill response control (regulatory requirement).	**Accept**
Vessels meet applicable MARPOL requirements for oily water (bilge) discharges as appropriate for vessel class.	Reduces potential for water quality impacts.	Considered a standard spill response control (regulatory requirement).	**Accept**
Vessels meet Australian Ballast Water Management Requirements.	Reduces risk of IMS.	Considered a standard spill response control (regulatory requirement).	**Accept**
Stakeholder consultation.	Early awareness of spill response activities to reduce potential disruption and ensure that relevant government agencies support the response strategies thus minimising potential impacts and risks to sensitivities.	Considered a standard spill response control.	**Accept**
Environmental Impact Assessment			
Interference with other users			
Spill response activities, including the use of vessels, in the nearshore and offshore marine environment and at shoreline locations, may disrupt other uses of the areas involved. As well as potential direct disturbance to commercial fishing, recreational fishing and/or marine-based tourism, this has the potential to			

affect tourism and/or the local community through demands on local accommodation and businesses and reducing the availability of services. The extent of disturbance relative to the operating areas of other users is likely to be small and temporary, with any disruption minimal compared to the effects of the spill itself. With control measures implemented, the consequence of disturbance to other users is considered to be '*Minor (II)*'.
Seabed/ground disturbance
The use of vessels and booms in nearshore areas has the potential to disturb benthic and/or shoreline habitats including sensitive habitats such as corals, seagrass, macroalgae and mangroves. Unmanaged activities of personnel, equipment and vehicles during shoreline response also has the potential to disturb shoreline habitats, including dune vegetation, samphire and mangroves, and could impact threatened and migratory fauna if they encroach on nests of turtles and birds, and/or bird roosting areas. Shoreline clean-up may involve the physical removal of substrates (e.g. beach sands) that could affect habitat values and alter local erosion/accretion patterns. With control measures implemented, the consequence of seabed/ ground disturbance is considered to be '*Minor (II)*'.
Light emissions
Spill response activities which require lighting may take place in areas important to turtles and birds (i.e. BIAs). Lighting may cause behavioural changes to fish, birds and marine turtles, which can have a heightened consequence during key life-cycle activities, for example turtle nesting and hatchling emergence. The most sensitive receptors to lighting from vessel and shoreline operations are seabirds/shorebirds and marine turtles, including threatened and migratory species. Females can be unsettled by artificial lighting on beaches and prone to abandon nesting attempts, and emerging turtle hatchlings on the beaches are particularly sensitive to light spill. However, sea-based response activities will be restricted to daylight hours and spill response vessels will demobilise after sunset to mooring areas offshore where they will display only navigation/safety lighting. Any temporary camps will be located in consultation with DoT and DBCA and associated lighting requirements will be managed (scale, directionality, colour) to reduce fauna disturbance. With control measures implemented, the consequence of light emissions is considered to be '*Negligible (I)*'.
Noise emissions
Noise emissions generated by vessels and aircraft associated with offshore response activities and mobile equipment and vehicles associated with shoreline response activities have the potential to disturb marine fauna, notably marine mammals through underwater sound and shoreline/ terrestrial species, particularly nesting, roosting and/or feeding birds. Given the activities will be relatively short-term at any location and the response strategies do not involve especially intensive noise sources, with control measures implemented the consequence of noise emissions will be '*Negligible(I)*'.
Atmospheric emissions
The internal combustion engines on vessels, in vehicles and/ or mobile equipment (e.g. generators) used to support response activities will generate atmospheric emissions that have the potential to reduce local air quality and contribute to GHG levels. Given the remote locations where most response activities are likely to be conducted and the localised effects from atmospheric emissions, the consequence of atmospheric emissions will be '*Negligible (I)*'.

Routine discharges
Sewage, grey water and other operational discharges from vessels used in response activities will create a localised and temporary reduction in marine water quality. However, standard maritime regulatory requirements for vessel discharges (e.g. prohibition of discharge close to shorelines, treatment prior to discharge) are considered to reduce any consequences to '*Negligible (I)*'.
Waste management
Waste generated during response activities, particularly oily wastes associated with clean-up activities, has the potential to cause adverse effects to habitats and biota if not appropriately managed. There is also the potential for contamination to be spread if vessels, vehicles and/or equipment are not appropriately cleaned to remove oily wastes when moving from spill impacted areas. All oily wastes will be collected, contained and appropriately disposed of in line with regulations (**Section 8.4**) to ensure potential physical (oiling) or toxic effects are avoided. Decontamination procedures and/or sites will be used during the spill response to ensure wastes from OWR response are collected/contained and the potential for secondary contamination of non-impacted areas is avoided. Sewage, putrescible and general waste generated onshore during response activities will be stored for subsequent disposal at approved locations, and/ or managed in consultation with DoT and DBCA in remote offshore (island) locations. With control measures implemented the consequence level of waste management will be '*Negligible (I)*'.
Invasive marine species
The mobilisation of vessels, vehicles, personnel and equipment into nearshore waters and coastal habitats has the potential for introducing of non-indigenous and potentially invasive species, either as biofouling or in the ballast of vessels, or as seeds/plant propagules or invasive fauna translocated by personnel, equipment or vehicles. All response vessels will be subject to IMS risk assessments (**Section 8.7**) and quarantine and biosecurity requirements, including inductions, pre-cleaning and inspections, will be applied to reduce the risks from onshore operations. The operational NEBA will specifically consider the potential risks from exotic species in the event that activities are required in areas where consequences would be elevated, such as at isolated offshore islands. The consequence of the introduction of invasive marine species is considered to be '*Major (IV)*'.
Marine fauna interaction
Oil spill response has the potential for interactions with marine fauna through: • Vessel movements associated with most response strategies; • Booms (potentially for source control around fuel tank rupture, containment and recovery operations, shoreline protection and deflection response), may create a physical barrier on the surface waters that has the potential to injure or entangle passing marine fauna that are either surface breathing or feeding; or • Unavoidably, during OWR.

OWR may include the hazing, capture, handling, transportation, cleaning and release of wildlife susceptible to oiling such as birds and marine turtles. While OWR is aimed at reducing spill impacts to fauna, if not planned and implemented appropriately it can potentially create additional stress through incorrect cleaning and handling of oiled wildlife and exacerbate impacts by driving more wildlife into oiled areas or interfering with key life-cycle processes (e.g. nesting, internesting). Vessel use during response, particularly in shallow coastal waters, also increases the chance of contact or physical disturbance with marine megafauna such as turtles and dugongs. With control measures implemented, the consequence of interactions with marine fauna from vessels is considered to be '*Minor (II)*'.
Marine spills
Potential impacts from a large spill from a vessel collision during a LOWC spill response (**Section 8.1)**, a refuelling spill (**Section 8.3**) and vessel deck spills (**Section 8.4**) have been described previously. With standard control measures, the consequence of a large level 2 spill from a vessel collision scenario is '*Moderate (III)*'
Dispersant toxicity/action
The removal of surface oil by the application of dispersants reduces the risk of impacts to seabirds, marine mammals and sensitive shoreline receptors (e.g. shorebirds and nesting turtles) and habitats (e.g. mangroves). However, the use of dispersants has the potential to increase the impact to receptors under the sea surface, including coral, seagrass, macroalgae, and fish spawning/nursery areas, increasing the proportion of oil entrained into the water column and through the toxicity of dispersant chemicals. These sensitive receptors are generally located in shallow coastal areas of the mainland and offshore islands. Increased entrained hydrocarbon concentrations may also impact on marine fauna either directly or indirectly through impacts to subsea habitats. Filter feeding invertebrates, fish and sharks are most susceptible to direct impacts. Fish and sharks, including threatened/migratory species, may ingest oil directly or uptake toxic compounds across gill structures. As a result of impacts to marine fauna and subtidal habitats, the values of protected areas, recreation, tourism and commercial fishing activities may also be affected. Dispersant application will only occur following consultation with relevant agencies and where a net environmental benefit is demonstrated, taking account of real-time spill trajectory modelling. Only dispersants of acceptable toxicity that have been approved for use in Australian waters will be used, and operational limitations on application will reduce the potential for effects to sensitive areas. Implementation of these controls is considered to reduce the consequence level to '*Minor (II)*'.
Assessment of Likelihood and Inherent Risk Ranking
The likelihood of a LOWC (**Section 8.1)** or vessel collision (**Section 8.2)** spill that would trigger spill response operations is '*Remote (E)*'. Given the highest consequence ranking above in the impact assessment Section was '*Moderate (III)*' for further marine spills and the introduction of invasive marine species, the likelihood of a large spill yields an inherent risk ranking of '*Low (2)*'.

Additional Control Measures Considered (ALARP Evaluation)			
Control Measure	**Environmental Benefit**	**Evaluation of Decision**	**Decision**
Restrict external lighting to lower intensity and longer wavelength light source.	Long wavelength and low intensity lights reduce potential for impacts on certain sensitive receptors from light emissions.	Vessels will not be conducting response activities at night. Restricted intensity and wavelength lighting on vessels are not standard equipment on vessels operating on the NWS. Hence, there will be additional costs of maintaining suitably equipped (lighting) vessels on standby or delays to allow vessel lights to be refit. This is considered grossly disproportionate to environmental benefit considering the low risk and impact with proposed control measures in place.	**Reject**
No onsite refuelling of vessels.	Avoiding refuelling of vessels onsite would eliminate the potential for minor onsite spills during refuelling of vessels.	It is impractical for small vessels, as it would require offshore vessels to return to port to refuel. This could interrupt, delay and/ or reduce the efficiency of response activities, thereby increasing overall spill risk. The cost is considered grossly disproportionate to environmental benefit considering the low risk	**Reject**

		and impact with proposed control measures in place.	

ALARP Assessment

The risk of a large hydrocarbon release to the marine environment requiring response has been reduced to ALARP (**Sections 8.1** and **8.2**).

A NEBA is the primary tool used during spill response to evaluate appropriate response options with the goal of selecting strategies that result in the greatest net benefit to key environmental sensitivities. In the '*Remote (E)*' likelihood of a Level 2 MDO or Level 3 Crude Oil spill, the NEBA process will be applied to ensure that the implementation of response activities will reduce overall impacts to the environment from the spill and associated response.

A preliminary NEBA has been conducted on the basis of the predicted worst case hydrocarbon spill extent and knowledge of existing sensitive receptors in the MEZ and EMBA, including the values of the Marine Parks potentially affected (Appendix A of both OPEPs for MDO and Crude Oil spills). The most appropriate spill response strategies have been identified based on this assessment. All of the identified response strategies are recognised oil spill response techniques in Australia where a net environmental benefit may result.

The selection of spill response strategies and the implementation of spill response plans in the event of a spill will be performed in collaboration with specialist spill responders and statutory authorities, and through application of operational NEBAs over the duration of the response, as outlined in the OPEPs (**Appendix F**) for the Activity (Kanga-1 Exploration Well OPEP for a Crude Oil Spill (AU-HSE-KG1-EX-PLN-037) and the Kanga-1 Exploration Well OPEP for a MDO Spill (AU-HSE-KG1-EX-PLN-039)). The operational NEBAs will be based on real-time information to ensure that impacts and risks are continually reduced to ALARP during a spill response.

In addition to the control measures identified in this Section, the OPEPs for an MDO and crude oil spill also provide more detailed EPOs and EPSs that are tailored for each response strategy, which have not been reproduced here. There are no reasonably practicable additional or alternative control measures to further reduce potential impacts and risks of emergency response activities on the environment. Given that implementation of response activities cannot be avoided if the potential impacts from a spill are to be minimised, all reasonably practicable controls to reduce impacts of response activities have been identified. With the management proposed to reduce the likelihood of an emergency spill scenario, the application of NEBA and the controls identified above, the assessed residual risk for this impact is '*Low*' (2) and classified as Type A decision. With no reasonable additional or alternative control measures identified that would offer a net environmental benefit, the impacts and risks are considered ALARP.

Residual Risk Summary

Consequence	Likelihood	Residual risk
Major (IV)	Remote (E)	Low (2)

Demonstration of Acceptability	
Are the environmental impacts and risks reduced to ALARP, and the residual risk ranking determined to be '*Very Low (1)*' to '*Medium (3)*'?	Yes – risks are reduced to ALARP, and the residual risk ranking is 'Low' (2).
Is the Activity carried out in a manner consistent with the principles of ESD?	Yes – All oil spill response activities are implemented with the aim of reducing the overall environmental impact, and the control measures described consider the conservation of biological and ecological diversity, through both the selection of control measures and the management of their performance. No additional controls, beyond those identified during the detailed ALARP assessment can reasonably be implemented to further reduce the risk of impact. Therefore, the Activity does not compromise the relevant principles of ESD.
Are the potential risks and hazards consistent with SapuraOMV's policy and standards?	Yes – aligns with SapuraOMV's HSE Policy and HSEMS.
Have legislative and other requirements been met? Industry codes, standards and guidelines applied?	Yes – response has been developed in accordance with: • OPGGSA; • AMSA Technical Guideline for the Preparation of Marine Pollution Contingency Plans for Marine and Coastal Facilities (AMSA, 2015); and • NOPSEMA Guidance Note - Oil Pollution Risk Management (NOPSEMA, 2018).
Have stakeholder expectations been addressed?	N/A – no concerns raised.

All practicable means to prevent a LOWC or vessel collision that would require response actions will be in place prior to and during the drilling activities. Every effort has been made to identify and select suitable spill response options, based on a NEBA evaluation. The spill response options selected are based on hydrocarbon characteristics, and the known sensitivities and values that could be impacted (including Marine Parks), and are consistent with relevant standards and guidelines, including NATPLAN. The selection of spill response strategies and the implementation of spill response plans will be performed through an industry standard process and in collaboration with spill response providers and statutory authorities, as outlined in the OPEPs for the Activity.

The proposed control measures are considered to be consistent with legislation, good oilfield practice, professional judgement and environmental best practice. The residual risk ranking was assessed as '*Low (2)*', and stakeholders have been informed of the proposed Activity, and no concerns have been

raised (**Section 5)**. The Activity has been evaluated in accordance with SapuraOMV's HSE Policy objectives and SapuraOMV is satisfied that with the proposed control measures implemented, the impacts and risks of spill response activities have been reduced to an acceptable level.			
Environmental Performance Outcomes, Standards and Measurement Criteria			
Environmental Performance Outcome	**Environmental Performance Standard**	**Measurement Criteria**	**Responsibility**
Oil spill response undertaken in a manner that will result in net benefit to the marine environment.	Implement selected spill response strategies in accordance with the relevant OPEP for a Crude Oil (AU-HSE-KG1-EX-PLN-037) or MDO (AU-HSE-KG1-EX-PLN-039) spill including EPOs and EPSs.	Incident Management Team (IMT) log. Incident Action Plans (IAPs).	Incident Commander
	SapuraOMV maintains the capability to combat spills as per the external services contracting strategy in Section 6.2 of the relevant OPEP for a crude oil (AU-HSE-KG1-EX-PLN-037) or MDO AU-HSE-KG1-EX-PLN-039) spill.	Contracts/agreements.	SapuraOMV Senior HSE Specialist

	Unless directed otherwise by the Control Agency (DoT), for a LOWC crude oil spill demarcation zones for personnel, equipment and plant/vessel movements will be established on shorelines or nearshore areas to reflect sensitivity of habitats and fauna usage (e.g. bird nesting/breeding/roosting, turtle nesting sites) and prioritise existing access.	IMT log. IAPs.	Incident Commander
	Shoreline staging areas are established in consultation with DoT and DBCA.	IMT log. IAPs.	Incident Commander
	Response vehicles/plant/equipment undergo inspection and cleaning prior to deployment to site.	Daily operations reports.	Incident Commander
	Spill response personnel undergo an induction/briefing prior to mobilisation to site that addresses environmental sensitivities, including biosecurity issues.	Induction records.	Incident Commander
	No onsite nighttime response activities.	Daily operations reports.	Incident Commander
	Assessment of relevant shoreline/ nearshore characteristics (soil/depth profile, habitat values,	IMT log. IAPs.	Incident Commander

	fauna usage) prior to disturbance by on-site response implementation.	Shoreline Assessment Team (SAT) reports.	
	AMSA maritime notifications (e.g. Notice to Mariners) issued to manage collision risks from third party vessels.	IMT log.	Incident Commander
	SIMOPS Plan developed to manage collision risks where IMT requires multiple vessel activities.	IMT Log	Incident Commander
	Compliance with EPBC Regulations 2000– Part 8 Division 8.1 Interacting with Cetaceans. • Within caution zone (300 m either side of the animal), vessels will not drift or approach closer than 100 m for a whale, 50 m for a dolphin known to be in the area; and • Vessels will not change course or speed suddenly, and must move at a constant slow speed away from a whale if it approaches the vessel or comes within 150 m, 50 m for a dolphin. • Helicopters will not fly lower than 1650 ft when within 500 m horizontal distance of a	Daily operations reports note when cetaceans were sighted in the caution zone and interaction management actions implemented.	Vessel Masters Helicopter Pilots Aircraft Pilots

	cetacean except when landing or taking off and will not approach a cetacean from head on. • Must not operate an aircraft (other than a helicopter/gyrocopter) at a height lower than 1,000 ft within a horizontal radius of 300 m of a cetacean. • Must not knowingly allow the aircraft to approach a cetacean from head on.		
	Site refuelling of vessels involved in response activities undertaken in accordance with contractor refuelling procedure.	IMT log. IAPs. Daily operations report.	Vessel Masters
	Vessels adopt measures consistent with Biodiversity Conservation Regulations (2018) - Part 5 Division 2 Interaction with Marine Fauna: • Taking action to avoid approaching or drifting closer than 30 m of a whale shark. • Not exceeding 6 knots within 250 m of a whale shark.	Daily operations reports note when whale sharks were sighted in the caution zone and interaction management actions implemented.	Vessel Masters
	All vessels involved in oil spill response activities will manage sewage in accordance with	Vessel logs demonstrate that all sewage discharges are compliant	Chief Engineers

	MARPOL Annex IV and AMSA Marine Order 96 (as appropriate to vessel class).	with MARPOL Annex IV and AMSA Marine Order 96.	
	All vessels involved in oil spill response activities will manage garbage and putrescible wastes in accordance with MARPOL Annex V and AMSA Marine Order 95.	Garbage Record Book.	Vessel Masters
	All vessels involved in oil spill response activities will manage deck drainage and bilge in accordance with MARPOL Annex I and AMSA Marine Order 91 (as appropriate to vessel class).	Oil Record Book.	Chief Engineers
	All vessels involved in oil spill response activities will manage ballast water exchange following approved methods of the Australian Ballast Water Management Requirements (DAWE, 2020f)	Ballast Water Record System (electronic or hard copy).	Vessel Masters
	All vessels involved in oil spill response activities will be fitted with lights, signals, standard navigation and communications equipment, as required by the *Navigation Act 2012*.	Pre-mobilisation inspection confirms that required navigation equipment is fitted to response vessel to ensure compliance with the *Navigation Act 2012*.	Vessel Masters

	Consultation with relevant government agencies and stakeholders.	Consultation/IMT records.	SapuraOMV Senior HSE Specialist

8.9 MODU Loss of Station

Planned Activity			
The following activities were identified as having the potential for MODU loss of station: • MODU operations.			
Hazard Identification			
As described in **Section 3.2.2**, the MODU will be secured to the seabed through a series of anchors, anchor chains and anchor wires. During the Activity, the MODU will maintain station via a mooring system, which involves monitoring position and using onboard winches to adjust tension on each of the anchor chain/wire legs as required in response to loads and/or position changes. In the event of mooring system failure, the MODU may be unable to maintain station and could drag its anchors and drift under the influence of metocean conditions. Mooring failure is most likely to occur during cyclonic conditions, when the MODU may be de-manned and the mooring system subject to extreme wave and wind forces. Anchors and/or associated anchor lines will disturb the seabed as they are dragged by the MODU with the extent of disturbance dependent on the distance over which the MODU moves and the extent of physical contact (eg number of anchors remaining attached to the MODU). If there is offshore infrastructure in the path of the drifting MODU, such as operating pipelines or platforms, it may be damaged through contact, potentially resulting in a release of production fluids.			
Standard Control Measures			
Control Measure	**Environmental Benefit**	**Evaluation of Decision**	**Decision**
Project-specific Mooring Design Analysis.	Ensure adequate MODU station holding capacity to prevent loss of station.	Benefits considered to outweigh the negligible costs.	**Accept**
MODU onboard positioning system	Provides for position to be monitored and mooring line tension adjustments made to reduce risk of losing station.	Benefit outweighs the cost.	**Accept**

MODU machinery and equipment maintained in accordance with planned maintenance system (PMS).	Reduces risk of mooring component failure causing loss of MODU station keeping capacity.	Benefit outweighs the cost.	**Accept**
NOPSEMA accepted MODU Safety Case.	Reduces the likelihood of loss of station by implementing controls for safe operation of the Facility and demonstrating that the Major Accident Event (MAE) risk from loss of station is being managed to ALARP. The MODU Safety Case: • Identifies the hazards and risks; • Describes how the risks are controlled; and • Describes the safety management system in place to ensure the controls are effectively and consistently applied.	Benefit outweighs the cost. Regulatory requirement.	**Accept**
Daily monitoring of metocean conditions via location-specific BOM forecasts	Provides for mooring to be adjusted to address expected conditions, including early warning of pending cyclones.	Benefit outweighs the cost.	**Accept**

Environmental Impact Assessment

Seabed disturbance as a result of the MODU losing station has the potential to impact:

- Benthic habitats and fauna.

If the MODU and/or its anchors damage operating petroleum infrastructure resulting in a loss of integrity, the release of hydrocarbons has the potential to impact:

- Water and sediment quality;
- Marine and intertidal (shoreline) flora and fauna;

- Protected and significant areas; and
- Socio-economic receptors.

MODU anchor drag is likely to result in depressions ('scars') on the seabed and/or scouring from anchor lines, causing direct and indirect impacts to associated benthic communities and habitats. This may result in direct mortality of benthic fauna within the footprint of the anchor and chain. The benthic substrate within the operational area is expected to be made up of unconsolidated soft sediment, predominantly mud and calcareous substrates and be featureless with no known sensitive seabed features (**Section 4.4.5**). Depressions in this substrate will remain viable habitat that would be expected to recolonise with benthic species within weeks to months following removal of the disturbance (Currie and Isaacs, 2005) and gradually infill following retrieval of the equipment through deposition of detrital matter and movement of sediments by water currents. Whether the disturbance involves other habitat types will depend on the distance the MODU moves from its moored position. Previous instances of MODU losing station during cyclonic conditions on the NWS have involved the MODU drifting approximately 6 km (NOPSEMA 2020). The nearest seafloor KEF (Ancient Coastline at 125 m depth contour) is located ~2.6 km south of the operational area at its closest point. Although there is uncertainty as to the extent of impacts to benthic habitats and the possibility of impacts to this KEF, credible disturbance would involve only a relatively small proportion of the habitat/KEF distribution with subsequent recovery expected. Therefore, the potential worst case consequences of disturbance are considered to be '*Moderate (III)*'.

The nearest petroleum production infrastructure is the Angel gas platform and export pipeline, located approximately 26 km south of the Kanga-1 drilling location at its nearest. The operating EP for this facility (Woodside 2018) indicates that a worst case release of hydrocarbons due to loss of integrity in this pipeline could potentially have major, long term environmental impacts. Therefore, the potential consequences from the damage that contact from a drifting MODU might credibly cause is considered *'Major (IV)'* in the SapuraOMV risk matrix.

Assessment of Likelihood and Inherent Risk Ranking

The likelihood of the MODU losing station and causing disturbance to benthic habitat values extending beyond the operational area or affecting a KEF with standard control measures in place is considered '*Unlikely (D)*'. The inherent risk ranking is evaluated as '*Low (2)*'.

There is no petroleum infrastructure to the west, east or north of the well location that could be impacted a drifting MODU and no infrastructure in any direction that would be considered 'close proximity' as described in the APPEA *Mooring in Australian Tropical Waters Guideline*. For a loss of MODU station to cause a release of hydrocarbons from a petroleum production facility, the MODU would need to drift at least 26 km to the south, through increasingly shallow waters and to impact the facility with sufficient force to cause a loss of integrity, and the facility would need to be continuing production during the cyclone. The likelihood of the MODU being pushed this distance in one direction, without the dragging anchors catching and the subsequent contact with the pipeline then resulting in loss of integrity is considered *'Remote (E)'*. The inherent risk ranking is evaluated as '*Low (2)*'

Additional Control Measures Considered (ALARP Evaluation)

Control Measure	Environmental Benefit	Evaluation of Decision	Decision

Drilling restricted to timing that avoids the cyclone season.	Reduces the likelihood of MODU losing station by avoiding de-manning and/or reducing risk of exposure to extreme metocean conditions.	Restricting the drilling timeframe may affect the availability of a suitable MODU and have significant economic and schedule costs. Cyclone season in NW WA extends over approx. half the year and drilling during this period is common practice and subject to stringent safety regulation to ensure risks are ALARP. Environmental risks are low with controls in place. Costs considered grossly disproportionate to benefit.	**Reject**
MODU mooring consistent with the requirements of Mooring in Australian Tropical Waters Guideline (APPEA, 2019).	Reduces the likelihood of MODU losing station to ALARP	Best industry practice. Benefit outweighs the cost.	**Accept**
Mooring design by MODU Contractor and verified by third party independent specialist contractor	Assures appropriate competencies underlying mooring design	Benefit outweighs the cost.	**Accept**
If drilling in cyclone season, the MODU Contractor required to have a SapuraOMV endorsed Cyclone Contingency Plan (CCP) in place	Ensures cyclone preparations address potential risk to MODU mooring integrity	Benefit outweighs the cost.	**Accept**
Use of dynamic positioning (DP) to hold MODU position	Using DP would eliminate the requirement to place anchors on the seabed.	DP not practical in this water depth. Potentially more impacts from underwater noise and increased atmospheric emissions.	**Reject**

<table>
<tr><td>MODU anchoring locations determined by mooring analysis and may consider geophysical and geotechnical site survey</td><td>Reduces the likelihood of anchor drag leading to loss of station.</td><td>This control measure is achievable and practicable as the site survey is already scheduled to occur.</td><td>Accept</td></tr>
<tr><td colspan="4">ALARP Assessment</td></tr>
<tr><td colspan="4">The impact assessment and evaluation has identified a range of standard control measures that when implemented are considered to manage impacts and risks from MODU station holding. Further opportunities to reduce impacts have been investigated with a number of additional controls accepted, including a pre-drilling geotechnical survey in the operational area prior to MODU mobilisation, use of an independent specialist to verify the mooring design and a requirement for the MODU mooring to comply with the requirements of the APPEA Mooring in Australian Tropical Waters Guideline (2019). With the proposed control measures in place, the residual likelihood of causing the defined consequences was considered ‘Remote’ (E) and with the highest residual consequence of ‘Major (IV)’, the residual risk of impacts due to losing station was assessed as ‘Low’ (2). With no reasonable additional or alternative control measures identified that would offer a net environmental benefit, the impacts and risks are considered ALARP.</td></tr>
<tr><td colspan="4">Residual Risk Summary</td></tr>
<tr><td>Consequence</td><td>Likelihood</td><td colspan="2">Residual risk</td></tr>
<tr><td>Major (IV)</td><td>Remote (E)</td><td colspan="2">Low (2)</td></tr>
<tr><td colspan="4">Demonstration of Acceptability</td></tr>
<tr><td colspan="2">Are environmental impacts and risks reduced to ALARP, and the residual risk ranking between ‘Very Low (1)’ to ‘Medium (3)’?</td><td colspan="2">Yes – risks are reduced to ALARP, and the residual risk ranking is Low (2).</td></tr>
<tr><td colspan="2">Is the Activity carried out in a manner consistent with the principles of ESD?</td><td colspan="2">Yes – although the event was considered extremely unlikely to occur and there is uncertainty associated with the actual extent of impacts, the development/implementation of measures to prevent environmental degradation has not been postponed and comprehensive management is in place, consistent with the precautionary principle. The level of impact and risk to the environment has been considered with regard to the principles of ESD and control measures described to ensure the conservation of biological and ecological diversity.</td></tr>
</table>

Are the potential risks and hazards consistent with SapuraOMV's policy and standards?	Yes – aligns with SapuraOMV's HSE Policy and HSEMS.
Have legislative and other requirements been met? Industry codes, standards and guidelines applied?	Yes –management will comply with the relevant legislative requirements (Safety Case) and industry (APPEA) guidelines regarding mooring during this Activity.
Have stakeholder expectations been addressed?	N/A – no concerns raised.

Use of anchors for offshore mooring of MODU is standard industry practice, both on the NWS and internationally. The risks of losing station are well documented and the recognised safety risks necessitate detailed assessment and demonstration of ALARP management via the MODU's Safety Case. Both national and international industry guidance are in place to manage the risk, and the MODU operator will be required to comply with the latest APPEA best practice guideline for mooring in Australian tropical waters.

The residual (and inherent) risk was assessed as '*Low*' (2) and classified as a Type A decision. SapuraOMV considers the adopted control measures appropriate to manage the risk to the marine environment of MODU losing station. With no further reasonably practicable additional or alternative control measures identified that would reduce impacts and risks, the impacts and risks are considered to be ALARP.

Environmental Performance Outcomes, Standards and Measurement Criteria

Environmental Performance Outcome	Environmental Performance Standard	Measurement Criteria	Responsibility
No unplanned loss of station during drilling activities.	Mooring design developed by MODU Contractor and verified by third party independent specialist contractor	Mooring design report.	SapuraOMV Drilling Manager
	Mooring Basis of Design (BoD) reviewed and endorsed by SapuraOMV, specialist mooring contractor and MODU operator.	Records confirms endorsement of mooring BoD by SapuraOMV, specialist mooring contractor and MODU operator prior to mobilisation.	SapuraOMV Drilling Manager
	MODU mooring consistent with the requirements of *Mooring in Australian Tropical Waters Guideline* (APPEA, 2019) including:	Records demonstrate MODU mooring system developed and implemented consistent with requirements of APPEA 2019.	MODU Contractor

	• Completing mooring risk assessment • Mooring equipment inspection and operating standards • Mooring personnel competency and training requirements • Management of Change process		
	NOPSEMA accepted Safety Case in place for MODU operations.	MODU inspection records.	SapuraOMV Drilling Manager
	MODU mooring limited to that specified in the project-specific mooring design analysis and as required to ensure adequate MODU station keeping capacity	Records demonstrate Mooring Design Analysis completed and implemented during anchor deployment.	MODU OIM
	Daily monitoring of metocean conditions via location-specific BOM forecasts	MODU inspection records confirm onboard access to BOM location-specific forecasts.	MODU OIM
	If drilling in cyclone season, MODU Cyclone Contingency Plan (CCP) in place and endorsed by SapuraOMV that includes: • Mooring tension re-adjustment procedures to address cyclonic metocean conditions • Mooring procedures in the event of MODU de-manning	Record of SapuraOMV endorsement of CCP prior to drilling commencing.	MODU Contractor
	GPS based positional monitoring system onboard MODU	MODU inspection records confirm MODU GPS system onboard and functional.	MODU OIM

	MODU Machinery and equipment maintained in accordance with planned maintenance system (PMS).	PMS records.	Chief Engineer
	Anchoring only to occur in suitable locations selected from pre-drilling site survey.	Pre-drilling site survey report, identifying anchoring locations.	SapuraOMV Drilling Manager
		MODU logs demonstrate anchoring only at designated location(s).	MODU OIM

9. Implementation Strategy

9.1 Health, Safety and Environmental Management System

SapuraOMV will operate under the HSEMS for the duration of the Activity. The purpose of the HSEMS is to provide clear direction on managing HSE related risks, impacts or threats associated with its core business as an exploration and production company.

SapuraOMV's HSE objectives are to:

- Continuously provide a workplace:
    - that is free from injury or illness;
    - that promotes a healthy workplace and mitigates significant health risks; and
    - that has minimum environmental footprint.
- Continuously enhance operational integrity and safe behaviours through a continual focus on minimising HSE risks.

The HSEMS is built on four fundamental management principles:

- Leadership;
- Risk management;
- Effective implementation; and
- Continuous improvement.

These fundamental management principles are described in detail in the HSEMS.

The HSEMS framework (**Figure 9-1**) supports the implementation of these principles and ensures a systematic approach to plan, manage and carry out activities as intended. This is achieved through our continuous improvement cycle of Plan-Do-Check-Act.

In the context of this EP, the HSEMS and implementation strategy enables SapuraOMV to ensure that:

- Environmental impacts and risks continue to be identified and are reduced to ALARP;
- Control measures remain effective in reducing environmental impacts and risks to ALARP and acceptable levels;
- EPOs and EPSs are being met; and
- Stakeholder consultation is maintained, as appropriate.

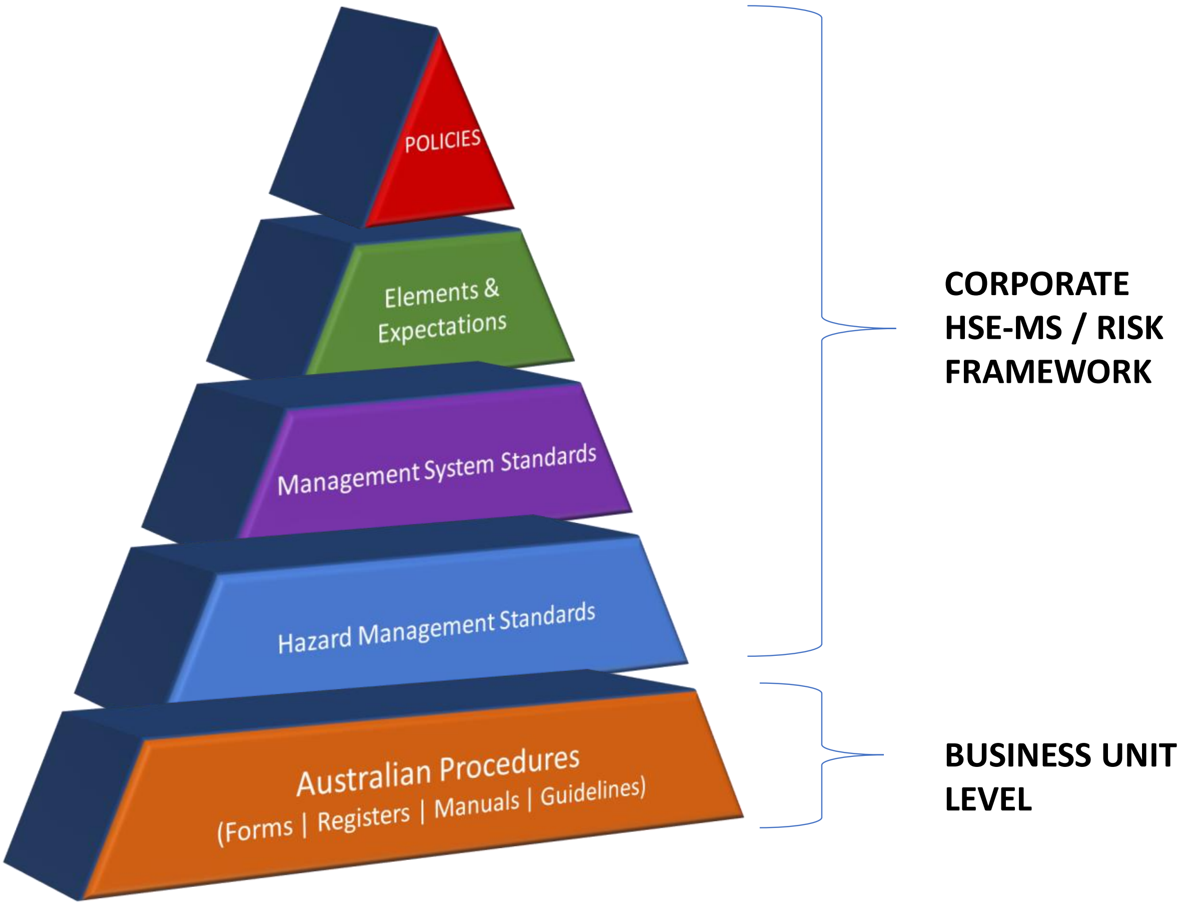


Figure 9-1 Corporate HSEMS framework structure

9.2 Organisation

9.2.1 Organisational Structure

The organisational structure relevant to the Kanga-1 exploration drilling Activity is outlined in **Figure 9-2**.

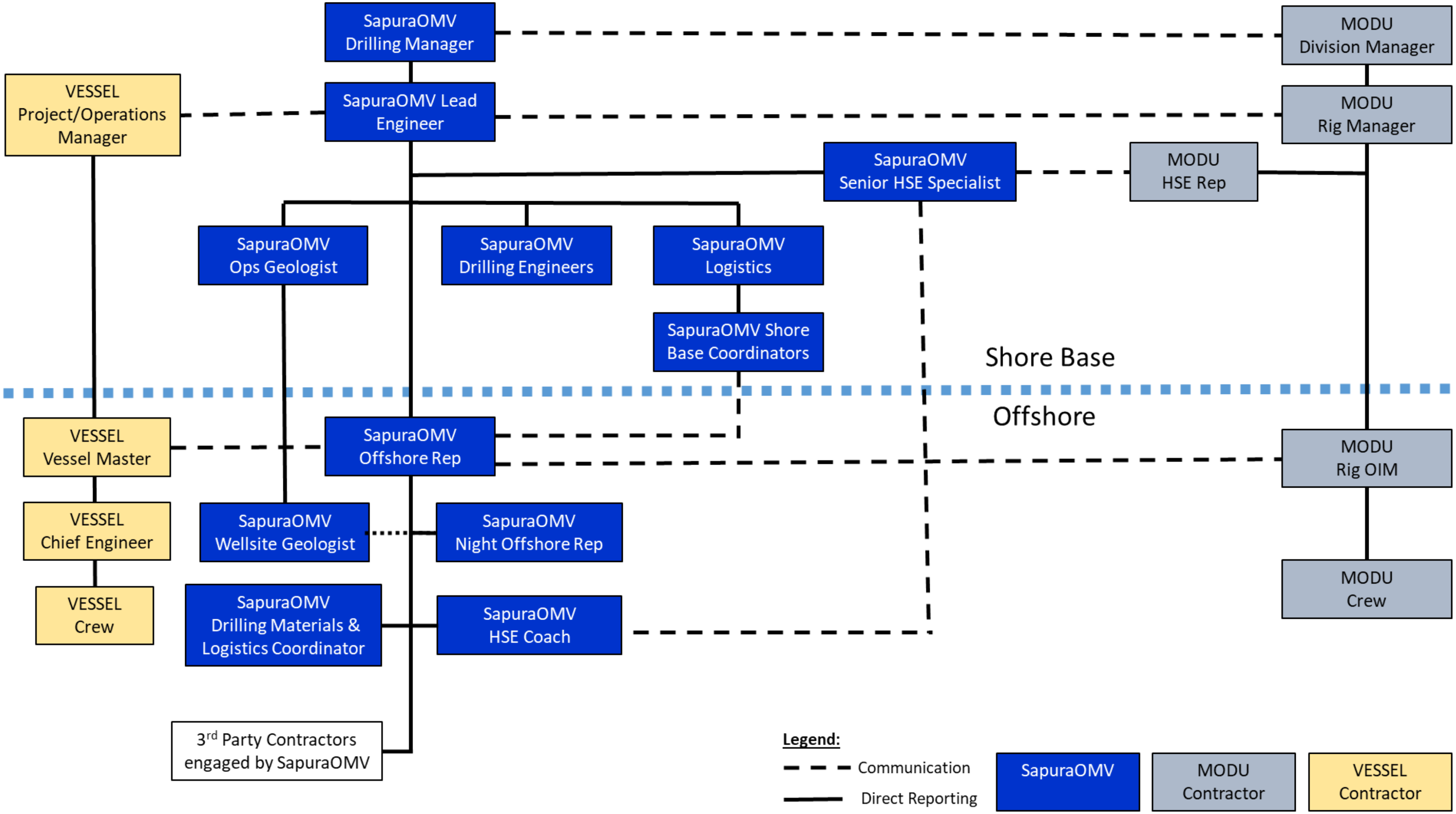


Figure 9-2 Organisational structure for the Kanga-1 exploration drilling program

9.2.2 Roles and Responsibilities

In accordance with Regulation 14(4) of the OPGGS(E)R, a clear chain of command for the implementation of the drilling program is outlined in **Figure 9-2**.

SapuraOMV has established and implements standards, procedures and systems to build and maintain a trained and competent workforce capable of fulfilling its assigned roles and responsibilities, as well as meeting its legislative and regulatory requirements. This is reflected in **Table 9-1**, which sets out the roles and responsibilities of key personnel in relation to the implementation, management and review of this EP. All roles and responsibilities relative to emergency spill management are detailed in the Kanga-1 Exploration Well OPEP for a Crude Oil Spill (AU-HSE-KG1-EX-PLN-037) and the Kanga-1 Exploration Well OPEP for a MDO Spill (AU-HSE-KG1-EX-PLN-039).

Table 9-1 Relevant roles and responsibilities

Key Role	Responsibility
Onshore	
SapuraOMV Drilling Manager	• Ensures personnel and resources are available for the program to deliver the required technical, commercial and HSE objectives. • Ensures that the exploration drilling is planned and executed in accordance with the SapuraOMV procedures and policies, Australian regulatory requirements and this EP. • Liaises with SapuraOMV Country Manager on progress and performance of the program. • Oversees SapuraOMV's functional organisation during the exploratory drilling Activity, including (in conjunction with Procurement Analyst, or delegate) contractor selection and management. • Contractor management including informing major contractors (rig contractor and vessel operators) of their HSE obligations. • Signs off reportable and recordable incident reports and annual environmental report for NOPSEMA. • Oversees the Activity and has a team in place dedicated to the program including: o SapuraOMV Senior HSE Specialist o Lead Engineer o Drilling Engineers o Shorebased Coordinators o SapuraOMV Offshore Representative(s) o Materials & Logistics Coordinator
Lead Engineer	• Supports the Drilling Manager by leading the planning and execution of activities in a safe and efficient manner, and in compliance with applicable legislation, the control measures identified in this EP. • Ensuring that personnel from SapuraOMV and contractors are allocated according to scope requirements and have appropriate training, qualifications and experience. • Ensuring that the control measures identified in the EP are implemented throughout the Activity. • Implementing the Management of Change process when triggered.
SapuraOMV Senior HSE Specialist	• Responsible for ensuring all HSE obligations and commitments are met. • Responsible for oversight of this EP. • Provides HSE advice and guidance in relation to EP Activity HSE matters. • Responsible for all compliance and incident reporting in relation to the EP. • Liaises with drilling personnel and SapuraOMV HSE functional management on relevant matters detailed above, such as NOPSEMA reporting. • Provides HSE technical oversight to the Kanga-1 Exploratory Drilling campaign. • Maintains and manages revisions of the EP as necessary. • Prepares environmental induction, MODU and vessel inspection information.

Key Role	Responsibility
	• Arranges briefing of project personnel and MODU/ vessel crew members of the environmental sensitivities of the Activity, environmental management procedures and performance outcomes detailed in the EP as part of the environmental induction process. • Assists with review, investigation and reporting of environmental incidents. • Ensures stakeholder consultation is undertaken as per the requirements of the EP. • Assists in preparation of external regulatory reports required for the Activity, in line with environmental approval requirements and SapuraOMV HSE incident reporting procedures. • Issues NOPSEMA pre-start and cessation notifications. • Assists in the preparation of the Annual Environmental Report. • Provides updates to SapuraOMV HSE on, amongst other things, campaign HSE readiness, emergency response activities, results of risk assessment, audits etc. • Stakeholder engagement: ○ Ensures SapuraOMV stakeholder database is up-to-date. ○ Issues Activity notifications to listed stakeholders for planned activities (e.g. AHO, AMSA JRCC). ○ Informs SapuraOMV Drilling Manager of any issues resulting from stakeholder correspondence. ○ Maintains records of correspondence with stakeholders.
Drilling Contractor – MODU Manager	• Accountable for execution and compliance with all facets of the drilling contract(s). • Ensures personnel and resources are available for the drilling Activity to deliver the required technical, commercial and HSE outcomes. • Ensures that the Activity is planned and executed in accordance with the SapuraOMV procedures and policies, Australian regulatory requirements and this EP.
Drilling Contractor – HSE Representative	• Ensures HSE issues are communicated through daily report and daily pre-start meetings. • Ensures emissions and discharges as identified in Section 9.4.5 are recorded and provided to SapuraOMV in required timeframes.
Vessel Contractor – Project /Operations Manager	• Accountable for execution and compliance with all facets of the marine vessel contract(s). • Responsible for the provision of requisite marine vessel resources, including competently-trained crew. • Ensures personnel and resources are available for the drilling Activity to deliver the required technical, commercial and HSE objectives. • Ensures that the Activity is planned and executed in accordance with the SapuraOMV procedures and policies, Australian regulatory requirements and this EP.
Incident Commander	• As per the OPEPs, the Incident Commander leads the Incident Management Team and is responsible for the overall management and support to the response operations of a spill incident.
Offshore	
SapuraOMV Offshore Representative(s)	• Responsible on the MODU for ensuring that the commitments made in this EP are implemented by contractors (e.g. through audit and inspection). • Offshore SapuraOMV focal point for communications between SapuraOMV and MODU/ vessel personnel. • Completion of an initial inspection of the MODU and support/ supply vessel (including evaluating compliance with EP commitments as documented in a commitment register, supported by SapuraOMV Senior HSE Specialist (or delegate) as appropriate). • Assists with the crew project induction. • Daily oversight of operations in conjunction with the MODU and vessel management team. • Daily communications and reports back to the SapuraOMV Drilling Manager. • Participates in the investigation of any environmental incidents.

Key Role	Responsibility
	• Reports any potential hydrocarbon spill reportable incidents to the SapuraOMV IMT Incident Commander and Senior HSE Specialist.
SapuraOMV HSE Coach	• Monitors conformance with EPOs, EPSs and the implementation strategy in the EP. • Maintains the environmental compliance register. • Completes daily HSE reports, and regular inspection and audits. • Completes HSE inductions and promotes general awareness. • Attends HSE meetings and contributes to HSE initiatives. • Collates HSE data and records. • Contributes to HSE incident reporting, management and investigation. Provides operational HSE oversight and advice. • Facilitates the development and implementation of MoC documents.
MODU Offshore Installation Manager (OIM)	• Responsible for the daily control and management of the MODU. • Oversees work activities and work program. • Ensures HSE management system and procedures are implemented. • Implement facility SOPEP/SMPEP in an emergency. • Ensures that appropriate control and mitigation measures are implemented to minimise potential environmental effects resulting from operations (e.g. waste management and disposal). • Reports (to SapuraOMV) any incidents/activities arising from operations that are likely to have a negative impact on the performance objectives detailed in this EP. Makes statutory incident reports as necessary. • Oversees offshore compliance with this EP and any relevant statutory regulations. • Ensures that procedures and systems comply with environmental performance objectives, standards and measurement criteria, as outlined in this EP; and that Contractor HSE management systems are observed. • Conducts regular workplace inspections. • Ensures regular drills and exercises are conducted and all personnel actively participate.
Vessel Master(s)	• Conduct vessel operations in line with all Australian and international legislation and in accordance with this EP. • Implement vessel's SOPEP/SMPEP in an emergency. • Establish and maintain radio contact with other vessels in the Operational Area and adjacent waters. • Ensure any environmental incidents are reported immediately to SapuraOMV.
MODU/ Vessel Chief Engineer	• Overall responsibility for operation and maintenance of engines, generators and other machinery aboard the MODU/ vessel. • Ensure implementation of planned maintenance systems (PMS) for all key machinery. • Responsibility for waste management systems dealing with sewage, grey water, putrescibles and bilge water.
All crew	• Work in accordance with accepted MODU and vessel HSE systems and procedures. • Comply with EP requirements as applicable to assigned role. • Report a hazardous condition, near miss, unsafe act, accident or environmental incident immediately to supervisors. • Attend HSE meetings and training when required.

9.3 Awareness, Training and Competency

9.3.1 Training and Competency

In accordance with Sapura OMV's Training and Competency Procedure (AU-HS-PRO-002-1.0), training and competency expectations for our personnel and our contractors will be verified prior to mobilisation. Contractors will be required to have their own competency programs and systems for establishing, verifying and tracking the knowledge, skills and abilities of their personnel. The requirements for contractor personnel in terms of training, competency and experience will be communicated to the contractor through contract terms and conditions. This includes the training competency requirements described in this EP.

Personnel qualification and training records will be sampled before and/or during the Activity. Such checks will be performed during the procurement process, MODU acceptance testing, inductions, crew change, and operational inspections and audits.

All SapuraOMV and contractor personnel will be required to attend a project induction as described in **Section 9.3.2**.

9.3.2 Environmental Awareness

Inductions are conducted for all personnel (including SapuraOMV representatives, contractors, subcontractors and visitors) before mobilising to or on arrival at the Activity locations. Inductions cover the HSE requirements under the SapuraOMV HSEMS, including information about the commitments contained in this EP.

The environmental content of these inductions includes the following:

- Environmental aspects of the Activity;
- Ecological and socio-economic sensitivities of the Activity location, including a 'no recreational fishing policy' to be implemented in the operational area;
- Relevant legislative requirements, standards and procedures;
- SapuraOMV's HSE Policy;
- Monitoring and reporting performance outcomes and standards using measurement criteria;
- Oil spill preparedness and response; and
- Incident reporting requirements.

9.4 Compliance Assurance

9.4.1 Overview

Environmental monitoring, inspections and audits will be used to assure compliance and support evaluation of environmental performance and the effectiveness of the Implementation Strategy.

SapuraOMV implements the risk-based assurance process HSE Assurance Procedure AU-HS-PRO-008-1.0 to monitor and manage:

- Conformance with HSEMS expectations;
- Organisational capability; and
- Effectiveness of the HSEMS in meeting objectives, stakeholder and business needs.

A Kanga-1 EP compliance register will be drafted for use by the SapuraOMV Offshore Representative during the drilling campaign to log and gather evidence of compliance with all EP commitments. The compliance register will be the primary source of compliance monitoring and can be submitted to NOPSEMA in the event of a compliance audit. Routine inspections will be undertaken onboard the MODU and support vessels as part of this process, and the results, findings, actions and learnings that arise from all assurance activities will be recorded and any corrective actions identified and tracked to closure.

9.4.2 Contractor Reviews and Audits

SapuraOMV conducts reviews and audits of contractors at various stages including pre-award of contract, pre-Activity and during Activity, commensurate to the Activity type, in accordance with its HSEMS and auditing procedure.

Environmental audits of the MODU and vessels will be undertaken by SapuraOMV HSE personnel prior to commencement of the Activity and during operations to ensure the program is being undertaken in accordance with this EP, and relevant legislation. The following audits are planned:

- Pre-award HSE evaluation of the MODU and support vessel contractor's management systems;
- Pre-Activity HSE and condition audits of the MODU and vessels;
- Desktop audit of the MODU and vessels management systems; and
- HSE and condition audit (at least once during the Activity) of the MODU and vessels.

The audits will be documented and corrective actions will be tracked to completion in accordance with the SapuraOMV Evaluation Assurance. Likewise, any incidents and corrective actions will be tracked in accordance with SapuraOMV Incident Investigation and Reporting Standard.

9.4.3 Management of Non-conformances

Non-conformances may comprise of incidents, audit findings, failures to meet defined EPOs or EPS, or deviations from standards or procedures. Mechanisms for identifying and managing non-conformance associated with the Activity include:

- Audits and inspections, e.g. those conducted by the SapuraOMV Offshore Representative prior to or during the Activity;
- Emissions and discharges monitoring;
- Reports from personnel (e.g. hazard observations); and
- Incident reporting and investigations.

If non-conformances are identified during environmental monitoring, assurance or performance monitoring, they will be elevated to the SapuraOMV Drilling Manager and:

- Actions will be taken immediately towards re-establishing compliance and to stop/ remove the cause of non-conformance;
- If warranted, investigations will be carried out to investigate and analyse the root cause; and
- Preventative actions will be implemented.

All non-conformances and corrective actions will be tracked and monitored by the SapuraOMV Offshore Representative until close-out. The SapuraOMV Offshore Representative will ensure all non-conformances and corrective actions are communicated to field personnel and discussed during toolbox meetings following the incident and after close-out.

9.4.4 Communication and Consultation

The SapuraOMV Offshore Representative will facilitate the communication of arising HSE issues, via the daily report and daily pre-start meetings.

Stakeholder consultation specific to the Activity is detailed in **Section 5**.

9.4.5 Monitoring Records

Monitoring will be undertaken for the duration of the Activity, and records kept as detailed in **Table 9-2**.

Table 9-2 Emissions and discharges monitoring requirements

Emission / Discharge	Parameter	Record	Monitoring Method	Responsibility
Fuel - vessel(s)	Volume used	Oil Record Book	Daily Report	Chief Engineers
Fuel - MODU	Volume used	Oil Record Book	Daily Report	Chief Engineers
Bilge	Volume discharged	Oil Record Book	Daily Report	Chief Engineers
Sewage/grey water	Volume discharged	Engine Room Log Book	Daily Report	Chief Engineers
Putrescible waste	Volume discharged	Garbage Record Book	Daily Report	Vessel Masters MODU OIM
Ballast water exchange	Volume intake/discharged	Ballast Record Book	Daily Report	Vessel Masters
Drill fluids and cuttings	Chemical name Chemical quantity Fluid type Fluid volume	Daily Drilling Report	Daily Report	MODU OIM
Cement	Chemical name Chemical Quantity	Daily Drilling Report	Daily Report	MODU OIM
Spills to marine environment	Chemical/ hydrocarbon type Volume discharged	Incident Report	Daily Report	Vessel Masters MODU OIM
Waste lost to marine environment	Material lost	Incident Report	Daily Report	Vessel Masters MODU OIM

9.4.6 Environmental Performance Review

SapuraOMV will undertake an internal review of the environmental performance of the Activity on completion. The review will consider:

- An evaluation of conformance with the compliance register (based on the environmental performance outcomes, standards and measurement criteria outlined in **Sections 7** and **8**);
- Improvements to the implementation strategy included within the EP;
- Compliance with SapuraOMV's Policies and Procedures; and
- The management of non-conformances identified during the survey, including reportable and recordable incidents.

The outcomes of the review will be circulated to relevant persons in SapuraOMV and to other stakeholders as appropriate. The outcomes of the review will be incorporated into environmental management measures applied to future activities to further improve SapuraOMV's environmental performance, where relevant, and will be included in the Environmental Performance Report submitted to NOPSEMA.

9.4.7 Management of Change

Proposed changes to this EP and OPEPs will be managed in accordance with SapuraOMV's Management of Change (MoC) Procedure (AU-HS-PRO-003-1.1). The MoC Procedure provides a systematic process to initiate, document, assess, authorise, communicate and implement changes or proposed changes to the Activity. The MOC process will also be used to manage any changes triggered by external factors, such as:

- New hazards or risks, e.g. new concern raised by relevant person, gazetting of a new marine park;
- Legislation changes or government documents, such as changes to management plans, species recovery plans, conservation advice releases from DAWE;
- New publications, research or guidelines of relevance; and
- Outcomes of external audits, inspections and investigations.

The MoC Procedure considers the implications of any proposed change to the EP and/or OPEPs currently in force whilst meeting regulatory requirements. If the change does not trigger revision under the OPGGS(E)R, SapuraOMV will amend the EP and record the changes within the EP. If the MoC assessment determines that a change does trigger a revision of the EP, SapuraOMV will update the EP and re-submit it to NOPSEMA for acceptance as per **Section 9.4.8**.

Accepted MoCs become part of the in-force EP or OPEPs, will be tracked, and where appropriate, SapuraOMV's environmental commitments register (ECR) will be updated to ensure changes to EPOs or EPSs are communicated to the workforce and implemented. Any MoC will be distributed to the relevant persons, and the most relevant management position (e.g. OIM, vessel masters) will ensure the MoC is communicated and implemented, which may include crew meetings/ briefings/ communications as appropriate for the change.

The MoC Procedure will be periodically checked against NOPSEMA guidance to ensure ongoing compliance and will be undertaken as part of the management review process. Monitoring of potential external triggers of change will be conducted via subscriptions to relevant government websites, journals and advices, as well as through the ongoing consultation process.

9.4.8 Environment Plan Revisions

In accordance with Regulation 17 of the OPGGS(E)R, a revision of this EP shall be submitted to NOPSEMA as per the following regulatory requirements:

- With the regulator's approval before the commencement of a new Activity;
- Before the commencement of any significant modification or new stage of the Activity that is not provided for in the EP as currently in force;
- Before, or as soon as practicable after, the occurrence of any significant new or significant increase in environmental impact or risk;
- The occurrence of a series of new or a series of increases in existing environmental impacts or risks which, taken together, amount to the occurrence of a significant new or significant increase in environmental impact or risk; or
- A change in titleholder that results in a change in the manner in which the environmental impacts and risks of an Activity are managed.

9.4.9 Record Management

SapuraOMV will store operational documents and records that are relevant to the EP. Records generated for the petroleum Activity will be retrievable and retained for five years after the day when the EP ceases to be in force. Operational documents and records associated with this EP will include:

- Project induction presentation and attendance records;
- Records relating to training and competency;

- Records of emissions and discharges;
- Daily drilling reports and daily well reports;
- Management of change records;
- Consultation records;
- Incident notifications and investigation records;
- Recordable and reportable incident reports;
- Environmental commitments register; and
- Environmental performance report(s).

9.4.10 Reporting Requirements

9.4.10.1 Environmental Performance Report

In accordance with the OPGGS(E)R Regulation 14(2), SapuraOMV will submit a report on the environmental performance of the Activity within three months of submission of an end-of-activity notification to NOPSEMA. Performance will be measured against the EPOs and EPSs described in this EP via the relevant measurement criteria.

9.4.10.2 Incident Reporting

Notification and reporting requirements for environmental incidents to external agencies are provided in **Table 9-3** and Section 3.2 of the relevant OPEP for a crude oil or MDO spill (see **Appendix F**).

Table 9-3 Regulatory incident reporting

Requirement	Timing	Contact
Recordable Incident A recordable incident is defined as: '*…a breach of an environmental performance outcome or standard in the environment plan that applies to the activity and is not a reportable incident.*' As a minimum, the written incident report must describe: • The incidents and all material facts and circumstances concerning the incidents; • Any actions taken to avoid or mitigate any adverse environmental impacts; • Any corrective actions already taken, or that may be taken, to prevent a repeat of similar incidents; and • If no recordable incidents occur during the reporting month, a 'nil report' will be submitted.	Before the 15th day of the following calendar month	NOPSEMA – submissions@nopsema.gov.au
Reportable Incident A reportable incident is defined as: '*… an incident relating to an activity that has caused, or has the potential to cause an adverse environmental impact; and under the environmental risk assessment process the environmental impact is categorised as moderate to significant environmental damage.*' Therefore, reportable incidents under this EP are those unplanned events that have a moderate or greater consequence severity level. In accordance with this definition, reportable incidents identified under this EP are: • Hydrocarbon spill (Level 3) – LOWC;		

Requirement	Timing	Contact
• Hydrocarbon spill (Level 2) – vessel collision; and • Introduction of invasive marine species.		
Verbal notification The notification must contain: • All material and circumstances concerning the incident; • Any action taken to avoid or mitigate the adverse environmental impact of the incident; and • The corrective action that has been taken or is proposed to be taken to stop control or remedy the reportable incident.	As soon as practicable, but no later than two hours of the incident having been identified	NOPSEMA – 1300 674 472
Written notification Verbal notification of a reportable incident to the regulator must be followed by a written report. As a minimum, the written incident report will include: • The incident and all material facts and circumstances concerning the incident; • Actions taken to avoid or mitigate any adverse environmental impacts; • The corrective actions that have been taken, or may be taken, to prevent a recurrence of the incident; and • The action that has been taken or is proposed to be taken to prevent a similar incident occurring in the future.	Within 3 days of notification of incident	NOPSEMA – submissions@nopsema.gov.au
Written notification Incident reports must be submitted to NOPTA.	Within 7 days of written report submission to NOPSEMA	NOPTA – reporting@nopta.gov.au
AMSA • All slicks trailing the vessel; • All spills in Australian Commonwealth waters (notwithstanding the size or amount of oil or sheen); and • All spills where National Plan equipment is used in response.	Immediate notification by Vessel Master	1800 641 792 (Emergency) (02) 6230 6811 (Office)
Written notification	Written Marine Pollution Report (POLREP) for submitted by Vessel Master; timing not specified.	AMSA POLREP: https://www.amsa.gov.au/environment/maritime-environmentalemergencies/nationalplan/Contingency/Oil/documents/Appendix7.pdf
Vessel strike with marine mammals	Within 72 hours	DAWE – Online national Ship Strike Database https://data.marinemammals.gov.au/report/shipstrike
Injury to or death of EPBC Act-listed species	Within 7 days	DAWE – 1800 803 772 protected.species@environment.gov.au
Suspected or confirmed IMS introduction	Verbal notification ASAP	DPIRD Fishwatch – 1800 815 507 biosecurity@fish.wa.gov.au
Identification of item of underwater cultural heritage such as vessel or aircraft remains and/or associated relics	Written notification	UnderwaterHeritage@environment.gov.au

9.5 Emergency Management and Response

SapuraOMV will implement the relevant Kanga-1 Exploration Well OPEP for a crude oil or MDO spill in the event of a significant hydrocarbon release. SapuraOMV will activate its Incident Management Team as the Controlling Agency in the event of a loss of well control incident, as per the Kanga-1 Exploration Well OPEP for a Crude Oil Spill (AU-HSE-KG1-EX-PLN-037), or a Level 2 MODU refuelling spill, as per the Kanga-1 Exploration Well OPEP for a MDO Spill (AU-HSE-KG1-EX-PLN-039) (see **Appendix F**). In the event of vessel collision spill, the Incident Management Team will assist AMSA as a Supporting Agency as per the Kanga-1 Exploration Well OPEP for a MDO Spill (AU-HSE-KG1-EX-PLN-039).

To maintain a state of oil spill preparedness, personnel with OPEP responsibilities will be made aware of their obligations, contracts with critical equipment and personnel suppliers will be managed, and agreements will be in place with national regulatory agencies for support in oil spill response.

SapuraOMV has insurance policies in place that would cover the costs of clean-up or remediation activities following a spill. These policies cover activities in Australian Commonwealth and State waters (if required) and are therefore applicable to the whole of the Kanga-1 exploration well drilling program.

The Notification Plan in each of the OPEPs provide the contact details and timing to notify Commonwealth, State and support agencies. In addition, SapuraOMV will advise potentially affected stakeholders identified in **Section 5.4**.

9.5.1 Testing Spill Response Arrangements

In accordance with Regulation 14(8A) and (8C) of the OPGGS(E)R, the response arrangements will be tested:

- When they are introduced;
- When they are significantly amended; and
- No later than 12 months after the most recent test.

Prior to commencing drilling activities, response arrangements applicable to a major spill scenario will be tested as per Section 8.6 of the MDO and crude oil spill OPEPs**Appendix F**)). The outcomes of the test will be documented to assess the effectiveness of the exercise against its objectives and to record any lessons learnt. Any actions will be recorded and tracked to completion.

All key spill response personnel will be trained to an appropriate level to undertake their role in its implementation as described in Section 8.4 of the MDO spill OPEP and Section 8.5 of the crude oil spill OPEP (**Appendix F**). Classroom training will be supported by drills and exercises to ensure that competencies are maintained.

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[TSSC] Threatened Species Scientific Committee (2015d). Conservation Advice *Rhincodon typus* whale shark. Canberra: Department of the Environment.

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Appendices

Appendix A – SapuraOMV HSE Policy

Health, Safety and Environmental Policy

SapuraOMV Upstream Sdn. Bhd. recognizes that implementing good Health, Safety & Environmental (HSE) management is critical to achieving, maintaining and continually improving operational excellence for long term business sustainability.

In line with this aspiration, we shall comply with all applicable HSE legal requirements and other requirements in the country we operate.

We remain committed towards prevention of work place injuries, occupational illnesses, property damages and minimizing our impact on the environment through pollution prevention, emissions reduction and waste recycling by:

- establishing, implementing and improving Health, Safety and Environmental Management System (HSEMS) to ensure continual improvement in HSE management and performance;
- managing all HSE risks associated with our business activities and provide control measures to eliminate or reduce all HSE risks to as low as reasonably practicable (ALARP) to our employees, subcontractors, vendors, stakeholders, and to the environment;
- demonstrating leadership commitment, assuring responsibility and accountability at management and supervisory levels in championing HSE initiatives and ensuring compliance with HSE policies and procedures;
- periodically measuring and reviewing HSE performance against HSE objectives and standards;
- ensuring asset integrity and reliability of facilities, equipment and processes to safeguard our people, the environment, our asset and our reputation;
- incorporating HSE performance indicator targets for senior management staff and all employees;
- providing adequate resources including competent human resources to achieve HSE objectives;
- continually developing our employees' skills and competencies through training opportunities;
- encouraging a proactive intervention culture and transparency in HSE reporting as an integral part of our HSE best practice; and
- communicating the essence and intent of this policy to our employees and other stakeholders.

SapuraOMV Upstream Sdn. Bhd. employees and other stakeholders including subcontractors, vendors, suppliers and visitors shall remain fully committed to achieving the objectives of this policy.

MAMDOUH BADAWI	**MUHAMMAD ZAMRI JUSOH**	**WOLFGANG STOCK**
Chief Operating Officer	Chief Executive Officer	Chief Financial Officer

22nd July 2019

Appendix B – Legislation and Guidelines

Legislation and Guidelines	Summary	Related International Conventions	Administering Authority
Australian Ballast Water Requirements, Version 8	Australian Ballast Water Management Requirements set out the obligations on vessel operators with regards to the management of ballast water and ballast tank sediment when operating within Australian seas. These requirements are enforceable under the Biosecurity Act 2015.	• International Convention for the Control and Management of Ships' Ballast Water and Sediments (adopted in principlein 2004 and in force on 8 September 2017).	DAWE
Australian Maritime Safety Authority Act 1990 (AMSA Act)	This Act specifies that the Australian Maritime Safety Authority's (AMSA) role includes protection of the marine environment from pollution from ships and other environmental damage caused by shipping. This Act facilitates international cooperation and mutual assistance in preparing and responding to a major oil spill incident and encourages countries to develop and maintain an adequate capability to deal with oil pollution emergencies. Requirements are given effect through AMSA. AMSA is the lead agency for responding to oil spills in the marine environment and is responsible for the Australian National Plan for Maritime Environmental Emergencies (NatPlan).	• International Convention on Oil Pollution Preparedness, Response and Cooperation 1990; • Protocol on Preparedness, Response and Cooperation to pollution Incidents by hazardous and Noxious Substances 2000; • International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties 1969; and • Articles 198 and 221 of the United Nations Convention on the Law of the Sea 1982.	AMSA
Biosecurity Act 2015 Biosecurity Regulations 2016	This Act replaced the *Quarantine Act 1908* in 2015 and provides the Commonwealth with powers to take measures of quarantine, and implement related programs as are necessary, to prevent the introduction of any plant, animal, organism or matter that could contain anything that could threaten Australia's native flora and fauna or natural environment. This Act includes mandatory controls on the use of seawater as ballast in ships and the declaration of sea vessels voyaging out of and into Commonwealth waters. The Regulations stipulate that all information regarding the voyage of the vessel and the ballast water is declared correctly to the quarantine officers.	• International Convention for the Control and Management of Ships' Ballast Water and Sediments (adopted in principlein 2004 and in force on 8 September 2017).	DAWE
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	This Act applies to actions that have, will have or are likely to have a significant impact on matters of national environmental or cultural significance. This Act is the Australian Government's key piece of environmental legislation. The Act protects matters of national environmental significance (MNES) and provides for a Commonwealth environmental assessment and approval process for actions. There are eight MNES, these being: • World heritage properties;	• 1992 Convention on Biological Diversity and 1992 Agenda 21, • Convention on International Trade in Endangered Species of Wild Fauna and Flora 1973, • Agreement between the Government and Australia and the Government of Japan for the Protection of	DAWE

Legislation and Guidelines	Summary	Related International Conventions	Administering Authority
	• Ramsar wetlands; • Listed Threatened species and communities; • Listed Migratory species under international agreements; • Nuclear actions; • Commonwealth marine environment; • Great Barrier Reef Marine Park; and • Water trigger for coal seam gas and coal mining developments. Australian Marine Park Management Plans were also developed under this Act. The National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) is the sole assessor for offshore petroleum activities in Commonwealth water (as of 28 February 2014). Under the new arrangements, environmental protection will be met through NOPSEMA's decision-making processes.	Migratory Birds and Birds in Danger of Extinction and their Environment 1974; • Agreement between the Government and Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment 1986; • Agreement between the Government of Australia and the Government of the Republic of Korea on The Protection of Migratory Birds 2006; • Convention on Wetlands of International Importance especially as Waterfowl Habitat 1971 (Ramsar); • International Convention for the Regulation of Whaling 1946; and • Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) 1979.	
Environment Protection and Biodiversity Conservation Regulations 2000	Part 8 of the regulations provide distances and actions to be taken when interacting with cetaceans.	NA	DAWE
Guidelines for The Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (2011)	Intended to provide a globally consistent approach to the management of biofouling, which is the accumulation of various aquatic organisms on ships' hulls.	NA	MEPC
Marine Pest Plan 2018 – 2023: the National Strategic Plan for Marine Pest Biosecurity	The vision of the Marine Pest Plan is: '*Maintaining Australia's healthy and resilient marine environment that is protected from the threat of marine pests, and which supports our economy and social amenity*.' While the vision sets the broad direction for the future of marine pest biosecurity in Australia, Marine Pest Plan 2018–2023 describes the steps to make this vision a reality, and the outcomes to achieve.	NA	DAWE

Legislation and Guidelines	Summary	Related International Conventions	Administering Authority
Maritime Legislation Amendment (Prevention of Air Pollution from Ships) Act 2007	An Act to amend the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*, and for other purposes. This amended Act provides the protection of the sea from air pollution from ships.	• MARPOL (certain sections).	AMSA
MODU Mooring in Australian Tropical Waters Guideline Rev2 (2019)	This guideline has been developed by industry to provide a consistent and common approach to MODU mooring exposed to cyclonic conditions in Australian tropical waters.	NA	APPEA
National Biofouling Management Guidelines for the Petroleum Production and Exploration Industry 2009	The guidance document provides recommendations for the management of biofouling hazards by the petroleum industry.	NA	DAWE
National Greenhouse and Energy Reporting Act 2007	Introduces a single national reporting framework for the reporting and dissemination of information about greenhouse gas emissions, greenhouse gas projects and energy production and consumption.	• United Nations Framework Convention on Climate Change 1992; and • The Kyoto Protocol	Climate Change Authority
National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds	The Guidelines outline the process to be followed where there is the potential for artificial lighting to affect wildlife. They apply to new projects, lighting upgrades (retrofitting) and where there is evidence of wildlife being affected by existing artificial light.	NA	DAWE
National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna	The overarching goal of the strategy is to provide guidance on understanding and reducing the risk of vessel collisions and the impacts they may have on marine megafauna.	NA	DAWE
Navigation Act 2012	This Act regulates ship-related activities. An act regulating navigation and shipping including Safety of Life at Sea (SOLAS). A number of Marine Orders enacted under this Act apply directly to offshore petroleum exploration and production activities: • Marine Order 21: Safety and Emergency Arrangements	• MARPOL (certain sections); • International Convention for the Safety of Life at Sea 1974; and • COLREG 1972	AMSA

Legislation and Guidelines	Summary	Related International Conventions	Administering Authority
	• Marine Order 27: Safety of Navigation and Radio Equipment • Marine Order 30: Prevention of collisions • Marine Order 31: SOLAS and non-SOLAS certification • Marine Order 58: Safe Management of Vessels • Marine Order 70 – Seafarer Certification		
Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGSA) Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS(E)R)	The Act addresses all licensing, health, safety, environmental and royalty issues for offshore petroleum exploration and development operations extending beyond the three-nautical mile limit. The OPGGS Act contains a broad requirement for titleholders to operate in accordance with "good oil-field practice". The OPGGS Environment Regulations provide an objective based regime for the management of environmental performance for Australian offshore petroleum exploration and production activities in areas of Commonwealth jurisdiction. Key objectives of the Environment Regulations include: • To ensure operationa are carried out in a way that is consistent with the principles of ecologically sustainable development; • To adopt best practice to achieve agreed environment protection standards in industry operations; and • To encourage industry to continuously improve its environmental performance.	NA	NOPSEMA
Protection of the Sea (Prevention of Pollution from Ships) Act 1983 Protection of the Sea (Prevention of Pollution from Ships) (Orders) Regulations 1994	This Act relates to the protection of the sea from pollution by oil and other harmful substances discharged from ships. This Act disallows any harmful discharge of sewage, oil and noxious substances into the sea and sets the requirements for a shipboard waste management plan. The following Marine Orders relating to marine pollution prevention have been put in place to give effect to relevant regulations of Annexes I, II, III, IV, V and VI of MARPOL 73/78: • Marine Order 91: Marine Pollution Prevention - Oil	• MARPOL (certain sections).	AMSA

Legislation and Guidelines	Summary	Related International Conventions	Administering Authority
	• Marine Order 93: Marine Pollution Prevention - Noxious Liquid Substances • Marine Order 94: Marine Pollution Prevention - Packaged Harmful Substances • Marine Order 95: Marine Pollution Prevention – Garbage • Marine Order 96: Marine Pollution Prevention – Sewage • Marine Order 97: Marine Pollution Prevention - Air Pollution		
Protection of the Sea (Harmful Antifouling Systems) Act 2006	This Act relates to the protection of the sea from the effects of harmful anti-fouling systems. It prohibits the use of harmful organotins in ant-fouling paints used on ships. The Act also provides that Australian ships must hold 'anti-fouling certificates', provided they meet certain criteria. This is enacted by Marine Order 98 (Marine Pollution – Anti-fouling Systems) 2013	• International Convention on the Control of Harmful Anti-fouling Systems on Ships 2001	AMSA
Source Control Planning Guide for Subsea Wells (2019). Report 594.	Guide Operating Companies in the planning and preparation of a suitable subsea source control emergency response plan. The scope covers basic emergency response organisational format, roles and responsibilities, well design considerations, source control options and implementation considerations.	NA	International Association of Oil and Gas Producers and International Petroleum Industry Environmental Conservation Association
Underwater Cultural Heritage Act 2018	This Act replaces *the Historic Shipwrecks Act 1976*. It protects the heritage values of remains of vessels, aircraft and certain associated articles that have been in Commonwealth waters for at least 75 years. Vessels and aircraft that have been underwater less than 75 years, and other types of underwater cultural heritage, can be protected through individual declaration based on an assessment of heritage significance. It also increases penalties applicable to damaged sites. The Act came into effect on 1 July 2019.	• Agreement between the Netherlands and Australia concerning old Duch Shipwrecks 1972	DAWE

Appendix C – EPBC Act Protected Matters Search

Appendix C.1 Operational Area (4 km by 4 km)

Australian Government

Department of Agriculture, Water and the Environment

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.

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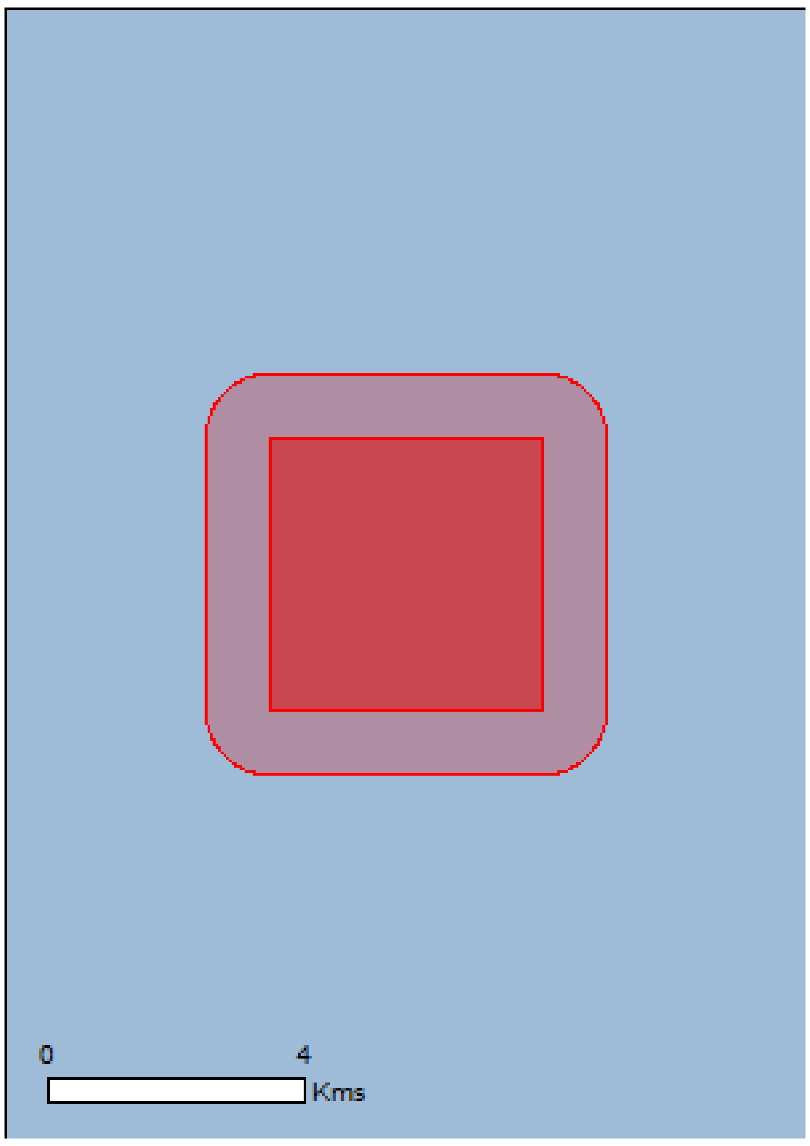

Coordinates

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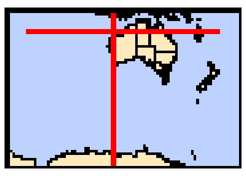


Summary

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:	14
Listed Migratory Species:	30

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	53
Whales and Other Cetaceans:	22
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	None
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
North-west

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may 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
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 likely to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area
Sharks		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat may occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
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 may occur within area

Name	Threatened	Type of Presence
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat likely to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis 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

Name	Threatened	Type of Presence
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		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
Fish		
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
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
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
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 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 spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
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 likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely 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 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	Species or species habitat likely 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 borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
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
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area

Name	Status	Type of Presence
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

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

-19.33535 116.33841,-19.29919 116.3384,-19.29919 116.37647,-19.33535 116.37648,-19.33535 116.33841

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.

Department of Agriculture Water and the Environment
GPO Box 858
Canberra City ACT 2601 Australia
+61 2 6274 1111

Appendix C.2 LOWC Spill MEZ

Australian Government
Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

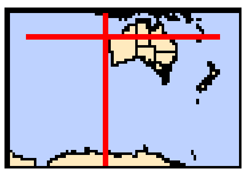
This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

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: 01/10/20 08:37:08

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:	7
Wetlands of International Importance:	4
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	146
Listed Migratory Species:	103

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:	8
Commonwealth Heritage Places:	19
Listed Marine Species:	202
Whales and Other Cetaceans:	43
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	1
Australian Marine Parks:	32

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	79
Regional Forest Agreements:	1
Invasive Species:	51
Nationally Important Wetlands:	14
Key Ecological Features (Marine)	20

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		
Lesueur National Park	WA	Listed place
Shark Bay, Western Australia	WA	Listed place
The Ningaloo Coast	WA	Listed place
Indigenous		
Dampier Archipelago (including Burrup Peninsula)	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

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Ashmore reef national nature reserve	Within 10km of Ramsar
Eighty-mile beach	Within Ramsar site
Hosnies spring	Within Ramsar site
The dales	Within Ramsar site

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside 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
Aquatic Root Mat Community 1 in Caves of the Leeuwin Naturaliste Ridge	Endangered	Community known to occur within area
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to 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		
Accipiter hiogaster natalis Christmas Island Goshawk [82408]	Endangered	Species or species habitat known to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Breeding known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	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 tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Breeding 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
Chalcophaps indica natalis Christmas Island Emerald Dove, Emerald Dove (Christmas Island) [67030]	Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat likely to 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
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat known to occur

Name	Status	Type of Presence
		within area
Fregata andrewsi Christmas Island Frigatebird, Andrew's Frigatebird [1011]	Endangered	Breeding known 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 known to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Malurus leucopterus edouardi White-winged Fairy-wren (Barrow Island), Barrow Island Black-and-white Fairy-wren [26194]	Vulnerable	Species or species habitat likely to occur within area
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
Ninox natalis Christmas Island Hawk-Owl, Christmas Boobook [66671]	Vulnerable	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
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat known to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Breeding likely to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat may occur within area
Pterodroma arminjoniana Round Island Petrel, Trinidade Petrel [89284]	Critically Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or

Name	Status	Type of Presence
		related behaviour known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat known 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 Shy Albatross [89224]	Endangered	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
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Turdus poliocephalus erythropleurus Christmas Island Thrush [67122]	Endangered	Species or species habitat likely to occur within area
Turnix varius scintillans Painted Button-quail (Houtman Abrolhos) [82451]	Vulnerable	Species or species habitat likely to occur within area
Crustaceans		
Engaewa walpolea Walpole Burrowing Crayfish [82676]	Endangered	Species or species habitat known to occur within area
Fish		
Galaxiella nigrostriata Blackstriped Dwarf Galaxias, Black-stripe Minnow [88677]	Endangered	Species or species habitat known to occur within area
Milyeringa veritas Blind Gudgeon [66676]	Vulnerable	Species or species habitat known to occur within area
Nannatherina balstoni Balston's Pygmy Perch [66698]	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

Name	Status	Type of Presence
Bettongia lesueur Barrow and Boodie Islands subspecies Boodie, Burrowing Bettong (Barrow and Boodie Islands) [88021]	Vulnerable	Species or species habitat known to occur within area
Bettongia lesueur lesueur Burrowing Bettong (Shark Bay), Boodie [66659]	Vulnerable	Species or species habitat known to occur within area
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat known to occur within area
Crocidura trichura Christmas Island Shrew [86568]	Critically Endangered	Species or species habitat likely 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 known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Isoodon auratus barrowensis Golden Bandicoot (Barrow Island) [66666]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes conspicillatus conspicillatus Spectacled Hare-wallaby (Barrow Island) [66661]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes hirsutus Central Australian subspecies Mala, Rufous Hare-Wallaby (Central Australia) [88019]	Endangered	Translocated population known to occur within area
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
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Macrotis lagotis Greater Bilby [282]	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
Parantechinus apicalis Dibbler [313]	Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
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
Pipistrellus murrayi		
Christmas Island Pipistrelle [64383]	Critically Endangered	Species or species habitat known to occur within area
Pseudocheirus occidentalis		
Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically 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
Pteropus natalis		
Christmas Island Flying-fox, Christmas Island Fruit-bat [87611]	Critically Endangered	Roosting known to occur within area
Rhinonicteris aurantia (Pilbara form)		
Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area
Setonix brachyurus		
Quokka [229]	Vulnerable	Species or species habitat known to occur within area
Other		
Bertmainius tingle		
Tingle Pygmy Trapdoor Spider [89126]	Endangered	Species or species habitat may occur within area
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
Westralunio carteri		
Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area
Plants		
Andersonia gracilis		
Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Anigozanthos viridis subsp. terraspectans		
Dwarf Green Kangaroo Paw [3435]	Vulnerable	Species or species habitat likely to occur within area
Asplenium listeri		
Christmas Island Spleenwort [65865]	Critically Endangered	Species or species habitat known to occur within area
Banksia nivea subsp. uliginosa		
Swamp Honeypot [82766]	Endangered	Species or species habitat may occur within area
Banksia squarrosa subsp. argillacea		
Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat may occur within area
Banksia verticillata		
Granite Banksia, Albany Banksia, River Banksia [8333]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Caladenia barbarella Small Dragon Orchid, Common Dragon Orchid [68686]	Endangered	Species or species habitat may occur within area
Caladenia elegans Elegant Spider-orchid [56775]	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
Caladenia lodgeana Lodge's Spider-orchid [68664]	Critically Endangered	Species or species habitat likely to occur within area
Calectasia cyanea Blue Tinsel Lily [7669]	Critically Endangered	Species or species habitat may occur within area
Chorizema varium Limestone Pea [16981]	Endangered	Species or species habitat known to occur within area
Diuris drummondii Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat known to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat may occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat may occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Drummondita ericoides Morseby Range Drummondita [9193]	Endangered	Species or species habitat known 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
Eucalyptus cuprea Mallee Box [56773]	Endangered	Species or species habitat may occur within area
Gastrolobium papilio Butterfly-leaved Gastrolobium [78415]	Endangered	Species or species habitat may occur within area
Grevillea batrachioides Mt Lesueur Grevillea [21735]	Endangered	Species or species habitat may occur within area
Grevillea humifusa Spreading Grevillea [61182]	Endangered	Species or species habitat may occur within area
Hemiandra gardneri Red Snakebush [7945]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Kennedia glabrata Northcliffe Kennedia [16452]	Vulnerable	Species or species habitat likely to occur within area
Kennedia lateritia Augusta Kennedia [45985]	Endangered	Species or species habitat likely to occur within area
Lambertia echinata subsp. occidentalis Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat may occur within area
Leucopogon obtectus Hidden Beard-heath [19614]	Endangered	Species or species habitat may occur within area
Macarthuria keigheryi Keighery's Macarthuria [64930]	Endangered	Species or species habitat likely to occur within area
Microtis globula South-Coast Mignonette Orchid [6780]	Vulnerable	Species or species habitat likely to occur within area
Paracaleana dixonii Sandplain Duck Orchid [86882]	Endangered	Species or species habitat likely to occur within area
Pneumatopteris truncata fern [68812]	Critically Endangered	Species or species habitat known to occur within area
Reedia spathacea Reedia [2995]	Critically Endangered	Species or species habitat known to occur within area
Tectaria devexa [14767]	Endangered	Species or species habitat likely to occur within area
Thelymitra stellata Star Sun-orchid [7060]	Endangered	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
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat likely 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
Cryptoblepharus egeriae Christmas Island Blue-tailed Skink, Blue-tailed Snake-eyed Skink [1526]	Critically Endangered	Species or species habitat likely 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 known to occur within area
Cyrtodactylus sadleiri Christmas Island Giant Gecko [86865]	Endangered	Species or species

Name	Status	Type of Presence
		habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Egernia stokesii badia Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink [64483]	Endangered	Species or species habitat known to occur within area
Emoia nativitatis Christmas Island Forest Skink, Christmas Island Whiptail-skink [1400]	Critically Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Lepidodactylus listeri Christmas Island Gecko, Lister's Gecko [1711]	Critically Endangered	Species or species habitat known to occur within area
Liasis olivaceus barroni Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat known to occur within area
Liopholis pulchra longicauda Jurien Bay Skink, Jurien Bay Rock-skink [83162]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Ramphotyphlops exocoeti Christmas Island Blind Snake, Christmas Island Pink Blind Snake [1262]	Vulnerable	Species or species habitat likely 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
Glyphis garricki Northern River Shark, New Guinea River Shark [82454]	Endangered	Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Breeding known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

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		

Name	Threatened	Type of Presence
Anous stolidus Common Noddy [825]		Foraging, feeding or related behaviour known 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]		Breeding known to occur within area
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat may occur within area
Ardenna pacifica Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat likely to 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 andrewsi Christmas Island Frigatebird, Andrew's Frigatebird [1011]	Endangered	Breeding known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Breeding known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Breeding 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
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 lepturus White-tailed Tropicbird [1014]		Breeding known to occur within area

Name	Threatened	Type of Presence
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons Little Tern [82849]		Breeding known to occur within area
Sula dactylatra Masked Booby [1021]		Breeding known to occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Sula sula Red-footed Booby [1023]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	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
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*	Breeding known to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely

Name	Threatened	Type of Presence
		to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
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 likely to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour 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	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Foraging, feeding or related behaviour known to occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Breeding known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish	Vulnerable	Species or species habitat known to occur

Name	Threatened	Type of Presence
[60756]		within area
Pristis zijsron		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa 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		
Cecropis daurica		
Red-rumped Swallow [80610]		Species or species habitat known to occur within area
Cuculus optatus		
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundo rustica		
Barn Swallow [662]		Species or species habitat known to occur within area
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat known to occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat known to 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]		Roosting known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba		
Sanderling [875]		Roosting known to occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis		
Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta		
Long-toed Stint [861]		Species or species habitat known to occur within area
Calidris tenuirostris		
Great Knot [862]	Critically Endangered	Roosting known to occur

Name	Threatened	Type of Presence
		within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Roosting known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Thalasseus bergii Crested Tern [83000]		Breeding known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Roosting 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
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area

Name	Threatened	Type of Presence
Tringa totanus		
Common Redshank, Redshank [835]		Roosting known to occur within area
Xenus cinereus		
Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth 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 -
Commonwealth Land - Christmas Island National Park
Defence - EXMOUTH ADMIN & HF TRANSMITTING
Defence - EXMOUTH VLF TRANSMITTER STATION
Defence - GERALDTON TRAINING DEPOT "A" Company 16th Battalion
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		
Christmas Island Natural Areas	EXT	Listed place
Lancelin Defence Training Area	WA	Listed place
Learmonth Air Weapons Range Facility	WA	Listed place
Mermaid Reef - Rowley Shoals	WA	Listed place
Ningaloo Marine Area - Commonwealth Waters	WA	Listed place
Scott Reef and Surrounds - Commonwealth Area	EXT	Listed place
Historic		
Administrators House Precinct	EXT	Listed place
Bungalow 702	EXT	Listed place
Cape Leeuwin Lighthouse	WA	Listed place
Drumsite Industrial Area	EXT	Listed place
Geraldton Drill Hall Complex	WA	Listed place
HMAS Sydney II and HSK Kormoran Shipwreck Sites	EXT	Listed place
Industrial and Administrative Group	EXT	Listed place
Malay Kampong Group	EXT	Listed place
Malay Kampong Precinct	EXT	Listed place
Phosphate Hill Historic Area	EXT	Listed place
Poon Saan Group	EXT	Listed place
Settlement Christmas Island	EXT	Listed place
South Point Settlement Remains	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

Name	Threatened	Type of Presence
		within area
Anous stolidus Common Noddy [825]		Foraging, feeding or related behaviour known to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Breeding known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
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]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known 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	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat likely to 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 andrewsi Christmas Island Frigatebird, Andrew's Frigatebird [1011]	Endangered	Breeding known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Breeding known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Breeding known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Roosting known to 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]		Roosting known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area
Hirundo daurica Red-rumped Swallow [59480]		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

Name	Threatened	Type of Presence
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting 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 known to occur within area
Pelagodroma marina White-faced Storm-Petrel [1016]		Breeding known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Breeding known to occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Breeding likely to occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Phalacrocorax fuscescens Black-faced Cormorant [59660]		Breeding likely to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area

Name	Threatened	Type of Presence
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
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]		Breeding known to occur within area
Puffinus griseus Sooty Shearwater [1024]		Species or species habitat may 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]		Roosting known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat known to occur within area
Sterna albifrons Little Tern [813]		Breeding known 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
Stiltia isabella Australian Pratincole [818]		Roosting known to occur within area
Sula dactylatra Masked Booby [1021]		Breeding known to occur within area

Name	Threatened	Type of Presence
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Sula sula Red-footed Booby [1023]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	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
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
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Tringa totanus Common Redshank, Redshank [835]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Fish		
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
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 sculptus Sculptured Pipefish [66197]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys haematopterus Reef-top Pipefish [66201]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Cosmocampus maxweberi Maxweber's Pipefish [66209]		Species or species habitat may occur within area
Doryrhamphus baldwini Redstripe Pipefish [66718]		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

Name	Threatened	Type of Presence
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus macrorhynchus Whiskered Pipefish, Ornate Pipefish [66222]		Species or species habitat may occur within area
Halicampus mataafae Samoan Pipefish [66223]		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
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
Hippichthys heptagonus Madura Pipefish, Reticulated Freshwater Pipefish [66229]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippichthys spicifer Belly-barred Pipefish, Banded Freshwater Pipefish [66232]		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

Name	Threatened	Type of Presence
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
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Micrognathus brevirostris thorntail Pipefish, Thorn-tailed Pipefish [66254]		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
Notiocampus ruber Red Pipefish [66265]		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
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat likely to 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

Name	Threatened	Type of Presence
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus fuscus Dusky Seasnake [1119]		Species or species habitat known to occur within area
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 coggeri Slender-necked Seasnake [25925]		Species or species habitat may occur within area
Hydrophis czeblukovi Fine-spined Seasnake [59233]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
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
Lapemis hardwickii Spine-bellied Seasnake [1113]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
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
Berardius arnuxii Arnoux's Beaked Whale [70]		Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		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	Breeding known to occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within

Name	Status	Type of Presence
		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 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 hectori Hector's Beaked Whale [76]		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

Name	Status	Type of Presence
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Foraging, feeding or related behaviour known to 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

Commonwealth ReservesTerrestrial [Resource Information]

Name	State	Type
Christmas Island	EXT	National Park (Commonwealth)

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)
Argo-Rowley Terrace	National Park Zone (IUCN II)
Argo-Rowley Terrace	Special Purpose Zone (Trawl) (IUCN VI)

Name	Label
Carnarvon Canyon	Habitat Protection Zone (IUCN IV)
Cartier Island	Sanctuary Zone (IUCN Ia)
Dampier	Habitat Protection Zone (IUCN IV)
Dampier	Multiple Use Zone (IUCN VI)
Dampier	National Park Zone (IUCN II)
Eighty Mile Beach	Multiple Use Zone (IUCN VI)
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)
Kimberley	Multiple Use Zone (IUCN VI)
Mermaid Reef	National Park Zone (IUCN II)
Montebello	Multiple Use Zone (IUCN VI)
Ningaloo	National Park Zone (IUCN II)
Ningaloo	Recreational Use Zone (IUCN IV)
Perth Canyon	Habitat Protection Zone (IUCN IV)
Perth Canyon	Multiple Use Zone (IUCN VI)
Perth Canyon	National Park Zone (IUCN II)
Shark Bay	Multiple Use Zone (IUCN VI)
South-west Corner	Multiple Use Zone (IUCN VI)
South-west Corner	National Park Zone (IUCN II)
South-west Corner	Special Purpose Zone (IUCN VI)
South-west Corner	Special Purpose Zone (Mining
Two Rocks	Multiple Use Zone (IUCN VI)

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Airlie Island	WA
Barrow Island	WA
Bedout Island	WA
Beekeepers	WA
Bernier And Dorre Islands	WA
Bessieres Island	WA
Boodie, Double Middle Islands	WA
Boullanger, Whitlock, Favourite, Tern And Osprey Islands	WA
Bundegi Coastal Park	WA
Cape Range	WA
Chatham Island	WA
D'Entrecasteaux	WA
Dirk Hartog Island	WA
Drovers Cave	WA
Escape Island	WA
Freycinet, Double Islands etc	WA
Hamelin Island	WA
Jarrkunpungu	WA
Jinmarnkur	WA
Jinmarnkur Kulja	WA
Jurabi Coastal Park	WA
Karajarri	WA
Koks Island	WA
Kujungurru Warrarn	WA
Kujungurru Warrarn	WA
Lancelin And Edwards Islands	WA
Leeuwin-Naturaliste	WA
Lesueur	WA
Little Rocky Island	WA
Lowendal Islands	WA
Montebello Islands	WA
Mount Frankland South	WA
Muiron Islands	WA
Murujuga	WA
Nambung	WA
Nanga Station	WA

Name	State
Nilgen	WA
North Sandy Island	WA
North Turtle Island	WA
Nyangumarta Warrarn	WA
Part Murchison house	WA
Round Island	WA
Serrurier Island	WA
Southern Beekeepers	WA
Stockdill Road	WA
Tamala Pastoral Lease (Part)	WA
Unnamed WA11883	WA
Unnamed WA11962	WA
Unnamed WA26400	WA
Unnamed WA33799	WA
Unnamed WA34039	WA
Unnamed WA36907	WA
Unnamed WA36909	WA
Unnamed WA36910	WA
Unnamed WA36913	WA
Unnamed WA36915	WA
Unnamed WA37338	WA
Unnamed WA37383	WA
Unnamed WA37500	WA
Unnamed WA40322	WA
Unnamed WA40828	WA
Unnamed WA40877	WA
Unnamed WA41080	WA
Unnamed WA42030	WA
Unnamed WA44665	WA
Unnamed WA44667	WA
Unnamed WA44672	WA
Unnamed WA44676	WA
Unnamed WA44682	WA
Unnamed WA44688	WA
Unnamed WA48205	WA
Unnamed WA48858	WA
Unnamed WA52366	WA
Unnamed WA53015	WA
Victor Island	WA
Walpole-Nornalup	WA
Wanagarren	WA
Wedge Island	WA
Zuytdorp	WA

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
South West WA RFA	Western Australia

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
Gallus gallus		
Red Junglefowl, Feral Chicken, Domestic Fowl		Species or species

Name	Status	Type of Presence
[917]		habitat likely to occur within area
Lonchura oryzivora Java Sparrow [59586]		Species or species habitat likely to occur within area
Meleagris gallopavo Wild Turkey [64380]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		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
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
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 asinus Donkey, Ass [4]		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
Feral deer Feral deer species in Australia [85733]		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

Name	Status	Type of Presence
		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		
Andropogon gayanus		
Gamba Grass [66895]		Species or species habitat likely to occur within area
Asparagus aethiopicus		
Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides		
Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus declinatus		
Bridal Veil, Bridal Veil Creeper, Pale Berry Asparagus Fern, Asparagus Fern, South African Creeper [66908]		Species or species habitat likely to occur within area
Brachiaria mutica		
Para Grass [5879]		Species or species habitat may occur within area
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
Chrysanthemoides monilifera subsp. monilifera		
Boneseed [16905]		Species or species habitat likely to occur within area
Cylindropuntia spp.		
Prickly Pears [85131]		Species or species habitat likely to occur within area
Genista linifolia		
Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana		
Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana		
Broom [67538]		Species or species habitat may occur within area
Jatropha gossypifolia		
Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
Lantana camara		
Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum		
African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
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
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		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
Prosopis spp. Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		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
Lycodon aulicus Wolf Snake, Common Wolf Snake, Asian Wolf Snake [83178]		Species or species habitat likely to occur within area
Lygosoma bowringii Christmas Island Grass-skink [1312]		Species or species habitat likely to occur within area
Ramphotyphlops braminus Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
"The Dales", Christmas Island	EXT
Broke Inlet System	WA
Bundera Sinkhole	WA
Cape Leeuwin System	WA
Cape Range Subterranean Waterways	WA
De Grey River	WA
Eighty Mile Beach System	WA
Hosine's Spring, Christmas Island	EXT
Lake MacLeod	WA
Lake Thetis	WA
Learmonth Air Weapons Range - Saline Coastal Flats	WA
Leslie (Port Hedland) Saltfields System	WA
Mermaid Reef	EXT
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
Ashmore Reef and Cartier Island and surrounding	North-west
Canyons linking the Argo Abyssal Plain with the	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
Mermaid Reef and Commonwealth waters	North-west
Seringapatam Reef and Commonwealth waters in	North-west
Wallaby Saddle	North-west
Albany Canyons group and adjacent shelf break	South-west
Ancient coastline at 90-120m depth	South-west
Cape Mentelle upwelling	South-west
Commonwealth marine environment surrounding	South-west
Commonwealth marine environment within and	South-west
Naturaliste Plateau	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

-9.84426 119.86067,-10.16311 120.19855,-10.36663 120.31526,-10.55692 121.09126,-10.1775 121.23358,-10.03185 121.28821,-10.00305 121.35384,-10.04159 121.37155,-11.25172 121.92747,-11.92378 121.60722,-12.22722 122.27957,-12.46132 123.61659,-13.5367 123.63705,-14.16654 122.3282,-14.88588 122.40473,-15.87236 121.53725,-17.4639 121.09432,-18.65501 121.544,-19.14928 121.54837,-19.56093 121.13702,-19.71559 120.6641,-19.95176 120.12337,-20.05145 119.3924,-20.12189 119.00027,-20.24372 118.68998,-20.36745 118.53389,-20.37271 118.47048,-20.17341 118.10825,-20.41461 117.96607,-20.44155 117.95019,-20.50678 117.91174,-20.46563 117.07597,-20.54988 116.8106,-20.85684 116.41168,-21.06052 116.00432,-21.11001 115.6769,-21.48121 115.43134,-21.54276 114.9951,-21.9246 114.43194,-21.90704 114.09693,-22.57258 113.76833,-22.81052 113.88254,-23.30545 113.8873,-23.79089 113.42557,-24.19143 113.49633,-24.68299 113.46366,-25.17488 113.10468,-25.58549 112.97347,-26.15561 113.28735,-26.66137 113.6672,-27.21651 114.04738,-27.45447 114.1014,-27.78891 113.5628,-28.42715 113.74482,-28.75679 114.61525,-29.62977 114.92138,-30.50857 115.13822,-30.89537 115.2959,-31.14947 115.44656,-32.36717 115.06498,-33.30362 114.22055,-34.21276 115.07446,-34.45785 115.15648,-34.43126 115.67528,-34.89048 115.9794,-34.86789 116.13213,-34.96725 116.65765,-35.47716 117.55803,-35.56792 117.55865,-33.35166 110.27443,-31.41978 108.23911,-29.64619 106.56119,-28.52107 105.47811,-27.8472 105.06969,-27.62986 103.40008,-27.18489 103.64611,-25.6969 105.1383,-23.27477 104.81211,-21.82321 104.0591,-20.06883 103.82189,-19.1176 104.88463,-18.0774 106.31882,-17.21593 106.2596,-16.47999 105.82957,-16.03887 103.71497,-15.83428 100.79111,-10.42922 99.9457,-9.47145 104.82534,-9.89918 106.68935,-9.29548 107.63937,-7.59679 107.70161,-8.09279 109.43646,-8.28553 111.528,-8.33549 112.4203,-8.26411 112.91999,-8.207 113.16983,-8.44197 113.74923,-8.56095 114.14184,-8.60854 114.61773,-8.38249 114.86758,-8.65613 115.35537,-8.84648 115.97403,-9.00115 116.90202,-9.06658 117.43541,-8.86433 117.84587,-8.70966 118.33961,-8.7513 118.88688,-8.63106 119.1157,-8.65453 119.43236,-9.04197 119.38671,-9.50638 119.01834,-9.63963 119.14683,-9.69674 119.5323,-9.84426 119.86067

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.

Department of Agriculture Water and the Environment
GPO Box 858
Canberra City ACT 2601 Australia
+61 2 6274 1111

Appendix C.3 LOWC Spill EMBA

Australian Government
Department of Agriculture, Water and the Environment

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.

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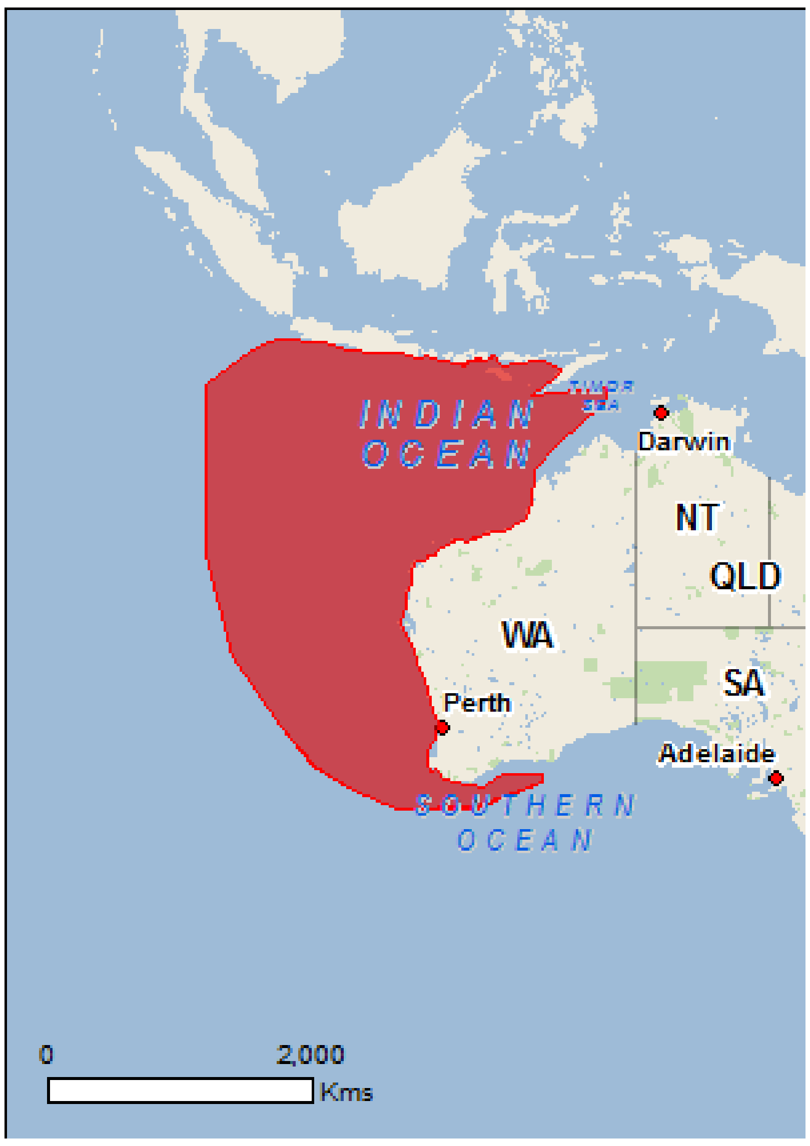
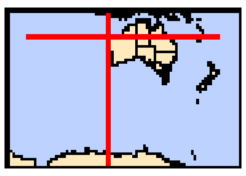


Coordinates
Buffer: 1.0Km



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:	7
Wetlands of International Importance:	4
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	7
Listed Threatened Species:	169
Listed Migratory Species:	107

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:	10
Commonwealth Heritage Places:	20
Listed Marine Species:	211
Whales and Other Cetaceans:	44
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	1
Australian Marine Parks:	40

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	101
Regional Forest Agreements:	1
Invasive Species:	62
Nationally Important Wetlands:	21
Key Ecological Features (Marine)	24

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		
Lesueur National Park	WA	Listed place
Shark Bay, Western Australia	WA	Listed place
The Ningaloo Coast	WA	Listed place
Indigenous		
Dampier Archipelago (including Burrup Peninsula)	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

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Ashmore reef national nature reserve	Within Ramsar site
Eighty-mile beach	Within Ramsar site
Hosnies spring	Within Ramsar site
The dales	Within Ramsar site

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside 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
Aquatic Root Mat Community 1 in Caves of the Leeuwin Naturaliste Ridge	Endangered	Community known to occur within area
Aquatic Root Mat Community in Caves of the Swan Coastal Plain	Endangered	Community known to occur within area
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Scott River Ironstone Association	Endangered	Community likely to occur within area
Sedgelands in Holocene dune swales of the southern Swan Coastal Plain	Endangered	Community known to occur within area

Name	Status	Type of Presence
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to 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		
Accipiter hiogaster natalis Christmas Island Goshawk [82408]	Endangered	Species or species habitat known to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Breeding known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	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 tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Breeding known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Breeding known to occur within area
Cereopsis novaehollandiae grisea Cape Barren Goose (south-western), Recherche Cape Barren Goose [25978]	Vulnerable	Species or species habitat may occur within area
Chalcophaps indica natalis Christmas Island Emerald Dove, Emerald Dove (Christmas Island) [67030]	Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Dasyornis longirostris Western Bristlebird [515]	Endangered	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 antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
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
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat known to occur within area
Fregata andrewsi Christmas Island Frigatebird, Andrew's Frigatebird [1011]	Endangered	Breeding known 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 known to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Malurus leucopterus edouardi White-winged Fairy-wren (Barrow Island), Barrow Island Black-and-white Fairy-wren [26194]	Vulnerable	Species or species habitat likely to occur within area
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
Ninox natalis Christmas Island Hawk-Owl, Christmas Boobook [66671]	Vulnerable	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
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat known to occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden	Endangered	Breeding likely to occur

Name	Status	Type of Presence
Bosunbird [26021]		within area
Phoebetria fusca		
Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Polytelis alexandrae		
Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat known to occur within area
Pterodroma arminjoniana		
Round Island Petrel, Trinidade Petrel [89284]	Critically Endangered	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 known 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		
Shy Albatross [89224]	Endangered	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
Thalassarche steadi		
White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Turdus poliocephalus erythropleurus		
Christmas Island Thrush [67122]	Endangered	Species or species habitat likely to occur within area
Turnix varius scintillans		
Painted Button-quail (Houtman Abrolhos) [82451]	Vulnerable	Species or species habitat likely to occur within area
Crustaceans		
Engaewa walpolea		
Walpole Burrowing Crayfish [82676]	Endangered	Species or species habitat known to occur within area
Fish		
Galaxiella nigrostriata		
Blackstriped Dwarf Galaxias, Black-stripe Minnow [88677]	Endangered	Species or species habitat known to occur within area
Milyeringa veritas		
Blind Gudgeon [66676]	Vulnerable	Species or species habitat known to occur within area
Nannatherina balstoni		
Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat known to occur within area
Ophisternon candidum		
Blind Cave Eel [66678]	Vulnerable	Species or species habitat known to occur

Name	Status	Type of Presence
		within area
Frogs		
Spicospina flammocaerulea		
Sunset Frog [64782]	Vulnerable	Species or species habitat may occur within area
Insects		
Hesperocolletes douglasi		
Douglas' Broad-headed Bee, Rottnest Bee [66734]	Critically Endangered	Species or species habitat may 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 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
Crocidura trichura		
Christmas Island Shrew [86568]	Critically Endangered	Species or species habitat likely 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 known to occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Breeding known to occur within area
Isoodon auratus barrowensis		
Golden Bandicoot (Barrow Island) [66666]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes conspicillatus conspicillatus		
Spectacled Hare-wallaby (Barrow Island) [66661]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes hirsutus Central Australian subspecies		
Mala, Rufous Hare-Wallaby (Central Australia) [88019]	Endangered	Translocated population known to occur within area
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

Name	Status	Type of Presence
Lagostrophus fasciatus fasciatus Banded Hare-wallaby, Merrnine, Marnine, Munning [66664]	Vulnerable	Species or species habitat known to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Macrotis lagotis Greater Bilby [282]	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
Parantechinus apicalis Dibbler [313]	Endangered	Species or species habitat known 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
Pipistrellus murrayi Christmas Island Pipistrelle [64383]	Critically Endangered	Species or species habitat known to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically 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
Pteropus natalis Christmas Island Flying-fox, Christmas Island Fruit-bat [87611]	Critically Endangered	Roosting known to occur within area
Rhinonicteris aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat known to occur within area
Other		
Bertmainius tingle Tingle Pygmy Trapdoor Spider [89126]	Endangered	Species or species habitat known to occur within area
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
Westralunio carteri Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur

Name	Status	Type of Presence within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Androcalva bivillosa Straggling Androcalva [87807]	Critically Endangered	Species or species habitat may occur within area
Anigozanthos viridis subsp. terraspectans Dwarf Green Kangaroo Paw [3435]	Vulnerable	Species or species habitat likely to occur within area
Asplenium listeri Christmas Island Spleenwort [65865]	Critically Endangered	Species or species habitat known to occur within area
Banksia brownii Brown's Banksia, Feather-leaved Banksia [8277]	Endangered	Species or species habitat likely to occur within area
Banksia nivea subsp. uliginosa Swamp Honeypot [82766]	Endangered	Species or species habitat may occur within area
Banksia squarrosa subsp. argillacea Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat may occur within area
Banksia verticillata Granite Banksia, Albany Banksia, River Banksia [8333]	Vulnerable	Species or species habitat likely to occur within area
Beyeria lepidopetala Small-petalled Beyeria, Short-petalled Beyeria [18362]	Endangered	Species or species habitat likely to occur within area
Caladenia barbarella Small Dragon Orchid, Common Dragon Orchid [68686]	Endangered	Species or species habitat may occur within area
Caladenia bryceana subsp. cracens Northern Dwarf Spider-orchid [64556]	Vulnerable	Species or species habitat known to occur within area
Caladenia elegans Elegant Spider-orchid [56775]	Endangered	Species or species habitat known to occur within area
Caladenia granitora [65292]	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
Caladenia lodgeana Lodge's Spider-orchid [68664]	Critically Endangered	Species or species habitat likely to occur within area
Calectasia cyanea Blue Tinsel Lily [7669]	Critically Endangered	Species or species habitat likely to occur within area
Chorizema varium Limestone Pea [16981]	Endangered	Species or species habitat known to occur within area
Commersonia apella Many-flowered Commersonia [86877]	Critically Endangered	Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Diuris drummondii Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat known to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat may occur within area
Drakaea concolor Kneeling Hammer-orchid [56777]	Vulnerable	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area
Drummondita ericoides Morseby Range Drummondita [9193]	Endangered	Species or species habitat known to occur within area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat may occur within area
Eucalyptus argutifolia Yanchep Mallee, Wabling Hill Mallee [24263]	Vulnerable	Species or species habitat known to occur within area
Eucalyptus beardiana Beard's Mallee [18933]	Vulnerable	Species or species habitat may occur within area
Eucalyptus cuprea Mallee Box [56773]	Endangered	Species or species habitat may occur within area
Gastrolobium papilio Butterfly-leaved Gastrolobium [78415]	Endangered	Species or species habitat may occur within area
Grevillea batrachioides Mt Lesueur Grevillea [21735]	Endangered	Species or species habitat may occur within area
Grevillea humifusa Spreading Grevillea [61182]	Endangered	Species or species habitat may occur within area
Hemiandra gardneri Red Snakebush [7945]	Endangered	Species or species habitat likely to occur within area
Isopogon uncinatus Albany Cone Bush, Hook-leaf Isopogon [20871]	Endangered	Species or species habitat likely to occur within area
Kennedia glabrata Northcliffe Kennedia [16452]	Vulnerable	Species or species habitat likely to occur within area
Kennedia lateritia Augusta Kennedia [45985]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Lambertia echinata subsp. occidentalis Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat may occur within area
Lambertia orbifolia Roundleaf Honeysuckle [15725]	Endangered	Species or species habitat likely to occur within area
Lechenaultia chlorantha Kalbarri Leschenaultia [16763]	Vulnerable	Species or species habitat likely to occur within area
Leucopogon obtectus Hidden Beard-heath [19614]	Endangered	Species or species habitat may occur within area
Macarthuria keigheryi Keighery's Macarthuria [64930]	Endangered	Species or species habitat likely to occur within area
Marianthus paralius [83925]	Endangered	Species or species habitat known to occur within area
Melaleuca sp. Wanneroo (G.J. Keighery 16705) [89456]	Endangered	Species or species habitat may occur within area
Microtis globula South-Coast Mignonette Orchid [6780]	Vulnerable	Species or species habitat likely to occur within area
Paracaleana dixonii Sandplain Duck Orchid [86882]	Endangered	Species or species habitat likely to occur within area
Pityrodia augustensis Mt Augustus Foxglove [4962]	Vulnerable	Species or species habitat likely to occur within area
Pneumatopteris truncata fern [68812]	Critically Endangered	Species or species habitat known to occur within area
Reedia spathacea Reedia [2995]	Critically Endangered	Species or species habitat known to occur within area
Sphenotoma drummondii Mountain Paper-heath [21160]	Endangered	Species or species habitat may occur within area
Stachystemon nematophorus Three-flowered Stachystemon [81447]	Vulnerable	Species or species habitat known to occur within area
Tectaria devexa [14767]	Endangered	Species or species habitat likely to occur within area
Thelymitra stellata Star Sun-orchid [7060]	Endangered	Species or species habitat likely to occur within area
Verticordia plumosa var. vassensis Vasse Featherflower [55804]	Endangered	Species or species habitat may occur within area
Wurmbea tubulosa Long-flowered Nancy [12739]	Endangered	Species or species habitat may occur within area
Reptiles		

Name	Status	Type of Presence
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Cryptoblepharus egeriae Christmas Island Blue-tailed Skink, Blue-tailed Snake-eyed Skink [1526]	Critically Endangered	Species or species habitat likely 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 known to occur within area
Cyrtodactylus sadleiri Christmas Island Giant Gecko [86865]	Endangered	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Egernia stokesii badia Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink [64483]	Endangered	Species or species habitat known to occur within area
Emoia nativitatis Christmas Island Forest Skink, Christmas Island Whiptail-skink [1400]	Critically Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat known to occur within area
Lepidodactylus listeri Christmas Island Gecko, Lister's Gecko [1711]	Critically Endangered	Species or species habitat known to occur within area
Liasis olivaceus barroni Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat known to occur within area
Liopholis pulchra longicauda Jurien Bay Skink, Jurien Bay Rock-skink [83162]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Ramphotyphlops exocoeti Christmas Island Blind Snake, Christmas Island Pink Blind Snake [1262]	Vulnerable	Species or species habitat likely 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

Name	Status	Type of Presence
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Glyphis garricki		
Northern River Shark, New Guinea River Shark [82454]	Endangered	Species or species habitat may occur within area
Pristis clavata		
Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Breeding known to occur within area
Pristis pristis		
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

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]		Breeding known 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]		Breeding known to occur within area
Ardenna grisea		
Sooty Shearwater [82651]		Species or species habitat may occur within area
Ardenna pacifica		
Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Calonectris leucomelas		
Streaked Shearwater [1077]		Species or species habitat known to occur within area
Diomedea amsterdamensis		
Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea antipodensis		
Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea dabbenena		
Tristan Albatross [66471]	Endangered	Species or species habitat likely to 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

Name	Threatened	Type of Presence
Fregata andrewsi Christmas Island Frigatebird, Andrew's Frigatebird [1011]	Endangered	Breeding known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Breeding known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Breeding 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
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 lepturus White-tailed Tropicbird [1014]		Breeding known to occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons Little Tern [82849]		Breeding known to occur within area
Sula dactylatra Masked Booby [1021]		Breeding known to occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Sula sula Red-footed Booby [1023]		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]	Endangered	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
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

Name	Threatened	Type of Presence
		within area
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Breeding known to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely 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 likely to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
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
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Foraging, feeding or related behaviour known to occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Breeding known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
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		
Cecropis daurica Red-rumped Swallow [80610]		Species or species habitat known to occur within area
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat known to occur

Name	Threatened	Type of Presence
		within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Roosting known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
[Numenius minutus](#) Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
[Numenius phaeopus](#) Whimbrel [849]		Roosting known to occur within area
[Pandion haliaetus](#) Osprey [952]		Breeding known to occur within area
[Phalaropus lobatus](#) Red-necked Phalarope [838]		Roosting known to occur within area
[Philomachus pugnax](#) Ruff (Reeve) [850]		Roosting known to occur within area
[Pluvialis fulva](#) Pacific Golden Plover [25545]		Roosting known to occur within area
[Pluvialis squatarola](#) Grey Plover [865]		Roosting known to occur within area
[Thalasseus bergii](#) Crested Tern [83000]		Breeding known to occur within area
[Tringa brevipes](#) Grey-tailed Tattler [851]		Roosting 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
[Tringa stagnatilis](#) Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
[Tringa totanus](#) Common Redshank, Redshank [835]		Roosting known to occur within area
[Xenus cinereus](#) Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth 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 -
Commonwealth Land - Christmas Island National Park
Defence - CAMPBELL BARRACKS - SWANBOURNE
Defence - EXMOUTH ADMIN & HF TRANSMITTING
Defence - EXMOUTH VLF TRANSMITTER STATION
Defence - GERALDTON TRAINING DEPOT "A" Company 16th Battalion
Defence - LANCELIN TRAINING AREA
Defence - LEARMONTH - AIR WEAPONS RANGE
Defence - LEARMONTH RADAR SITE - VLAMING HEAD EXMOUTH
Defence - SWANBOURNE RIFLE RANGE

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
[Ashmore Reef National Nature Reserve](#)	EXT	Listed place

Name	State	Status
Christmas Island Natural Areas	EXT	Listed place
Lancelin Defence Training Area	WA	Listed place
Learmonth Air Weapons Range Facility	WA	Listed place
Mermaid Reef - Rowley Shoals	WA	Listed place
Ningaloo Marine Area - Commonwealth Waters	WA	Listed place
Scott Reef and Surrounds - Commonwealth Area	EXT	Listed place
Historic		
Administrators House Precinct	EXT	Listed place
Bungalow 702	EXT	Listed place
Cape Leeuwin Lighthouse	WA	Listed place
Drumsite Industrial Area	EXT	Listed place
Geraldton Drill Hall Complex	WA	Listed place
HMAS Sydney II and HSK Kormoran Shipwreck Sites	EXT	Listed place
Industrial and Administrative Group	EXT	Listed place
Malay Kampong Group	EXT	Listed place
Malay Kampong Precinct	EXT	Listed place
Phosphate Hill Historic Area	EXT	Listed place
Poon Saan Group	EXT	Listed place
Settlement Christmas Island	EXT	Listed place
South Point Settlement Remains	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		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat known to occur within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous minutus Black Noddy [824]		Breeding known to occur within area
Anous stolidus Common Noddy [825]		Breeding known to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Breeding known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
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]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Cereopsis novaehollandiae grisea Cape Barren Goose (south-western), Recherche Cape Barren Goose [25978]	Vulnerable	Species or species habitat may occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to 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 within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat likely to 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
Eudyptula minor Little Penguin [1085]		Breeding known to occur within area

Name	Threatened	Type of Presence
Fregata andrewsi Christmas Island Frigatebird, Andrew's Frigatebird [1011]	Endangered	Breeding known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Breeding known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Breeding known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Roosting known to 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]		Roosting known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area
Hirundo daurica Red-rumped Swallow [59480]		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
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Motacilla cinerea Grey Wagtail [642]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known 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 known to occur within area
Pelagodroma marina White-faced Storm-Petrel [1016]		Breeding known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Breeding known to occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Breeding likely to occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Phalacrocorax fuscescens Black-faced Cormorant [59660]		Breeding likely to occur within area
Phalaropus lobatus Red-necked Phalarope [838]		Roosting known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Pterodroma macroptera Great-winged Petrel [1035]		Breeding 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		Breeding known to occur

Name	Threatened	Type of Presence
Shearwater [1043]		within area
Puffinus griseus		
Sooty Shearwater [1024]		Species or species habitat may 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]		Roosting known to occur within area
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat known to occur within area
Sterna albifrons		
Little Tern [813]		Breeding known 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
Stiltia isabella		
Australian Pratincole [818]		Roosting known to occur within area
Sula dactylatra		
Masked Booby [1021]		Breeding known to occur within area
Sula leucogaster		
Brown Booby [1022]		Breeding known to occur within area
Sula sula		
Red-footed Booby [1023]		Breeding known to occur within area
Thalassarche carteri		
Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta		
Shy Albatross [89224]	Endangered	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

Name	Threatened	Type of Presence
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
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Tringa totanus Common Redshank, Redshank [835]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Fish		
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area
Choeroichthys sculptus Sculptured Pipefish [66197]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Corythoichthys haematopterus Reef-top Pipefish [66201]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Cosmocampus maxweberi Maxweber's Pipefish [66209]		Species or species habitat may occur within area
Doryrhamphus baldwini Redstripe Pipefish [66718]		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 dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus macrorhynchus Whiskered Pipefish, Ornate Pipefish [66222]		Species or species habitat may occur within area
Halicampus mataafae Samoan Pipefish [66223]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
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
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
Hippichthys heptagonus Madura Pipefish, Reticulated Freshwater Pipefish [66229]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippichthys spicifer Belly-barred Pipefish, Banded Freshwater Pipefish [66232]		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
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Micrognathus brevirostris thorntail Pipefish, Thorn-tailed Pipefish [66254]		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
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
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
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Breeding known to 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
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus fuscus Dusky Seasnake [1119]		Species or species habitat known to occur within area
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

Name	Threatened	Type of Presence
		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
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		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
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
Enhydrina schistosa Beaked Seasnake [1126]		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 atriceps Black-headed Seasnake [1101]		Species or species habitat may occur within area
Hydrophis coggeri Slender-necked Seasnake [25925]		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
Lapemis hardwickii Spine-bellied Seasnake [1113]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat known to 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
Berardius arnuxii Arnoux's Beaked Whale [70]		Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		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	Breeding known 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

Name	Status	Type of Presence
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 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 hectori Hector's Beaked Whale [76]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Foraging, feeding or

Name	Status	Type of Presence
		related behaviour known to 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
Tasmacetus shepherdi Shepherd's Beaked Whale, Tasman Beaked Whale [55]		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

Commonwealth ReservesTerrestrial [Resource Information]

Name	State	Type
Christmas Island	EXT	National Park (Commonwealth)

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)
Argo-Rowley Terrace	National Park Zone (IUCN II)
Argo-Rowley Terrace	Special Purpose Zone (Trawl) (IUCN VI)
Ashmore Reef	Recreational Use Zone (IUCN IV)
Ashmore Reef	Sanctuary Zone (IUCN Ia)
Bremer	National Park Zone (IUCN II)
Bremer	Special Purpose Zone (Mining
Carnarvon Canyon	Habitat Protection Zone (IUCN IV)
Cartier Island	Sanctuary Zone (IUCN Ia)
Dampier	Habitat Protection Zone (IUCN IV)
Dampier	Multiple Use Zone (IUCN VI)
Dampier	National Park Zone (IUCN II)

Name	Label
Eighty Mile Beach	Multiple Use Zone (IUCN VI)
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)
Kimberley	Multiple Use Zone (IUCN VI)
Kimberley	National Park Zone (IUCN II)
Mermaid Reef	National Park Zone (IUCN II)
Montebello	Multiple Use Zone (IUCN VI)
Ningaloo	National Park Zone (IUCN II)
Ningaloo	Recreational Use Zone (IUCN IV)
Oceanic Shoals	Multiple Use Zone (IUCN VI)
Perth Canyon	Habitat Protection Zone (IUCN IV)
Perth Canyon	Multiple Use Zone (IUCN VI)
Perth Canyon	National Park Zone (IUCN II)
Shark Bay	Multiple Use Zone (IUCN VI)
South-west Corner	Habitat Protection Zone (IUCN IV)
South-west Corner	Multiple Use Zone (IUCN VI)
South-west Corner	National Park Zone (IUCN II)
South-west Corner	Special Purpose Zone (IUCN VI)
South-west Corner	Special Purpose Zone (Mining
Two Rocks	Multiple Use Zone (IUCN VI)
Two Rocks	National Park Zone (IUCN II)

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Airlie Island	WA
Barrow Island	WA
Bedout Island	WA
Beekeepers	WA
Bernier And Dorre Islands	WA
Bessieres Island	WA
Bold Park	WA
Boodie, Double Middle Islands	WA
Boullanger, Whitlock, Favourite, Tern And Osprey Islands	WA
Browse Island	WA
Bundegi Coastal Park	WA
Cape Range	WA
Chatham Island	WA
D'Entrecasteaux	WA
Dirk Hartog Island	WA
Drovers Cave	WA
Eclipse Island	WA
Escape Island	WA
Freycinet, Double Islands etc	WA
Gingilup Swamps	WA
Hamelin Island	WA
Jarrkunpungu	WA
Jinmarnkur	WA
Jinmarnkur Kulja	WA
Jurabi Coastal Park	WA
Kalbarri	WA
Karajarri	WA
Koks Island	WA
Kujungurru Warrarn	WA
Kujungurru Warrarn	WA
Lancelin And Edwards Islands	WA
Leeuwin-Naturaliste	WA
Lesueur	WA
Little Rocky Island	WA
Locker Island	WA
Lowendal Islands	WA
Montebello Islands	WA

Name	State
Mount Frankland South	WA
Muiron Islands	WA
Murujuga	WA
NTWA Bushland covenant (0013)	WA
Nambung	WA
Nanga Station	WA
Neerabup	WA
Nilgen	WA
North Sandy Island	WA
North Turtle Island	WA
Nyangumarta Warrarn	WA
Part Murchison house	WA
Port Gregory	WA
Rottnest Island	WA
Round Island	WA
Serrurier Island	WA
Southern Beekeepers	WA
Stockdill Road	WA
Tamala Pastoral Lease (Part)	WA
Torndirrup	WA
Unnamed WA11883	WA
Unnamed WA11962	WA
Unnamed WA26400	WA
Unnamed WA29777	WA
Unnamed WA31906	WA
Unnamed WA32478	WA
Unnamed WA33799	WA
Unnamed WA34039	WA
Unnamed WA36907	WA
Unnamed WA36909	WA
Unnamed WA36910	WA
Unnamed WA36913	WA
Unnamed WA36915	WA
Unnamed WA37338	WA
Unnamed WA37383	WA
Unnamed WA37500	WA
Unnamed WA40322	WA
Unnamed WA40828	WA
Unnamed WA40877	WA
Unnamed WA41080	WA
Unnamed WA41775	WA
Unnamed WA42030	WA
Unnamed WA44665	WA
Unnamed WA44667	WA
Unnamed WA44672	WA
Unnamed WA44676	WA
Unnamed WA44682	WA
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Unnamed WA44688	WA
Unnamed WA44705	WA
Unnamed WA45772	WA
Unnamed WA45773	WA
Unnamed WA48205	WA
Unnamed WA48858	WA
Unnamed WA49994	WA
Unnamed WA52366	WA
Unnamed WA53015	WA
Utcha Well	WA
Victor Island	WA
Walpole-Nornalup	WA
Wanagarren	WA
Wedge Island	WA
Yanchep	WA
Zuytdorp	WA

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
South West WA RFA	Western Australia

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		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		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
Gallus gallus Red Junglefowl, Feral Chicken, Domestic Fowl [917]		Species or species habitat likely to occur within area
Lonchura oryzivora Java Sparrow [59586]		Species or species habitat likely to occur within area
Meleagris gallopavo Wild Turkey [64380]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pavo cristatus Indian Peafowl, Peacock [919]		Species or species habitat likely to occur within area
Phasianus colchicus Common Pheasant [920]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		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
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
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 asinus Donkey, Ass [4]		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
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		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 norvegicus Brown Rat, Norway Rat [83]		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		
Andropogon gayanus Gamba Grass [66895]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax,		Species or species

Name	Status	Type of Presence
Florist's Smilax, Smilax Asparagus [22473]		habitat likely to occur within area
Asparagus declinatus		
Bridal Veil, Bridal Veil Creeper, Pale Berry Asparagus Fern, Asparagus Fern, South African Creeper [66908]		Species or species habitat likely to occur within area
Asparagus plumosus		
Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Asparagus scandens		
Asparagus Fern, Climbing Asparagus Fern [23255]		Species or species habitat likely to occur within area
Brachiaria mutica		
Para Grass [5879]		Species or species habitat may occur within area
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
Chrysanthemoides monilifera subsp. monilifera		
Boneseed [16905]		Species or species habitat likely to occur within area
Cylindropuntia spp.		
Prickly Pears [85131]		Species or species habitat likely to occur within area
Genista linifolia		
Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana		
Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana		
Broom [67538]		Species or species habitat may occur within area
Jatropha gossypifolia		
Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
Lantana camara		
Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to 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
Parkinsonia aculeata		
Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Pinus radiata		
Radiata Pine Monterey Pine, Insignis Pine, Wilding		Species or species

Name	Status	Type of Presence
Pine [20780]		habitat may occur within area
Prosopis spp.		
Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate		
Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla		
Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii		
Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta		
Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla		
Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Ulex europaeus		
Gorse, Furze [7693]		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
Lycodon aulicus		
Wolf Snake, Common Wolf Snake, Asian Wolf Snake [83178]		Species or species habitat likely to occur within area
Lygosoma bowringii		
Christmas Island Grass-skink [1312]		Species or species habitat likely to occur within area
Ramphotyphlops braminus		
Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
"The Dales", Christmas Island	EXT
Ashmore Reef	EXT
Broke Inlet System	WA
Bundera Sinkhole	WA
Cape Leeuwin System	WA
Cape Range Subterranean Waterways	WA
De Grey River	WA
Eighty Mile Beach System	WA
Gingilup-Jasper Wetland System	WA
Herdsman Lake	WA
Hosine's Spring, Christmas Island	EXT
Hutt Lagoon System	WA
Lake MacLeod	WA
Lake Thetis	WA
Learmonth Air Weapons Range - Saline Coastal Flats	WA
Leslie (Port Hedland) Saltfields System	WA
Loch McNess System	WA
Mermaid Reef	EXT
Murchison River (Lower Reaches)	WA
Rottnest Island Lakes	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
Ashmore Reef and Cartier Island and surrounding	North-west
Canyons linking the Argo Abyssal Plain with the	North-west
Canyons linking the Cuvier Abyssal Plain and the	North-west
Carbonate bank and terrace system of the Sahul	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
Mermaid Reef and Commonwealth waters	North-west
Pinnacles of the Bonaparte Basin	North-west
Seringapatam Reef and Commonwealth waters in	North-west
Wallaby Saddle	North-west
Albany Canyons group and adjacent shelf break	South-west
Ancient coastline at 90-120m depth	South-west
Cape Mentelle upwelling	South-west
Commonwealth marine environment surrounding	South-west
Commonwealth marine environment surrounding	South-west
Commonwealth marine environment within and	South-west
Diamantina Fracture Zone	South-west
Naturaliste Plateau	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

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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.

Department of Agriculture Water and the Environment
GPO Box 858
Canberra City ACT 2601 Australia
+61 2 6274 1111

Appendix C.4 MDO Spill MEZ

Australian Government

Department of Agriculture, Water and the Environment

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.

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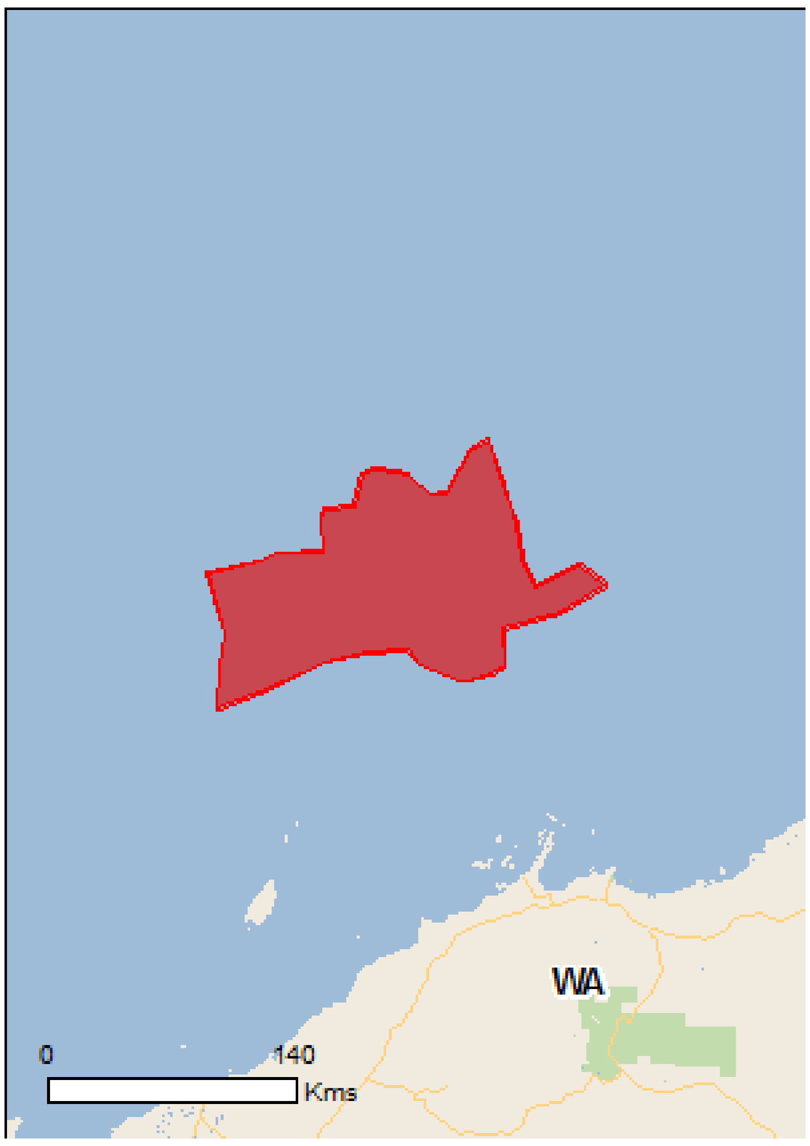

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Coordinates
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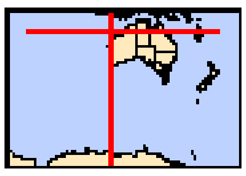


Summary

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:	17
Listed Migratory Species:	31

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:	56
Whales and Other Cetaceans:	25
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)	3

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
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	Species or species habitat may 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	Migration route known to occur within area
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Breeding known 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	Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
Sharks		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area

Name	Threatened	Type of Presence
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 may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat likely to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis 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

Name	Threatened	Type of Presence
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		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
Fish		

Name	Threatened	Type of Presence
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
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
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 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

Name	Threatened	Type of Presence
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
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
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely 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 likely 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 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	Species or species habitat 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 borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species

Name	Status	Type of Presence
		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 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
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 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
Ancient coastline at 125 m depth contour	North-west
Continental Slope Demersal Fish Communities	North-west
Glomar Shoals	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

-19.6324 115.71346,-19.77707 115.37463,-19.85131 115.17095,-19.66095 115.18046,-19.49724 115.21092,-19.21361 115.11955,-19.15432 115.38898,-19.1172 115.48131,-19.10863 115.70783,-18.94902 115.69651,-18.9055 115.71942,-18.89693 115.86123,-18.73608 115.90787,-18.71419 115.95927,-18.72656 116.08205,-18.74274 116.13344,-18.83411 116.24195,-18.83268 116.32904,-18.62139 116.45324,-18.5757 116.53938,-18.78319 116.60981,-18.97736 116.68024,-19.14344 116.70499,-19.27669 116.7759,-19.17628 117.00575,-19.25956 117.12596,-19.27193 117.12787,-19.39275 116.90349,-19.47306 116.61081,-19.65302 116.62089,-19.69204 116.55998,-19.72059 116.43434,-19.72059 116.39818,-19.64572 116.19697,-19.57323 116.13231,-19.59052 115.92286,-19.6324 115.71346

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.

Department of Agriculture Water and the Environment
GPO Box 858
Canberra City ACT 2601 Australia
+61 2 6274 1111

Appendix C.5 MDO Spill EMBA

Australian Government
Department of Agriculture, Water and the Environment

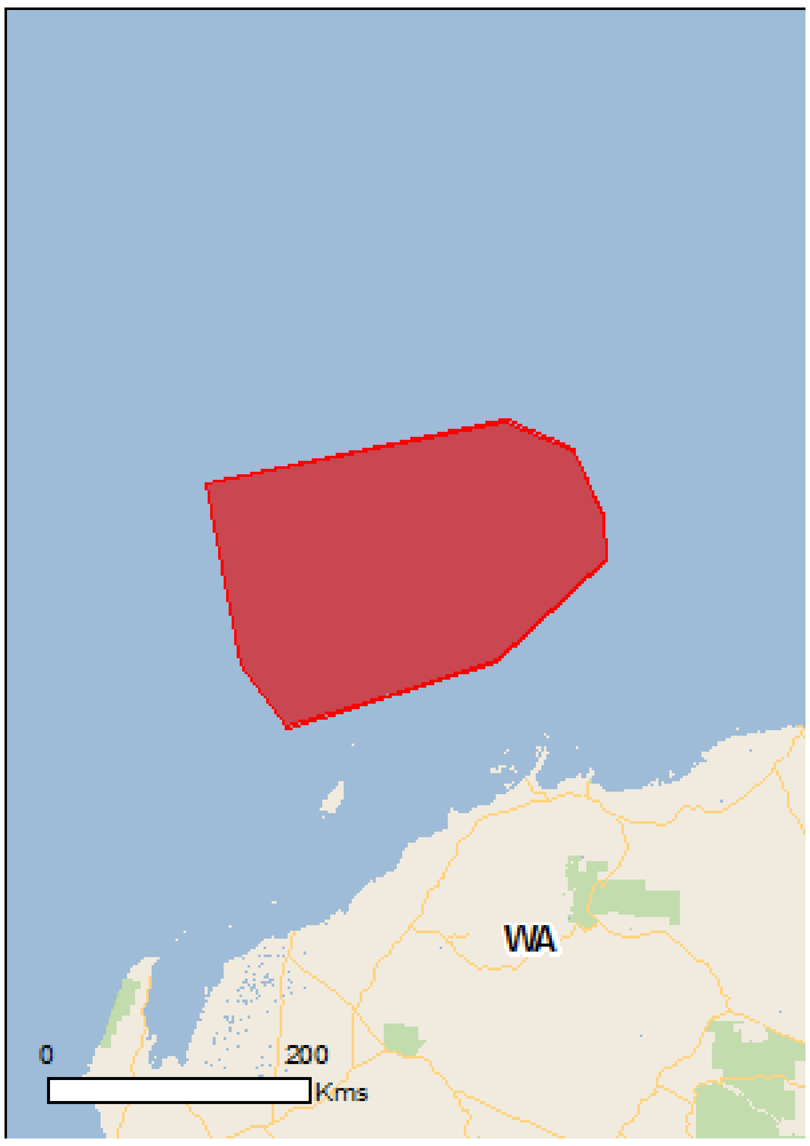
EPBC Act Protected Matters Report

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: 01/10/20 08:33:08



Coordinates
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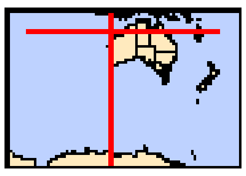

Summary

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:	36

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	70
Whales and Other Cetaceans:	27
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	1

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)	3

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	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area

Name	Status	Type of Presence
Reptiles		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	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 likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Sharks		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		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
Migratory Marine Species		

Name	Threatened	Type of Presence
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Dugong dugon Dugong [28]		Species or species habitat likely 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 likely to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		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
Fish		
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		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
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Species or species habitat likely to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur

Name	Threatened	Type of Presence
		within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
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	Species or species habitat known to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis czeblukovi Fine-spined Seasnake [59233]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis 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	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	Migration route known to occur within area

Name	Status	Type of Presence
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
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia 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 may 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

Name	Status	Type of Presence
		habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
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
Montebello	Multiple Use Zone (IUCN VI)

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
Ancient coastline at 125 m depth contour	North-west
Continental Slope Demersal Fish Communities	North-west
Glomar Shoals	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

-18.73669 114.52092,-18.32948 116.58171,-18.52174 117.04428,-18.95493 117.2472,-19.22904 117.26433,-19.88387 116.51623,-20.31588 115.07261,-19.91452 114.75113,-18.73669 114.52092

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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

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Please feel free to provide feedback via the Contact Us page.

Department of Agriculture Water and the Environment
GPO Box 858
Canberra City ACT 2601 Australia
+61 2 6274 1111

Appendix D – Existing Environment of the EMBA

SapuraOMV Upstream (Western Australia) Pty Ltd.

SapuraOMV Kanga-1 Exploration Well Environment Plan
Appendix D - Existing Environment of the EMBA

November 2020

Table of contents

Table index

Figure index

1. Introduction

The worst-case spill modelling results for low hydrocarbon thresholds, as defined in 'NOPSEMA Bulletin #1 Oil Spill Modelling' (NOPSEMA, 2019), were used as a predictive tool to set the geographical boundaries of the environment that may be affected (EMBA) by surface, subsurface and shoreline hydrocarbons from a loss of well control (LOWC) event at the Kanga-1 well site. This Appendix provides an overview of the environmental receptors that may be contacted by hydrocarbons within the EMBA. In addition, moderate thresholds (NOPSEMA, 2019) were used to define the outer boundaries of the moderate exposure zone (MEZ) which represents the spatial extent where hydrocarbon contact has the potential to cause impacts to receptors. This Appendix provides a comprehensive description of the relevant values and sensitivities of the marine environment within the MEZ from a LOWC event.

The description of environmental values provided in this Appendix was sourced from peer reviewed journals, and government and industry reports. The key sources of information referred to in this Appendix are from the Department of Agriculture, Water and the Environment (DAWE) resources and published literature. These resources were used to identify ecological, heritage, socio-economic and cultural environments, their associated values and sensitivities, and their presence in the MEZ and EMBA. These key sources included, but are not limited to:

- An EPBC Act Protected Matters Database search was conducted to identify matters of national environmental significance (MNES) and other matters protected under the EPBC Act occurring in the MEZ and EMBA (see **Appendix C).** Relevant DAWE websites, publications and peer-reviewed scientific publications were accessed for conservation values of these matters;
- DAWE Species Profile and Threats (SPRAT) Database, which includes information about species, ecological communities and key ecological features (KEFs) protected under the EPBC Act;
- National Conservation Values Atlas, which includes information on Biologically Important Areas (BIAs) for protected species under the EPBC Act;
- Species recovery plans, published conservation advice and peer-reviewed scientific publications; and
- State and Commonwealth online and published fisheries reports.

2. Regional Overview

Australia's offshore waters have been divided into six broad marine bioregions in order to facilitate their management by the Australian Government under the EPBC Act. Marine Bioregional Plans describe the marine environment and conservation values of each marine region, set out broad biodiversity objectives, identify regional priorities and outline strategies and actions to address these priorities.

The MEZ/EMBA intersect with the North-West Marine Region (NWMR) and the South-West Marine Region (SWMR). The Bioregional Plans for the NWMR (DSEWPaC, 2012a) and SWMR (DSEWPaC, 2012b) have been used in conjunction with other relevant management plans, reports and published papers to inform the description of the existing environment.

Based on the Integrated Marine and Coastal Regionalisation of Australia (IMCRA) Version 4.0, there are 15 bioregions that occur within the MEZ/EMBA (**Table 2-1**). These bioregions are based on fish, benthic habitat and oceanographic data (IMCRA v. 4.0).

Table 2-1 Bioregions within the MEZ and EMBA

Name	Presence	
	MEZ	EMBA
North-West Marine Region		
Northwest Shelf Transition	✓	✓
Northwest Shelf Province	✓	✓
Northwest Province	✓	✓
Northwest Transition	✓	✓
Timor Province	✓	✓
Central Western Transition	✓	✓
Central Western Shelf Transition	✓	✓
Central Western Shelf Province	✓	✓
South-West Marine Region		
Central Western Province	✓	✓
Southwest Shelf Transition	✓	✓
Southwest Transition	✓	✓
Southwest Shelf Province	✓	✓
Southern Province	✓	✓
Other		
Christmas Island Province	✓	✓
Cocos (Keeling) Island Province	✓	✓

2.1 North-West Marine Region

The NWMR comprises Commonwealth waters from the Western Australia–Northern Territory border to Kalbarri, south of Shark Bay. The region's north-western boundary is defined in accordance with the Perth Treaty negotiated with the Republic of Indonesia and includes areas over which Australia exercises jurisdiction over both the water column and the seabed and its associated resources (DSEWPaC, 2012a).

The NWMR is characterised by shallow-water tropical marine ecosystems with high species richness. High diversity is partly driven by the interaction between seafloor features and the currents of the region. The high species richness is also thought to be associated with the diversity of habitats available. The region has generally low productivity, with boom and bust cycles driven by monsoonal seasonality. Because the region is relatively shallow, surface currents exert a strong influence, and the region is dominated by the Indonesian Throughflow. Another important factor driving the ecological processes in the region is the strong seasonality in wind direction and rainfall. One of the most unusual and significant oceanographic features of the region is the occurrence of internal waves. Internal waves are large in amplitude and encourage the mixing of surface waters with deeper, more nutrient-rich waters, which is important for biological productivity in the region (DSEWPaC, 2012a).

2.1.1 Northwest Shelf Transition

The Northwest Shelf Transition extends from Cape Leveque to the eastern end of Melville Island (in the North Marine Region). The Indonesian Throughflow is the dominant oceanographic feature and dominates the majority of the water column (DEWHA, 2008a).

The vast majority of the provincial bioregion is located on the continental shelf with water depths generally in the range 10–100 m. The provincial bioregion has a complex seafloor topography with a diversity of features including submerged terraces, carbonate banks, pinnacles, reefs and sand banks. The carbonate banks and pinnacles of the Joseph Bonaparte Gulf are distinctly different in morphology and character to other parts of the Region, and are believed to support a high diversity of marine species (DEWHA, 2008a).

The biological communities of the Northwest Shelf Transition are typical of Indo-west Pacific tropical flora and fauna, and occur across a range of soft-bottom and harder substrate habitats. The inshore waters off the Kimberley are where the Western Australian (WA) population of humpback whales mate and give birth. The Northwest Shelf Transition is important for commercial fisheries, defence, and the petroleum industry (DEWHA, 2008a).

2.1.2 Northwest Shelf Province

This provincial bioregion is located primarily on the continental shelf between North West Cape and Cape Bougainville. It varies in width from about 50 km at Exmouth Gulf to more than 250 km off Cape Leveque. About half the bioregion has water depths of only 50–100 m. The bioregion is a dynamic oceanographic environment, influenced by strong tides, cyclonic storms, long-period swells and internal tides. Its waters derive from the Indonesian Throughflow, are warm and oligotrophic, and circulate throughout the bioregion via branches of the South Equatorial and Eastern Gyral Currents (DEWHA, 2008a).

Fish communities are diverse and both benthic and pelagic fish communities appear to be closely associated with different depth ranges. Humpback whales migrate through the bioregion and Exmouth Gulf is an important resting area, particularly for mothers and calves on their southern migration. A number of important seabird breeding sites are located in the bioregion (but adjacent to Commonwealth waters), including Eighty Mile Beach, the Lacepede Islands, and Montebello and Barrow islands. The bioregion is important for the petroleum industry and the location of commercial fishing operations. The nationally significant ports of Dampier and Port Hedland operate in this bioregion (DEWHA, 2008a).

2.1.3 Northwest Province

This provincial bioregion occurs offshore between Exmouth and Port Hedland and consists entirely of continental slope. Water depths generally range between 1000–3000 m. The dominant geomorphic feature is the Exmouth Plateau, while the Montebello Trough and Swan Canyon are also important features. It contains the steepest shelf break in the Marine Region along the Cape Range Peninsula near Ningaloo Reef. Circulation and recirculation (via the South Equatorial Current) of Indonesian Throughflow waters comprise the dominant surface flow. The predominantly southward moving surface waters consolidate along the narrow shelf break adjacent to Cape Range Peninsula to form the Leeuwin Current, a significant feature of this bioregion and those further south (DEWHA, 2008a).

The canyons in this bioregion probably channel currents onto the Exmouth Plateau and certainly onto the shelf along Ningaloo Reef, resulting in enhanced localised biological production. The Northwest Province represents the beginning of a transition between tropical and temperate marine species. High endemism in demersal fish communities on the slope is also evident in this provincial bioregion. Commercial fishing and petroleum are important industries in some parts of the bioregion (DEWHA, 2008a).

2.1.4 Northwest Transition

This provincial bioregion includes shelf break and continental slope and the majority of the Argo Abyssal Plain included in the NWMR. Key topographic features include the Mermaid, Clerke and Imperieuse Reefs, all of which are marine reserves and together constitute the Rowley Shoals. Surface circulation of Indonesian Throughflow waters occurs both via direct southward movement of the Throughflow itself, and recirculation of Throughflow waters via the South Equatorial Current. Cyclone incidence is high in this bioregion during summer months (DEWHA, 2008a).

Little is known about benthic biological communities in the deeper parts of the provincial bioregion, although high levels of species diversity and endemism have been identified among demersal fish communities on the continental slope. The Rowley Shoals are biodiversity hotspots in the bioregion and the steep change in slope around them attracts a range of pelagic migratory species including billfish, sharks, tuna and cetaceans. Commercial fishers operate within the bioregion and it may increase in importance for the petroleum industry in the future (DEWHA, 2008a).

2.1.5 Timor Province

This provincial bioregion covers almost 15 per cent of the NWMR, predominantly covering the continental slope and abyss between Broome and Cape Bougainville. Water depth ranges from about 200 m near the shelf break to 5920 m over the Argo Abyssal Plain. In addition to the Argo Abyssal Plain, the major geomorphic features are the Scott Plateau, the Ashmore Terrace, part of the Rowley Terrace and the Bowers Canyon. Ashmore Reef, Cartier Island, Seringapatam Reef and Scott Reef are important features of the provincial bioregion (DEWHA, 2008a).

The bioregion is dominated by the warm, oligotrophic waters of the Indonesian Throughflow. The thermocline in the water column in this bioregion is particularly pronounced and is associated with the generation of internal tides, an important oceanographic feature of this bioregion. The variety of geomorphic features in the Timor Province, together with the variation in bathymetry, results in several distinct habitats and biological communities, many of which are in close proximity to each other. The reefs and islands of the bioregion are regarded as particular hotspots for biodiversity. A high level of endemicity exists in demersal fish communities of the continental slope in the Timor Province and two distinct communities have been identified – one associated with the upper slope, the other with the mid slope. The bioregion is important for the petroleum industry, and commercial fisheries operate within it (DEWHA, 2008a).

2.1.6 Central Western Transition

This provincial bioregion covers the continental slope and abyss between Shark Bay and North West Cape. The major geomorphic features of the bioreg on are the Wallaby Saddle, Carnarvon Terrace, the Cuvier Abyssal Plain and the Cloates and Cape Range Canyons. Almost half the bioregion has water depths of more than 4000 m and the proximity of deep ocean areas to the continental slope and shelf may have resulted in distinctive biological communities (DEWHA, 2008a).

The Leeuwin Current, flowing south along the slope, is the dominant oceanographic feature. Interactions between the Leeuwin Current, Leeuwin Undercurrent and the nearshore Ningaloo Current facilitate vertical mixing of water layers and are believed to be associated with sporadic bursts in productivity (particularly during summer). The level of endemism within demersal fish communities on the slope is less than in the bioregions further north. This bioregion is also within the biogeographic transition between tropical and temperate marine species. The major industries in the bioregion are commercial fishing and petroleum (DEWHA, 2008a).

2.1.7 Central Western Shelf Transition

This is the smallest provincial bioregion n the NWMR and is located entirely on the continental shelf between North West Cape and Coral Bay. Although both the Leeuwin Current and the Leeuwin Undercurrent occur on the adjacent slope, this bioregion is strongly influenced by the interactions between these currents and the nearshore, northward flowing Ningaloo Current (DEWHA, 2008a).

The bioregion is located within a significant biogeographic transition between tropical and temperate species. A large proportion of the bioregion is covered by the Ningaloo Marine Park, and Ningaloo Reef is an area of high biodiversity with over 200 species of coral and more than 460 species of reef fish. Marine turtles, dugongs and dolphins frequently visit the reef lagoon and whale sharks and manta rays visit the outer reef. Commercial fishing and petroleum are the major industries in the bioregion (DEWHA, 2008a).

2.1.8 Central Western Shelf Province

This bioregion consists of the continental shelf between Kalbarri and Coral Bay. Most of the bioregion varies in depth between 50–100 m and has a predominantly flat, sandy substrate. The main currents are the Leeuwin (centred on the shelf break), the Ningaloo (which originates around the mouth of Shark Bay and flows north, and the northern extreme of the wind-driven Capes Current. In addition, during summer seepage out of Shark Bay of hypersaline water occurs and is known as the Shark Bay Outflow (DEWHA, 2008a).

The bioregion abuts the Shark Bay World Heritage Area, a globally important area for dugongs. Commercial fishing and petroleum are the main industries in the bioregion (DEWHA, 2008a).

2.2 South-West Marine Region

The SWMR comprises Commonwealth waters from the eastern end of Kangaroo Island in South Australia to Shark Bay in WA. The marine environment of the SWMR has high biodiversity and large numbers of species native to the region (known as endemism). The region is increasingly recognised as an area of global conservation significance for species of rare and endangered marine mammals and seabirds. The biological productivity of the SWMR is low in comparison with other marine regions. The most significant known influence on ecosystem structure and function in the SWMR is the Leeuwin Current. The current is stronger in winter than in summer and has three main influences: suppressing upwelling, maintaining warm-water communities much further south than they would normally occur, and driving inter annual variability in settlement of western rock lobster (DSEWPaC, 2012b).

2.2.1 Central Western Province

This offshore bioregion extends from the Southwest Shelf Transition to the limit of the Australian Exclusive Economic Zone (EEZ). The continental slope is cut by numerous canyons, including the Perth Canyon, the largest of Australia's submarine canyons. The bioregion is characterised by numerous eddies (circulating bodies of water, about 200-300 kilometres in diameter) that detach from the Leeuwin Current, trapping shallow water biological communities and nutrients and transporting them offshore. The Perth Canyon appears to be an important ecological feature attracting krill and fish aggregations that in turn attract larger species such as predatory fish and pygmy blue whales. This bioregion is of high value for recreational and commercial fishers and is important for shipping and defence training (DEWHA, 2008b).

2.2.2 Southwest Shelf Transition

This bioregion covers the continental shelf extending seaward from Kalbarri to Perth. Its ecology is heavily influenced by the Leeuwin Current, which carries subtropical and tropical species southward. Here they mix with temperate species to form diverse and unique biological communities, such as those surrounding the Houtman Abrolhos Islands. Adjoining one of the most populated coastal areas of the south-west, this bioregion is critical to a number of industries and other activities, including fishing (particularly for western rock lobster), defence and, more recently, petroleum production (DEWHA, 2008b).

2.2.3 Southwest Transition

This is one of the SWMR's least researched bioregions. It is dominated by the Naturaliste Plateau, a large extension of the continental plate, which adjoins the continental slope through the Naturaliste Trough. Little biological sampling has been conducted here due to its remoteness and rough waters, but based on its characteristics and data from elsewhere in the world, scientists believe that the Plateau hosts rich and diverse biological communities. Recently, a number of exploratory surveys of the seafloor have been undertaken to test the petroleum prospectivity (DEWHA, 2008b).

2.2.4 Southwest Shelf Province

This bioregion extends over a long stretch of continental shelf from Fremantle in the north around to Point Dempster, east of Esperance, in the south. Marine life in the bioregion is very diverse and clearly influenced by the warm waters of the Leeuwin Current. It includes globally important biodiversity hotspots, such as the waters off Geographe Bay and those surrounding the Recherche Archipelago. This bioregion is important to the petroleum industry, shipping, marine tourism, and charter, recreational and commercial fishing (DEWHA, 2008b).

2.2.5 Southern Province

This bioregion covers almost half the Region and extends offshore from the south-west corner of the Australian mainland across to the eastern boundary of the SWMR. Submarine canyons and the Diamantina Fracture Zone are key ecological features of the Southern Province. Some of these canyons are important aggregation areas for a range of species, including commercially fished species, deepdiving toothed whales, dolphins and New Zealand fur seals. There are a number of prospective areas for oil and gas in the bioregion (DEWHA, 2008b).

2.3 Christmas Island Province

This bioregion surrounds Christmas Island and covers a total area of 277,180 km^2 with water depths ranging from 0 - 6,545 m. This bioregion contains the fourth largest abyssal plain/deep ocean floor area and smallest area of slope of all the bioregions (DEH, 2005b). Waters support a suite of marine species typical of Indian Ocean tropical reefs. The recorded marine species diversity includes 88 coral species and over 600 fish species, including the whale shark (*Rhincodon typus*) and several other shark species, as well as hybrid fish. The green turtle (*Chelonia mydas*) and hawksbill turtle (*Eretmochelys imbricata*), are found in the offshore waters (DNP, 2014).

2.4 Cocos (Keeling) Island Province

This bioregion surrounds Cocos (Keeling) Island and covers a total area of 467,260 km^2 with water depths ranging from 0-6,468 m. This bioregion contains the largest abyssal plain/deep ocean floor area of all the bioregions. Due to the similar geomorphology and location adjacent to Indonesia, the fauna contained in this bioregion is probably similar or related to the fauna associated with the Christmas Island Province (DEH, 2005c).

3. Physical Environment

3.1 Climate and Meteorology

3.1.1 Air Temperature

Waters in northern WA predominantly lie in the arid tropics, with mean air temperatures ranging from a minimum of 11°C in winter to a maximum of 36°C in summer (Condie et al. 2006). Waters in the south-west and southern WA experience a Mediterranean style climate. In winter, with warm wind from the north, the temperature can exceed 20°C, while at other times, a bit of cold air of Antarctic origin can arrive, lowering the night temperature almost to freezing. During summer, hot and dry wind from the north-east, which comes from the desert, can become really intense, with air temperatures reaching above 40°C.

3.1.2 Winds

In northern WA, the summer and winter seasons fall into the periods September–March and May–July, respectively. Winds typically vary seasonally, with a tendency for winds to come from south-westerly during summer months and south-easterly in winter (**Figure 3-1**) (Condie et al. 2006). Transitional wind periods, during which either pattern may predominate, can be experienced in April–May and September of each year. Summer winds are more variable, and driven by high pressure cells that pass from west to east over the Australian continent. During winter months the relative position of the high pressure cells moves further north, leading to prevailing easterly winds blowing from the mainland (Pearce et al. 2003).

The south-west and southern WA wind patterns are characterised by a prevailing westerly wind stream in winter. This enables winter cold fronts and strong westerly winds to regularly penetrate the south-west, with cold fronts crossing the coast every week or so. Apart from the passage of storms, the weather is otherwise mild in winter with winds variable and relatively weak. In summer, cold fronts rarely penetrate into the south of the state with any strength and hot easterly winds prevail.

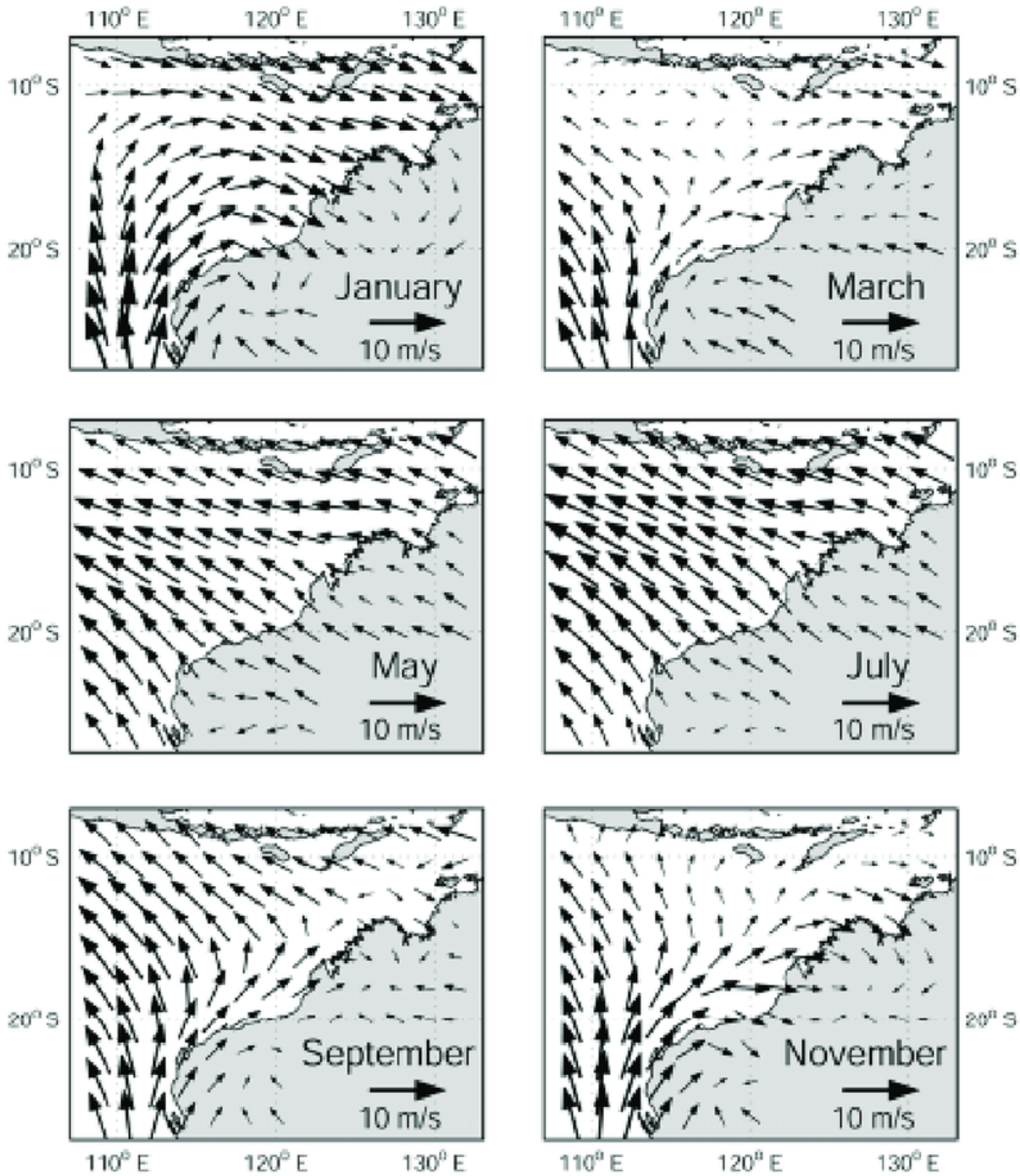


Figure 3-1 Seasonally averaged winds in northwest Australia (Condie et al. 2006)

3.1.3 Tropical Cyclones

Tropical cyclones are low pressure systems that form over warm tropical waters and have well defined wind circulations of at least gale force strength (sustained winds of 63 km/h or greater with gusts in excess of 90 km/h) (BoM, 2020b). The Australian cyclone season officially runs from November to April, although very few have occurred in November. Tropical cyclones in the Australian region are influenced by several factors, and in particular variations in the El Niño – Southern Oscillation. In general, more tropical cyclones cross the coast during La Niña years, and fewer during El Niño years. On average about eleven cyclones form in the Australian region (90-160° E) each cyclone season (BoM, 2020b).

Figure 3-2 shows the average number of tropical cyclones through the Australian region and surrounding waters in El Niño, La Niña, neutral years and using all years of data. The data are based on a 48-year period from the 1969/70 to 2017/18 tropical cyclone season.

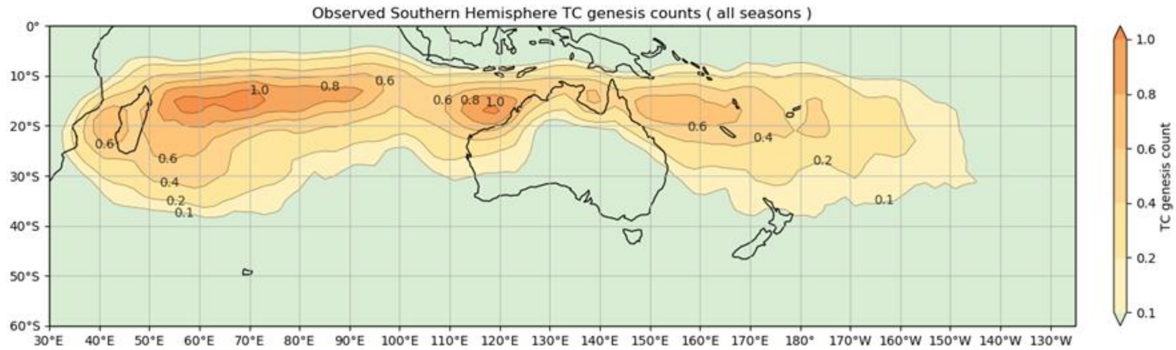


Figure 3-2 Average number of tropical cyclones in Australia from 1969 to 2018 (BoM, 2020b)

3.1.4 Rainfall

The NWMR has a pronounced monsoon season between December and March, which brings with it heavy rainfall. Historical rainfall data shows the highest mean monthly rainfall occurs from January to March (BoM, 2020a). In the SWMR, historical rainfall data indicate that the highest rainfall occurs in winter (June-August), while the lowest rainfall occurs in summer (December to February) (Charles et al*.* 2010).

3.2 Oceanography

The NWMR region is a dynamic oceanographic environment, influenced by strong tides, cyclonic storms, long-period swells and internal tides (DEWHA, 2008a), while the SWMR has a complex an unusual oceanographic patterns, driven largely by the Leeuwin Current and its associated currents (DEWHA, 2008b).

3.2.1 Currents

3.2.1.1 North-West Marine Region

The NWMR is influenced by a complex system of ocean currents that change between seasons and between years, which generally result in its surface waters being warm and nutrient-poor, and of low salinity (DEWHA, 2008a). Two ocean and coastal currents in the WA region are significant in shaping marine environmental conditions and climate. Forming on the North West Shelf (NWS), the Leeuwin Current exerts a major influence on the distribution of marine life and WA's weather. The Indonesian Throughflow is a system of currents that carries water westward from the Pacific to the Indian Ocean through the deep passages and straits of the Indonesian Archipelago. This is the only place in the world where warm, equatorial waters flow from one ocean to another, and this warm tropical water influences the character of the Leeuwin Current (CSIRO, 2020). **Figure 3-3** represents key patterns of ocean currents around Australia.

Currents within the shallow nearshore waters are primarily driven by the prevailing wind regime, resulting in almost exclusively northward flow between October and February, as a result of the dominant southerly winds prevailing during the summer months, and dominantly southward in winter (DEHWA, 2008a).

3.2.1.2 South-West Marine Region

Similar to the NWMR, the SWMR is influenced by a complex system of ocean currents (DEWHA, 2008b). The Leeuwin Current however has a major influence on the biological productivity of ecosystems and biodiversity in the region. It originates in tropical waters of the Indian Ocean as a result of a large-scale difference in water density between warmer, lower salinity waters flowing through the Indonesian Archipelago and the cooler more saline waters off south-western Australia (DEHWA, 2008b). The Leeuwin current flows all year round although the strength of the flow is significantly stronger in winter and weaker in the summer (DEHWA, 2008b). The Leeuwin Current originates in the tropical waters of the Indian Ocean as the result of a large-scale difference in water density between the warmer, low salinity waters flowing through the Indonesian Archipelago and the cooler, more saline ocean waters off south-western Australia (DEHWA, 2008b). Meso-eddies are formed through the interaction of the Leeuwin Current with seafloor features at the shelf break (DEHWA, 2008b).

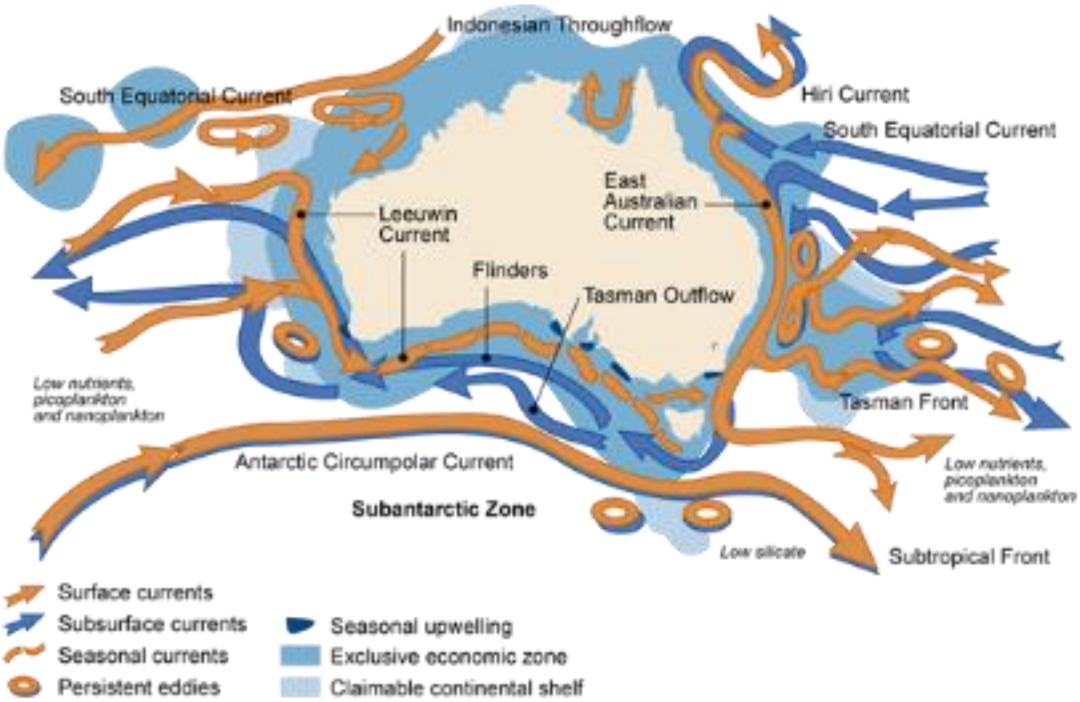


Figure 3-3 Ocean currents surrounding Australia (CoA, 2013)

3.2.2 Tides and Waves

3.2.2.1 North-West Marine Region

The tides of the region are mixed and predominantly semi-diurnal (two high tides and two low tides per day), with well-developed spring to neap tidal variation (DEWHA, 2008a). The NWMR has some of the largest tides in Australia, with an increase in amplitude from south to north, which corresponds with the increasing width of the shelf (Holloway, 1983). Tides and winds strongly influence water flow in the coastal zone and over the inner to mid-shelf, whereas flows over the outer-shelf, slope, rise and deeper waters are influenced by large scale regional circulation (DEWHA, 2008a).

Perhaps one of the most unique features of the NWMR is the occurrence of internal waves. Internal waves are dynamic, episodic events, which are strongly influenced by topography and generated by internal tides (DEWHA, 2008a). Internal tides occur at the thermocline, where the warm, low salinity waters of the Indonesian Throughflow overlay colder, more saline, deeper ocean waters. Internal tides are large in scale, frequently occurring across an ocean basin and forced by the gravitational pull of the moon and sun (DEWHA, 2008a).

Waves within the NWMR reflect the direction of the synoptic winds. They flow predominantly from the south-west in the summer and from the east in winter (Pearce et al. 2003). Only 10% of significant wave heights off Dampier exceed 1.2 m, with the average wave height being 0.7 m (Pearce et al. 2003).

3.2.2.2 South-West Marine Region

In the SWMR, swell and storm waves from the Southern and Indian Oceans are dominant on the Rottnest Shelf. Swell waves up to 2 m high comes from the west and south-west throughout the year. Storm waves up to 10 m high generate significant seas on the southern Rottnest Shelf in winter and spring (Richardson et al. 2005). Tides in the Rottnest province are microtidal and has a range of <0.5 m (Richardson et al. 2005). Similarly, the South West province has a small tidal range of <0.5 m around Albany and 0.7 m around Esperance (Sanderson et al. 2002 cited in Richardson et al. 2005). High modal, deep water waves and long period swells waves from the southwest are predominant in the South West Province. Wave heights have been recorded to reach up to >2.5 m around Cape Leeuwin, where the coast is most exposed to the southwest swell (Richardson et al. 2005).

3.2.3 Water Quality

3.2.3.1 North-West Marine Region

The NWMR is an oligotrophic environment (Holloway et al. 1985). Nutrient enrichment of the shelf occurs through river runoff, tidal mixing, internal tides, low frequency circulation, upwelling, and tropical cyclones that induce oceanic mixing and further upwelling (Holloway et al. 1985). The Leeuwin current maintains warm sea surface temperatures that inhibit the establishment of macrophyte communities that compete with reef building organisms (Hatcher, 1991) and contribute to the transportation of reef larvae and propagules down the west coast of Australia.

3.2.3.2 South-West Marine Region

On the northern Rottnest Shelf of the SWMR, sea surface temperatures range from 18°C in winter to 26°C in summer (Richardson et al. 2005). Temperatures fall below 20°C for up to 20% of the year (Richardson et al. 2005). On the southern Rottnest Shelf, sea water temperature ranges from 15–20°C, with very little variation in temperature with depth. The Leeuwin current is known to bring relatively warm, low-salinity, nutrient-poor water from the tropics into the SWMR (Richardson et al. 2005). The Leeuwin current hinders upwelling, resulting in low productivity. As this inhibits macroalgae growth, it allows for more active coral development (Richardson et al. 2005).

3.3 Bathymetry and Geomorphology

3.3.1 Geomorphology

3.3.1.1 North-West Marine Region

The NWMR is a tropical carbonate margin that comprises an extensive area of shelf, slope and abyssal plain/ deep ocean floor. The northern shelf (North-West and Sahul Shelves) is broad and gentle with an indiscernible shelf break, and the southern shelf (Dirk Hartog Shelf) is narrow. A series of reefs are located on the outer shelf/ slope. The NWMR is divided into four physiographic regions: the inner shelf; middle shelf; outer shelf/slope; and abyssal plain/deep ocean floor. These divisions are made on the basis of water depth and the geomorphic provinces. The inner shelf is between 0 – 30 m deep and is characterised by highly turbid waters throughout the year. It includes Shark Bay, Ningaloo Reef and King Sound Basin. The middle shelf environment covers the majority of shelf within the NWMR and is between 30 and 200 m water depth. It includes Dirk Hartog, Rowley/ Northwest and Sahul Shelves. The outer shelf/ slope region extends from ~ 200 m water depth to the abyssal plain/ deep ocean floor at ~4,000 m water depth. Prominent geomorphic features of the region include terraces, deeps/holes/valleys, ridges, plateaus and pinnacles. The MEZ/EMBA overlaps with all four physiographic regions of the NWMR.

3.3.1.2 South-West Marine Region

The SWMR can be divided into four major physiographic provinces: Rottnest, South-West, Great Australian Bight and Spencer and St. Vincent Gulfs. These divisions are based on major geomorphic and sedimentary provinces in the region. The MEZ/EMBA overlaps with the Rottnest and South-West physiographic provinces (Richardson et al. 2005). The Rottnest province is characterised by narrow, incipiently-rimmed shelf with submerged ridges and tropical carbonate platforms, an extensive continental slope dissected by numerous submarine canyons, a well-developed continental rise and an extensive area of deep abyssal plain. The Perth Canyon, which is the largest canyon on the Australian margin and a major biogeographical boundary is part of this province (Richardson et al. 2005). The South-West province is characterised by a narrow continental shelf with nearshore reefs and islands, a slope incised by numerous well-developed submarine canyons, mid-slope terraces, an extensive continental rise and the deepest marginal plateau on the Australian margin, the Naturaliste Plateau. This plateau forms a biogeographical 'island' separate from the shelf and slope. The South-West province has the largest abyssal plain in the region, and a broad area of unique and complex topography comprising abyssal hills, ridges and troughs.

3.3.2 Sedimentology

3.3.2.1 North-West Marine Region

Seabed sediments of the NWMR comprise bio-clastic, calcareous and organogenic sediments that were deposited by relatively slow and uniform sedimentation rates. The region is made up of a tropical carbonate shelf dominated by sand and gravel to 15° latitude, while the outer shelf/ slope zone is dominated by mud (Baker et al. 2008). It has a relatively homogenous rise and abyssal plain/ deep ocean floor that is dominated by non-carbonate mud because it occurs below the carbonate compensation depth (Baker et al. 2008).

Major contributors to sediment mobilisation in the NWMR include: storm events, including tropical cyclones; internal tides; and ocean currents, including the Leeuwin current (Baker et al. 2008). Sediments of the middle shelf region are predominantly influenced by tidal processes, including internal tides (Baker et al. 2008).

3.3.2.2 South-West Marine Region

Seabed sediments of the Rottnest province of the SWMR are predominantly cool-water carbonates, with shelf-parallel cool-water carbonate facies on the shelf and warm-water tropical carbonate facies on reef platforms (Richardson et al. 2005). Shelf sediments are typical cool-water bryozoans, molluscs and coralline algae components and generally occur as think discontinuous sheets over rocky or algal substrates. On the platforms, zooxanthellate coral fragments reflect warm-water sediment types (Richardson et al. 2005). The SWMR has a complex bathymetry on the shelf, with barrier dune systems, shore parallel ridges and reefs which are remnant of previous shorelines (Richardson et al. 2005). Surface sediment in the South-West province are dominated by cool-water carbonate shell and coral fragments, with local concentrations of bryozoans, foraminifera and algae (Richardson et al. 2005). A thin sediment blanket of bioclastic carbonate sands occur on areas of exposed shelf, and form sediment wedges in protected shelf areas. Deep water regions and canyons in this province contains a thin veneer of calcareous ooze (Richardson et al. 2005). The South-West province has a very narrow and shallow shelf during lowstands, with active canyon cutting and increased sediment transport to the deep ocean.

4. Biological Environment

4.1 Subtidal Communities

4.1.1 Macrophytes

Macrophytes are plants which include both macroalgae and seagrass.

4.1.1.1 Macroalgae

Macroalgae are multicellular, marine algae, commonly known as seaweed. Macroalgae are a prominent feature of tropical and subtropical reefs and are important contributors to primary production and nutrient cycling, and providing food and habitat for vertebrate and invertebrate fauna.

Macroalgae are primarily associated with hard substrates and can occur throughout Australian nearshore waters. Macroalgae are divided into three groups: Phaeophyceae (brown algae), Rhodophyta (red algae), and Chlorophyta (green algae). Macroalgae assemblages vary, but *Ecklonia radiata* and *Sargassum sp*. are typically common in deeper areas. The principal physical factors affecting the presence and growth of macroalgae include temperature, nutrients, water motion, light, salinity, substratum, sedimentation and pollution (Sanderson, 1997). They occur in moderate to high cover on exposed hard substrates, but typically have lower cover on hard substrates that are covered with a veneer of sediment (SKM, 2009). Macroalgae exhibit very high seasonal and interannual variation in biomass (Heyward et al. 2006) and distribution, abundance and biodiversity (BHPBIO, 2011). The distribution of hard substrates therefore indicates areas that may support macroalgal communities, although abundance and diversity may fluctuate annually.

Macroalgae are susceptible to disturbance from factors such as sedimentation, scouring and turbidity but the marked seasonality in biomass, abundance, diversity and distribution suggests macroalgae are likely to be resilient to acute, short-term disturbance acting at local scales. Macroalgae may be more susceptible to impacts acting over longer time scales (years) and at certain times of the year, where recruitment at a regional scale could be affected. Indirect impacts affecting the numbers, distribution and community structure of herbivorous fish can also be expected to have impacts (either positive or negative) on macroalgal habitats (Vergès et al. 2011).

Benthic macroalgae are present in all bioregions overlapping the MEZ/EMBA as discussed in **Section 2**, with the exception of the Northwest Province and Central Western Transition, which lie entirely in deep waters below the photic zone.

4.1.1.2 Seagrasses

Seagrasses are highly productive habitats that occur on intertidal flats and in shallow coastal waters worldwide from arctic to tropical climates. Seagrass generally grows in soft sediments within intertidal and shallow subtidal waters where there is sufficient light and are common in sheltered coastal areas such as bays, lees of islands and fringing coastal reefs (McClatchie et al. 2006; McLeay et al. 2003). Water temperature, light penetration, sediment type, salinity, and wave or current energy control seagrass distribution.

Seagrasses are biologically important for four reasons:

1. As sources of primary production;
2. As habitat for juvenile and adult fauna such as invertebrates and fish;
3. As a food resource; and
4. For their ability to attenuate water movement and trap sediment (Masini et al. 2009).

Twenty-five species of seagrass have been recorded in WA, the highest diversity in the world (Masini et al. 2009). Waters extending from Busselton to the Northern Territory (NT) border support predominantly tropical species although temperate species are also found, particularly between Busselton and Exmouth (Walker, 1987). One species, *Cymodocea angustata*, is endemic to WA.

Areas occupied by seagrass vary markedly both seasonal and interannual and it is not clear why some areas of suitable substrate will support seagrass in one year but not the next. It appears that recruitment to what may otherwise be suitable substrate is haphazard, lending weight to the descriptions of these seagrass communities as ephemeral (CALM, 2005a).

Seagrasses are present in all bioregions overlapping the MEZ/EMBA as discussed in **Section 2**, with the exception of the Northwest Province and Central Western Transition, which lie entirely in deep waters below the photic zone.

4.1.2 Coral Reefs

Corals are both primary producers and filter feeders and thus play a role in the provision of food to marine fauna and in nutrient recycling to support ecosystem functioning (CALM, 2005a). Corals create settlement substrate and shelter for marine flora and fauna. Studies have shown that declines in the abundance, or even marked changes in species composition of corals, has a marked impact on the biodiversity and productivity of coral reef habitats (Pratchett et al. 2008). As part of the reef building process, scleractinian corals are also important for protection of coastlines through accumulation and cementation of sediments and dissipation of wave energy (CALM, 2005a).

The waters in the MEZ contain extensive coral communities. Coral reefs within the region can be categorised into three general groups: fringing reefs, large platform reefs, and intertidal reefs. Corals are significant benthic primary producers that play a key ecosystem role in many reef environments. The distribution of corals in area is governed by the availability of hard substrate for attachment and light availability.

Coral reefs are dynamic environments that regularly undergo cycles of disturbance and recovery. Depending on how frequent and severe the disturbances are, recovery can take a few years or more than a decade. Disturbances can include bleaching, cyclones and disease outbreaks (Haapkylä et al. 2013). Coral susceptibility to bleaching and their ability to recover is an important consideration in the context of potential anthropogenic impacts.

Corals may be present in all bioregions overlapping the MEZ/EMBA as discussed in **Section 2**, with the exception of the Northwest Province and Central Western Transition, which lie entirely in deep waters below the photic zone, and the Southwest Transition and Southwest Shelf Province, which occur in waters too cold to support tropical coral reef species.

4.1.3 Benthic Invertebrates (non-coral)

The offshore marine environment from Busselton to the Northern Territory (NT) border is dominated by soft sediment seabeds; sandy and muddy substrates, occasionally interspersed with hard substrates covered with sand veneers, and rarely, exposed hard substrate. In shallow waters, non-coral benthic invertebrates may form part of the mosaic of benthic organisms found on hard substrates, alongside macrophytes and coral colonies. As light reduces with water depth, non-coral benthic invertebrates are the dominant community, albeit at low densities.

Benthic invertebrates comprise several types of feeding groups including deposit feeders, filter-feeders, grazers and predators. The abundance, diversity, biomass and species composition of benthic invertebrates can be used as indicators of changing environmental conditions. The distribution and abundance of benthic invertebrate species may be influenced by a wide variety of physical parameters (e.g. substrate composition, water temperature, depth, dissolved oxygen concentrations, pH, salinity, sediment C/N ratios and hydrography). Spatial and temporal differences in benthic species composition may also be influenced by a range of biological factors (e.g. primary productivity, competition and acclimatisation). Natural seasonal and inter-annual changes in these variables can also modify recruitment success and mortalities of individual species, and consequently the community structure of the benthos (OzCoasts, 2020).

4.1.4 Subtidal Rocky Reefs

This habitat occurs either as extensions of intertidal rocky shores or as isolated offshore reefs and are always submerged. Rocky reefs can support extensive communities of marine plants and are also important because they provide habitat for many species of fish, including commercially valuable marine species such as the rock lobster and the abalone. Reefs that are hidden from sunlight in deeper water, or under ledges, often have diverse and colourful communities of invertebrates (MESA, 2020).

The type of material a reef is made from also has a great influence on the animals and plants which live on it. Subtidal sandstone reefs, for example, are often undercut and have many ledges and crevices worn into them. The surfaces of sandstone reefs often teem with sponges, feather stars, urchins and anemones, while basalt reefs are more likely to support mobile animals such as Pacific Octopus, abalone and chitons. The number of caves and crevices in a reef will also contribute to the number of fish which seek shelter there (MESA, 2020).

The substrata is only one factor which influences the presence of biological communities. The distribution of fish and invertebrate communities is also correlated with latitude, depth, temperature and hydrology. Areas where the overlap of temperate and subtropical currents coincide will have a different distribution of communities.

Subtidal rocky reefs are common within the coastal bioregions overlapping the MEZ/EMBA.

4.2 Coastal Environments

4.2.1 Rocky Shorelines

Rocky shorelines are found across the EMBA/MEZ and are often indicative of high energy areas (wave action) where sand deposition is limited or restricted (perhaps seasonally or during a cyclone). They are formed from limestone pavement extending out from the beach into subtidal zones, for example along the Ningaloo Coast and North West Cape; higher relief platforms (>0.5 m off high water mark) are also present at a number of headlands along the North West Cape. This habitat is also widespread heading south towards Perth. Rocky shores can include pebble/ cobble, boulders, and rocky limestone cliffs (often at the landward edge of reef platforms). Rocky outcrops typically consist of hard bedrock, but some of the coastline has characteristic limestone karsted cliffs with an undercut notch. Rocky shorelines can vary from habitats where there is bedrock protruding from soft sediments to cliff like structures that form headlands. Rocky shorelines are an important foraging area for seabirds and habitat for invertebrates found in the intertidal splash zone (Morton and Britton cited in Jones, 2004). For example, several shorebirds (e.g. ruddy turnstone) feed along beaches and rocky shorelines (see shorebirds in **Section 4.4.11**).

4.2.2 Beaches

Sandy beaches are those areas within the intertidal zone where unconsolidated sediment has been deposited (and eroded) by wave and tidal action. Sandy beaches can vary from low to high energy zones; the energy experienced influences the beach profile due to varying rates of erosion and accretion. Sandy beaches are found across the EMBA/MEZ and vary in length, width and gradient. They are interspersed among areas of hard substrate (e.g. sandstone) that form intertidal platforms and rocky outcrops. There is a wide range of variation in sediment type, composition, and grain size along the MEZ/EMBA.

Sandy beaches provide habitat to a variety of burrowing invertebrates and subsequently provide foraging grounds for shorebirds (Garnet and Crowley, 2000). The number of species and densities of benthic macroinvertebrates that occur in the sand are typically inversely correlated with sediment grain-size and exposure to wave action, and positively correlated with sedimentary organic content and the amount of detached and attached macrophytes (Wildsmith et al. 2005). However, the distributions of these fauna among habitats will also reflect differences in the suite of environmental variables that characterize those habitats (Wildsmith et al. 2005).

Sandy habitats are important for both resident and migratory seabirds and shorebirds (refer **Sections 4.4.9** and **4.4.11**). Sandy beaches can also provide an important habitat for turtle nesting and breeding (see **Section 4.4.2**).

4.2.3 Mangroves and Saltmarshes

Mangroves commonly occur in sheltered coastal areas in tropical and sub-tropical latitudes (Kathiresan and Bingham, 2001). Up to eight species of mangroves are in the Central Western Shelf Transition region, but at most locations the dominant mangrove (in terms of area of intertidal zone occupied) is *Avicennia marina*, with the stilt rooted mangrove *Rhizophora stylosa* often occurring as thin zones of dense thickets within the broad zone of *A. marina*.

Mangroves grow in intertidal mud and sand and are found wherever suitable conditions are present including wave dominated settings of deltas, beach/dune coasts, limestone barrier islands and ria-archipelago shores (Semeniuk, 1993). Mangrove plants have specially adapted aerial roots (pneumatophores) that provide for gas exchange during low tide (McClatchie et al. 2006) and have evolved to adapt to fluctuating salinity, tidal inundation and fine, anaerobic, hydrogen sulfide rich sediment (Duke et al. 1998).

Mangroves play an important role in connecting the terrestrial and marine environments and reducing coastal erosion. They also play an important ecosystem role in nutrient cycling and carbon fixing (NOAA, 2010). Mangroves can help stabilise coastal sediments, provide a nursery ground for many species of fish and crustacean, and provide shelter or nesting areas for seabirds and are important habitat for migratory shorebirds (McClatchie et al. 2006).

Saltmarshes are terrestrial halophytic (salt-adapted) ecosystems that mostly occur in the upper-intertidal zone. They are typically dominated by dense stands of halophytic plants such as herbs, grasses and low shrubs. The diversity of saltmarsh plant species increases with increasing latitude (in contrast to mangroves). The vegetation in these environments is essential to the stability of the saltmarsh, as they trap and bind sediments. The sediments are generally sandy silts and clays, and can often have high organic material content. Saltmarshes provide a habitat for a wide range of both marine and terrestrial fauna, including infauna and epifaunal invertebrates, fish and birds.

During 2009, shoreline ecological aerial and ground surveys were conducted from Darwin in the NT to Broome in WA in response to the Montara oil spill (Duke et al. 2010). Approximately 5,100 km of shoreline was surveyed, analysed and mapped to quantitatively characterise coastal ecological features. Mangroves were found to grow along 63% of the surveyed shoreline and salt marshes occurred over 24% of the shoreline.

The two key State regulatory documents relevant to the protection and management of mangroves in WA are:

- Environmental Protection Austhority (EPA) (2001) Guidance Statement for Protection of Tropical Arid Zone Mangroves along the Pilbara Coastline. Guidance Statement No. 1; and
- EPA (2016) Technical Guidance – Protection of Benthic Communities and Habitats.

4.2.4 Wetlands

Wetlands are areas of land where water covers the soil – all year or just at certain times of the year. Wetlands may be natural or artificial and the water within a wetland may be static or flowing, fresh, brackish or saline. There are even underground wetlands.

Wetlands are a critical part of our natural environment. They protect our shores from wave action, reduce the impacts of floods, absorb pollutants and improve water quality. They provide habitat for animals and plants and many contain a wide diversity of life, supporting plants and animals that are found nowhere else. Wetlands provide an important range of environmental, social and economic services. Many wetlands are areas of great natural beauty and many are important to Aboriginal and Torres Strait Islander people (DAWE, 2020g). Wetlands also provide important benefits for industry. For example, they form nurseries for fish and other freshwater and marine life and are critical to Australia's commercial and recreational fishing industries (DAWE, 2020g).

The MEZ/EMBA overlaps four wetlands of international importance (Ramsar wetlands) (see **Section 5.3**). The EMBA overlaps seven wetlands of national importance, six of which are overlapped by the MEZ (see **Section 5.4**).

4.3 Plankton

Plankton consists of microscopic organisms typically divided into phytoplankton (algae) and zooplankton (fauna including larvae). Plankton play a major role in the trophic system with phytoplankton being a primary producer and zooplankton a primary consumer, which in turn are consumed by other fauna species.

Phytoplankton are autotrophic planktonic organisms living within the photic zone and spend either part or all of their lifecycle drifting with the ocean currents. Phytoplankton are dependent on oceanographic processes (e.g. currents and vertical mixing), that supply nutrients needed for photosynthesis. Thus, phytoplankton biomass is typically variable (spatially and temporally) (Evans et al. 2016), but greatest in areas of upwelling, or in shallow waters where nutrient levels are high. Peak primary productivity however varies on a local and regional scale.

According to the Australia State of the Environment 2016 report (Jackson et al. 2017), warming ocean temperatures has extended the distribution of tropical phytoplankton species (which have a lower productivity), further south resulting in a decline in primary productivity in oceanic waters north of 35°C, especially the NWS (Evans et al. 2016). However, trends of primary productivity across Australia are variable with the south-west of Australia experiencing an increase in productivity and northern Australia experiencing no change between 2002-2016 (Evans et al. 2016). Plankton is widespread throughout oceanic environments and is expected to occur in the MEZ/EMBA.

4.4 Listed Threatened and Migratory Species

The Protected Matters Search Tool (PMST) identified 54 listed threatened species and 97 listed migratory species under the EPBC Act 1999 as having the potential to occur in the MEZ (**Appendix C**). An additional four migratory species were identified as having the potential to occur in the EMBA (**Appendix C**).

Note: terrestrial or (solely) freshwater species that occur in the EPBC Protected Matters searches of the MEZ/EMBA have been excluded as they are not relevant to the consideration of potential affects from marine hydrocarbons exposure. Descriptions of species that may occur on shorelines include shorebirds, but terrestrial mammals, reptiles (such as pythons) and bird species that do not have habitats along shorelines have been excluded.

4.4.1 Sharks, Rays and Fish

The PMST reports (**Appendix C**) identified seven listed threatened species (five of which are migratory) and an additional six listed migratory species as having the potential to occur within the MEZ/EMBA (**Table 4-1**). **Table 4-2** summarises the Recovery Plans and Conservation Advices relevant to those species identified by the EPBC Protected Matters searches (**Table 4-1**) as potentially occurring within or using habitat in the MEZ/EMBA. Identified biologcially important areas (BIAs) for these species are presented in **Table 4-3** and **Figure 4-1**. **Sections 4.4.1.1** to **4.4.1.13** provide a comprehensive description of the sharks, rays and fish likely to be present within the MEZ.

Table 4-1 Threatened and/or migratory sharks, rays and fish potentially occurring within the MEZ and EMBA

Common Name	Species Name	EPBC Act Status		Presence	
		Threatened	Migratory	MEZ	EMBA
Great white shark	*Carcharodon carcharias*	Vulnerable	Migratory	✓	✓
Green sawfish	*Pristis zijsron*	Vulnerable	Migratory	✓	✓
Whale shark	*Rhincodon typus*	Vulnerable	Migratory	✓	✓
Narrow sawfish	*Anoxypristis cupidata*		Migratory	✓	✓
Shortfin mako	*Isurus oxyrinchus*		Migratory	✓	✓
Longfin mako	*Isurus paucus*		Migratory	✓	✓
Grey nurse shark (west coast)	*Carcharias taurus*	Vulnerable		✓	✓
Northern river shark	*Glyphis garricki*	Endangered		✓	✓
Porbeagle shark	*Lamna nasus*		Migratory	✓	✓
Dwarf sawfish	*Pristis clavata*	Vulnerable	Migratory	✓	✓
Freshwater sawfish	*Pristis pristis*	Vulnerable	Migratory	✓	✓
Reef manta ray	*Manta alfredi*		Migratory	✓	✓
Giant manta ray	*Manta birostris*		Migratory	✓	✓

Table 4-2 Threatened species Recovery Plans, Management Plans and Conservation Advice relevant to the Activity

Receptor	Recovery Plan, Management Plan or Conservation Advice	Threats Identified as Relevant to the Activity	Relevant EP Section
All vertebrate fauna	Threat Abatement Plan for Impacts of Marine Debris on Vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018)	Marine debris	**Section 8.5**
White shark	Recovery Plan for the White Shark (*Carcharodon carcharias*) (DSEWPaC, 2013b)	Ecosystem effects as a result of habitat modification	**Sections 7.2, 8.1, 8.2**
Green sawfish	Commonwealth Conservation Advice on *Pristis zijsron* (green sawfish) (DEWHA, 2008c)	Habitat degradation and modification	**Sections 8.1, 8.2**

Receptor	Recovery Plan, Management Plan or Conservation Advice	Threats Identified as Relevant to the Activity	Relevant EP Section
	Sawfish and River Sharks Multispecies Recovery Plan (DoE, 2015b)		
Whale shark	Approved Conservation Advice for *Rhincodon typus* (whale shark) (TSSC, 2015d)	Vessel strike	**Section 8.6**
		Habitat disruption from mineral exploration, production and transportation	**Sections 7.4, 8.1, 8.2**
Grey nurse shark	Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (DoE, 2014a)	Pollution	**Sections 8.1, 8.2, 8.3**
		Ecosystem effects - habitat modification	**Sections 7.2, 8.1, 8.2**
Northern river shark	Approved Conservation Advice for *Glyphis garricki* (northern river shark) (DoE, 2014b)	Habitat degradation and modification	**Sections 8.1, 8.2**
	Sawfish and River Sharks Multispecies Recovery Plan (DoE, 2015a)		
Dwarf sawfish	Approved Conservation Advice for *Pristis clavata* (Dwarf Sawfish) (DEWHA, 2009)	Habitat degradation and modification	**Sections 8.1, 8.2**
	Sawfish and River Sharks Multispecies Recovery Plan (DoE, 2015a)		
Freshwater (Largetooth) sawfish	Approved Conservation Advice for *Pristis pristis* (Largetooth Sawfish) (DoE, 2014c)	Habitat degradation and modification	**Sections 8.1, 8.2**
	Sawfish and River Sharks Multispecies Recovery Plan (DoE, 2015a)		

Table 4-3 BIAs for sharks and sawfishes within the MEZ and EMBA

Species	BIA	Area/ Location	Presence	
			MEZ	EMBA
Great white shark	Foraging	Waters off pinniped colonies throughout the South-west Marine Region	✓	✓
Dwarf sawfish	Foraging, Nursing and Pupping	Eighty Mile Beach	✓	✓
Freshwater sawfish	Foraging and Pupping	Eighty Mile Beach	✓	✓
Green sawfish	Foraging	Cape Keraudren	✓	✓
	Nursing and pupping	Eighty Mile Beach Cape Keraudren	✓	✓
Whale shark	Foraging	Northward from Ningaloo along 200 m isobath	✓	✓
	Foraging (high density prey)	Ningaloo Marine Park and adjacent Commonwealth waters.	✓	✓

4.4.1.1 Grey Nurse Shark (West Coast Population) (Vulnerable)

The grey nurse shark (west coast population) (*Carcharias taurus*) has a broad inshore distribution, primarily in sub-tropical to cool temperate waters (DAWE, 2020a). The west coast population of grey nurse shark are predominantly found in the south-west coastal waters of WA (DAWE, 2020a) and has been recorded as far north as the NWS (DAWE, 2020a). Grey nurse sharks are often observed hovering motionless just above the seabed, in or near deep sandy-bottomed gutters or rocky caves, and in the vicinity of inshore rocky reefs and islands (DAWE, 2020a). The species has been recorded at varying depths, but is generally found between 15–40 m (DAWE, 2020a). Grey nurse sharks have also been recorded in the surf zone, around coral reefs, and to depths of around 200 m on the continental shelf. They generally occur either alone or in small to medium sized groups, usually of fewer than 20 sharks (DAWE, 2020a). Grey nurse sharks that are observed alone are thought to be moving between aggregation sites (DAWE, 2020a).

4.4.1.2 Great White Shark (Vulnerable, Migratory)

In Australian waters, great white sharks (*Carcharodon carcharias*) are widely but not evenly distributed, with observations more frequent in some areas (i.e. within pinniped colonies) (DSEWPaC, 2013a). The species have been recorded to occur from central Queensland, around the south coast to north-west WA, but many have been recorded further north on both coasts (Last and Stevens, 2009). Great white sharks can be found in areas close inshore around rocky reefs, surf beaches and shallow coastal bays and also as far out as the outer continental shelf and slope areas (Pogonoski et al. 2002). The species is known to undertake migrations along the WA coast, with individuals occasionally travelling as far north as North West Cape during spring, before returning south for summer (DSEWPaC, 2013a). However, the movements of individuals are not coordinated with each other, so that great white sharks can be recorded in northern localities at any time of the year (Bruce and Bradford, 2008). Waters off pinniped colonies throughout the SWMR have been identified as a foraging BIA for this species which overlaps with the MEZ/EMBA (**Table 4-3**).

4.4.1.3 Northern River Shark (Endangered)

The northern river shark (*Glyphis garricki*) is typically recorded in freshwater and brackish river waters, however there are records from full saline conditions (Morgan and Whitty, 2013). These are among some of the most threatened shark species in the world due to naturally small populations and threat from habitat degradation and fishing. Northern river sharks utilise rivers, tidal sections of large tropical estuarine systems and macrotidal embayments, as well as inshore and offshore marine habitats (DoE, 2015a). Adults have been recorded only in marine environments, whereas neonates, juveniles and sub-adults have been recorded in freshwater, estuarine, and marine environments (DoE, 2015a). Northern river sharks have been recorded in WA and the NT. In WA, they have been sighted in both the west and east Kimberley, including King Sound, the Ord and King Rivers, the west arm of Cambridge Gulf and also from Joseph Bonaparte Gulf (DoE, 2015a).

4.4.1.4 Shortfin Mako Shark (Migratory)

The shortfin mako (*Isurus oxyrinchus*) is a large pelagic shark and has a circumglobal distribution, inhabiting tropical and temperate waters. It is rarely encountered in waters with temperatures below 16° C (Last and Stevens, 2009). In Australian waters, the shortfin mako has been recorded in offshore waters all around the continent's coastline except for the Arafura Sea, Gulf of Carpentaria and Torres Strait. The shortfin mako is highly migratory and can travel large distances, migrating from Australian waters to areas well beyond the Australian EEZ (Rogers et al. 2009).

The shortfin mako preferentially inhabits depths from the surface to 600 m, with a slight preference to shallower water at night (Rogers et al. 2009). However, studies have found that the majority of time is spent in the top 50 m (Nasby-Lucas et al. 2019). Little is known about the population size and distribution in WA.

4.4.1.5 Longfin Mako Shark (Migratory)

The longfin mako (*Isurus paucus*) co-inhabits much of the same range as the shortfin mako within Australian waters (Last and Stevens, 2009). However, the longfin mako is thought to be much less common and to have a more tropical distribution (Last and Stevens, 2009; Rowling et al. 2010), and its preferred depth distribution is deeper than that of the shortfin mako (Rigby et al. 2019).

4.4.1.6 Porbeagle Shark (Migratory)

The porbeagle (*Lamna nasus*) is widespread and inhabits temperate, subarctic and subantarctic waters of the North Atlantic and Southern Hemisphere (DAWE, 2020a). In Australia, the species occurs in waters from southern Queensland to south-west Australia (DAWE, 2020a). Porbeagles typically occur in oceanic waters off the continental shelf, although they occasionally enter coastal waters (DAWE, 2020a). The porbeagle is known to undertake seasonal migrations, although the timing and details of these migratory movements are not well-understood (DAWE, 2020a). Individuals have been tracked moving large distances (i.e. 1,500-1,800 km) along continental shelves and crossing the Atlantic Ocean between Europe and North America (DAWE, 2020a).

4.4.1.7 Whale Shark (Vulnerable, Migratory)

Whale sharks (*Rhincodon typus*) have a global distribution in tropical and warm temperate waters. In Australia, whale sharks occur mainly off the NT, Queensland, and northern WA. Isolated records exist of whale sharks off New South Wales, Victoria and South Australia (Last and Stevens, 2009).

Whale sharks form seasonal aggregations at Ningaloo Reef, WA (March – July); off the coastal waters off Christmas Island (December – January); and in the Coral Sea (November – December). These seasonal aggregations are thought to be linked to localised seasonal 'pulses' of food productivity. These aggregations are all considered BIAs for whale sharks (TSSC, 2015a).

At Ningaloo Reef, aggregations of whale sharks (mostly juvenile males <8 m total length) occur where the continental shelf reaches its narrowest point (~10 km) (Meekan et al. 2006; Norman et al. 2007). Whale sharks tend to stay within a few kilometres of the shore and in waters about 30–50 m deep (Wilson et al. 2006). A recent study revealed an extended distribution of whale sharks along the WA coastline (Norman et al. 2016), and while some animals are present only during the austral autumn and aggregate seasonally at Ningaloo Reef, others may be present along the WA coast for all months of the calendar year (Norman et al. 2016).

The 200 m isobath along the northern part of the WA coast is an important migration route, with migration occurring mainly between July and November. Research on the migration patterns of whale sharks in the western Indian Ocean, indicates that a small number of the WA (Ningaloo) population migrate through the wider vicinity of the Browse Basin region (Meekan and Radford, 2010). Whale sharks from Ningaloo Reef fitted with satellite trackers were observed to travel either north-east towards Timor Leste, or north-west towards the Indonesia islands of Sumatra and Java, with some individuals passing through the broad vicinity of Scott Reef (Wilson et al. 2006; Meekan and Radford, 2010). Two foraging BIAs for this species overlap the MEZ/EMBA (see **Table 4-3**), one encompassing the aggregation area at Ningaloo and one focused on the migration path northwards from Ningaloo, extending broadly (up to ~220 km wide) up the entire north-west coast of WA (**Figure 4-1**).

4.4.1.8 Dwarf Sawfish (Vulnerable, Migratory)

Dwarf sawfish inhabit shallow coastal areas (2-3 m water depth) and estuarine habitats, rarely frequenting freshwater areas. This species is known to use estuarine areas as nursery habitats, remaining there until reaching maturity (~3 years). It is not clear the extent to which adult species migrate from coastal waters, as captures in offshore surveys are very uncommon. The dwarf sawfish's distribution in Australia has been considered to extend from the Pilbara coast in WA across northern Australia and into the Gulf of Carpentaria (DoE, 2015a). Eighty Mile Beach is a BIA for foraging, nursing and pupping for this species. This BIA overlaps the MEZ/EMBA (**Table 4-3**).

4.4.1.9 Freshwater Sawfish (Vulnerable, Migratory)

The freshwater sawfish, also known as the largetooth or river sawfish, grow up to 7 m in length and may potentially occur in all large rivers of northern Australia (DoE, 2015a). It is a marine/estuarine species spending its first three-four years in freshwater. Juveniles are predominantly found in rivers and estuaries, while mature animals tend to occur more often in coastal and offshore waters up to 25 m water depth. Their preferred habitat is muddy seabeds of river embayments and estuaries. Nursing areas for the species include Eighty Mile Beach, Roebuck Bay and King Sound. BIAs that overlap the MEZ/EMBA are presented in **Table 4-3**.

4.4.1.10 Green Sawfish (Vulnerable, Migratory)

The green sawfish was once known to occur across the Indo-west Pacific region, but current estimates suggest they have experience substantial population declines and Australia probably represents the last secure population across their global range (Stevens et al. 2005). Within Australia, green sawfish are currently distributed from approximately the Whitsundays in Queensland, across northern Australian waters to Shark Bay in WA (DoE, 2015a). The Ashburton River estuary provides critical habitat for green sawfish in the southern Pilbara (Morgan et al. 2016).

Green sawfish occur in inshore coastal environments including estuaries, river mouths, embayments and along sandy and muddy beaches, as well as offshore marine habitats (Stevens et al. 2005; Thorburn et al. 2004). They have been recorded in very shallow water (less than one metre) to offshore trawl grounds in over 70 m of water (Stevens et al. 2005). Despite being found in deep water, evidence suggests that the range of green sawfish is mostly restricted to the inshore coastal fringe, with a strong association with mangroves and adjacent mudflats (Stevens et al. 2008). Green sawfish appear to actively pursue schools of baitfish and prawns (Peverell and Pillans, 2004). BIAs for this species that overlap the MEZ/EMBA are presented in **Table 4-3**.

4.4.1.11 Narrow Sawfish (Migratory)

The narrow sawfish (*Anoxypristis cuspidate*) is a marine or marginal (brackish water) species found from inshore waters to a depth of 40 m (Compagno et al. 2006). Inshore and estuarine waters are critical habitats for juveniles and pupping females, whilst adults predominantly occur offshore (D'Anastasi et al. 2013).

The central coasts of western and eastern Australia are confirmed as the southern most extent of the narrow sawfish (D'Anastasi et al. 2013). It is most common in the Gulf of Carpentaria with southward ranges extending to Broad Sound in Queensland and the Pilbara Coast (circa 116°E), WA (Last and Stevens, 2009). Like other sawfish species, the narrow sawfish has experienced a considerable decline in numbers due to human activities, including fishing pressure, and habitat loss and degradation (Bray, 2020).

4.4.1.12 Reef Manta Ray (Migratory)

The reef manta ray (*Manta alfredi*) is widely distributed in tropical and sub-tropical waters throughout much of the Indian and Pacific Oceans, from the surface down to depths of 432 m (Lawson et al. 2017). It is commonly sighted inshore, but is also found around offshore coral reefs, rocky reefs and seamounts (Marshall et al. 2009). Long-term sighting records of the reef manta ray at established aggregation sites suggest this species is more resident in tropical waters and may exhibit smaller home ranges, philopatric movement patterns and shorter seasonal migrations than the giant manta ray (Marshall et al. 2019).

4.4.1.13 Giant Manta Ray (Migratory)

The giant manta ray (*Manta birostris*) inhabits tropical, marine waters worldwide, but is also found occasionally in temperate areas. In Australia, the species is recorded from south-western WA, around the north coast and south to the southern coast of New South Wales (McGrouther, 2019). The species is commonly sighted along productive coastlines with regular upwelling, oceanic island groups, particularly offshore pinnacles and seamounts. It is commonly encountered on shallow reefs, while being cleaned, or sighted feeding at the surface inshore and offshore. It is also occasionally observed in sandy bottom areas and seagrass beds (Marshall et al. 2018). A global investigation of major aggregation sites revealed that the giant manta ray may be a more oceanic and a more migratory species than the reef manta ray (Marshall et al. 2018).

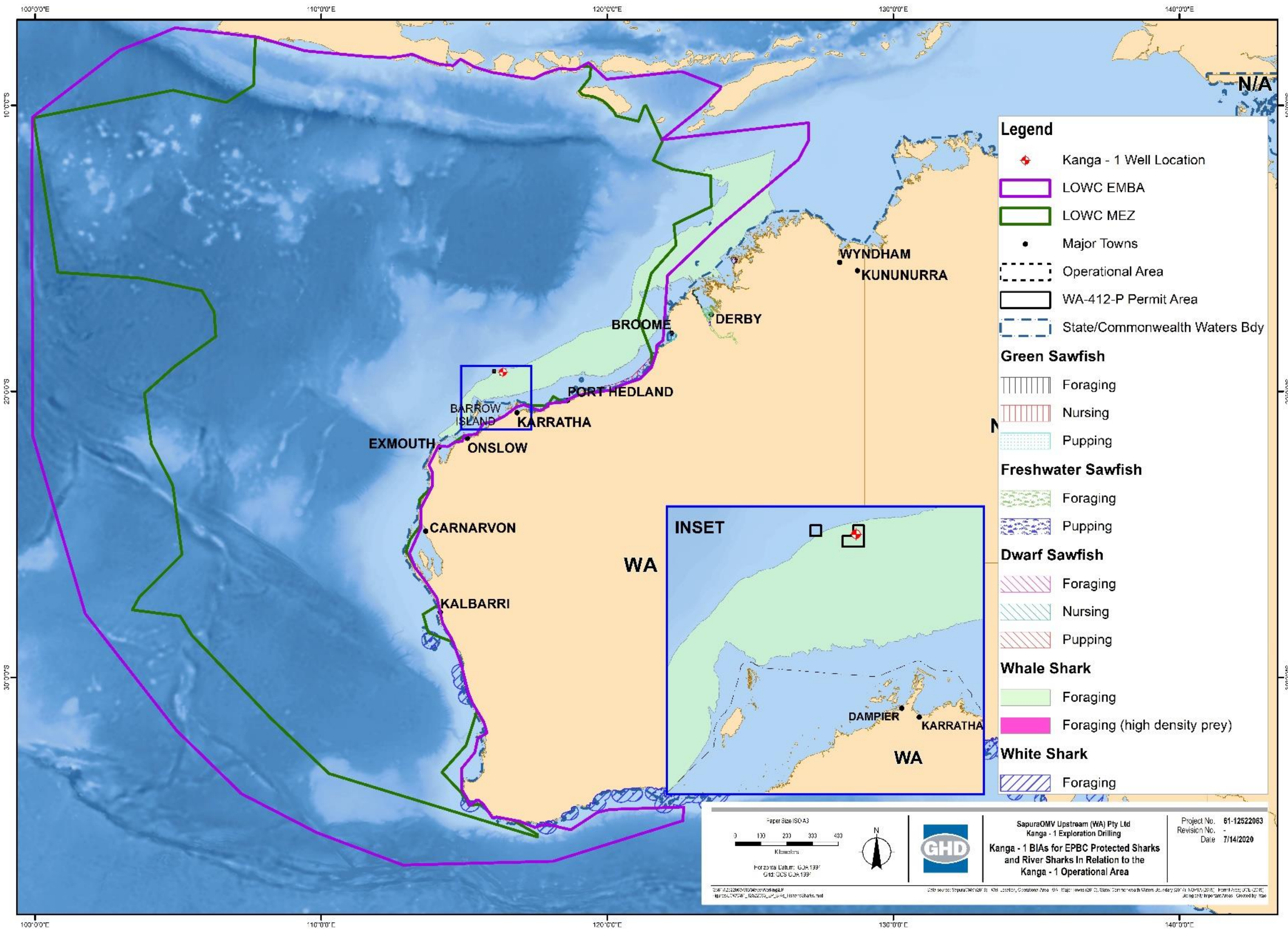


Figure 4-1 BIAs for sharks and fish in the vicinity of the MEZ and EMBA

4.4.2 Marine Reptiles

EPBC Protected Matters Search Tool (PMST) reports (**Appendix C**) identified six species of turtles and two species of seasnakes as known/ likely to be present within the MEZ/EMBA. In addition, one species of crocodile may also be present in the EMBA (**Table 4-4**). **Table 4-5** summarises the Recovery Plans and Conservation Advices relevant to those species identified by the EPBC Protected Matters searches (**Table 4-4**) as potentially occurring within or using habitat in the MEZ/EMBA.

Table 4-4 Threatened and/or migratory marine reptiles potentially occurring within the MEZ and EMBA

Common Name	Species Name	EPBC Act Status		Presence	
		Threatened	Migratory	MEZ	EMBA
Loggerhead turtle	*Caretta caretta*	Endangered	Migratory	✓	✓
Green turtle	*Chelonia mydas*	Vulnerable	Migratory	✓	✓
Leatherback turtle	*Dermochelys coriacea*	Endangered	Migratory	✓	✓
Hawksbill turtle	*Eretmochelys imbricata*	Vulnerable	Migratory	✓	✓
Flatback turtle	*Natator depressus*	Vulnerable	Migratory	✓	✓
Olive Ridley turtle	*Lepidochelys olivacea*	Endangered		✓	✓
Short-nosed seasnake	*Aipysurus apraefrontalis*	Critically Endangered		✓	✓
Leaf-scale seasnake	*Aipysurus foliosquama*	Critically Endangered		✓	✓
Salt-water crocodile	*Crocodylus porosus*		Migratory		✓

Table 4-5 Threatened species Recovery Plans, Management Plans and Conservation Advice relevant to the Activity

Receptor	Recovery Plan, Management Plan or Conservation Advice	Threats Identified as Relevant to the Activity	Relevant EP Section
All vertebrate fauna	Threat Abatement Plan for Impacts of Marine Debris on Vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018)	Marine debris	**Section 8.5**
All Marine Turtles	National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (DoEE, 2020)	Light pollution	**Section 7.3**
Loggerhead turtle Green turtle Leatherback turtle Hawksbill turtle Flatback turtle Olive Ridley turtle	Recovery Plan for Marine Turtles in Australia 2017 – 2027 (DoEE, 2017a)	Deteriorating water quality	**Sections 7.6, 7.7, 8.1, 8.2, 8.3**
		Marine debris	**Section 8.5**
		Loss of habitat	**Sections 7.2, 8.1**
		Vessel disturbance	**Section 8.6**
		Light pollution	**Section 7.3**
Short-nosed seasnake	Approved Conservation Advice for *Aipysurus apraefrontalis* (Short-nosed Sea Snake) (DSEWPaC, 2011a)	Deteriorating water quality	**Sections 7.6, 7.7, 8.1, 8.2, 8.3**
		Marine debris	**Section 8.5**
		Loss of habitat	**Sections 7.2, 8.1**
		Vessel disturbance	**Section 8.6**

Receptor	Recovery Plan, Management Plan or Conservation Advice	Threats Identified as Relevant to the Activity	Relevant EP Section
Leaf-scaled seasnake	Approved Conservation Advice for *Aipysurus foliosquama* (Leaf-scaled Sea Snake) (DSEWPaC, 2011b)	Habitat loss, disturbance and modification	**Sections 7.2, 8.1, 8.5, 8.6**

4.4.3 Marine Reptiles - Turtles

Six species of marine turtles occur in and nest on the sandy beaches of WA, all of which are likely to be present within the MEZ/EMBA, and the following sections provide details on these species. BIAs and habitat critical to the survival of these species that overlap the MEZ/EMBA are presented in **Table 4-6, Table 4-7** and **Figure 4-2**.

Table 4-6 BIAs of marine turtles within the MEZ and EMBA

Species	BIA	Area/ Location	Presence	
			MEZ	EMBA
Loggerhead turtle	Foraging	De Grey River area to Bedout Island	✓	✓
	Internesting	Dirk Hartog Island	✓	✓
	Internesting buffer	Cohen Island Dirk Hartog Island Gnarloo Bay Lowenthal Island Montebello Islands Muiron Islands Ningaloo Coast and Jurabi Coast Rosemary Island	✓	✓
	Nesting	Cohen Island Dirk Hartog Island Lowenthal Island Montebello Islands Muiron Islands Ningaloo Coast and Jurabi Coast Rosemary Island	✓	✓
Green turtle	Aggregation	Between Middle and North Mangrove Island - big shallow intertidal flats. (also on west side of Cape Preston and Montgomery Reef in Kimberly) Coral reef habitat west of the Montebello group. Extends the entire length of Montebellos	✓	✓
	Basking	Middle Island West Coast Barrow Island West Coast and North Coast	✓	✓
	Foraging	Coral reef habitat west of the Montebello group. Extends the entire length of Montebellos Dampier Archipelago (islands to the west of the Burrup Peninsula) De Grey River area to Bedout Island Delambre Island Inshore tidal and shallow subtidal areas around Barrow Island Legendre Island, Huay Island Montebello Islands - Hermite Island, Northwest Island, Trimouille Island Montebello Islands	✓	✓

Species	BIA	Area/ Location	Presence	
			MEZ	EMBA
		North Turtle Island Seringapatam Reef String of islands between Cape Preston and Onslow, inshore of Barrow Island		
	Internesting	Barrow Island Coral reef habitat west of the Montebello group. Extends the entire length of Montebellos Dampier Archipelago (islands to the west of the Burrup Peninsula) Montebello Islands Scott Reef	✓	✓
	Internesting buffer	Ashmore Reef Cartier Island Dampier Archipelago (islands to the west of the Burrup Peninsula) Delambre Island Legendre Island, Huay Island Middle Island West Coast Barrow Island West Coast and North Coast Montebello Islands – Hermite Island, Northwest Island, Trimouille Island Montebello Islands North and South Muiron Islands North West Cape Scott Reef Scott Reef – Sandy Islet	✓	✓
	Mating	Coral reef habitat west of the Montebello group. Extends the entire length of Montebellos Dampier Archipelago (islands to the west of the Burrup Peninsula) Middle Island West Coast Barrow Island West Coast and North Coast Montebello Islands – Hermite Island, Northwest Island, Trimouille Island Montebello Islands	✓	✓
	Migration corridor	Dampier Archipelago (islands to the west of the Burrup Peninsula)	✓	✓
	Nesting	Cartier Island Dampier Archipelago (islands to the west of the Burrup Peninsula) Delambre Island Legendre Island, Huay Island Middle Island West Coast Barrow Island West Coast and North Coast Montebello Islands – Hermite Island, Northwest Island, Trimouille Island Montebello Islands North and South Muiron Islands North West Cape Scott Reef Scott Reef – Sandy Islet	✓	✓

Species	BIA	Area/ Location	Presence	
			MEZ	EMBA
Hawksbill turtle	Foraging	Cartier Island Dampier Archipelago (islands to the west of the Burrup Peninsula) De Grey River area to Bedout Island Delambre Island Barrow Island – shallow water coral reef and artificial reef (pipeline) habitat Lowendal Island Group Montebello Islands – Hermite Island, Northwest Island, Trimouille Island String of islands between Cape Preston and Onslow, inshore of Barrow Island	✓	✓
	Internesting	Dampier Archipelago (islands to the west of the Burrup Peninsula) Lowendal Island Group	✓	✓
	Internesting buffer	Ah Chong and South East Island Ashmore Reef Barrow Island Dampier Archipelago (island to the west of the Burrup Peninsula) Delambre Island (and other Dampier Archipelago Islands) Lowendal Island Group Montebello Islands – Hermite Island, Northwest Island, Trimouille Island Ningaloo Coast and Jurabi Coast Rosemary Island Scott Reef Thevenard Island Varanus Island	✓	✓
	Mating	Barrow Island Dampier Archipelago (island to the west of the Burrup Peninsula) Lowendal Island Group Montebello Islands – Hermite Island, Northwest Island, Trimouille Island	✓	✓
	Migration corridor	Dampier Archipelago (island to the west of the Burrup Peninsula)	✓	✓
	Nesting	Ah Chong and South East Island Barrow Island Dampier Archipelago (island to the west of the Burrup Peninsula) Delambre Island (and other Dampier Archipelago Islands) Lowendal Island Group Montebello Islands – Hermite Island, Northwest Island, Trimouille Island Ningaloo Coast and Jurabi Coast Rosemary Island Scott Reef Thevenard Island	✓	✓

Species	BIA	Area/ Location	Presence	
			MEZ	EMBA
		Varanus Island		
Flatback turtle	Aggregation	Coral reef habitat west of the Montebello group. Extends the entire length of Montebellos	✓	✓
	Foraging	Barrow Island Coral reef habitat west of the Montebello group. Extends the entire length of Montebellos Dampier Archipelago (islands to the west of the Burrup Peninsula) De Grey River area to Bedout Island Delambre Island Legendre Island, Huay Island Montebello Islands - Hermite Island, Northwest Island, Trimouille Island String of islands between Cape Preston and Onslow, inshore of Barrow Island	✓	✓
	Internesting	Coral reef habitat west of the Montebello group. Extends the entire length of Montebellos Dampier Archipelago (islands to the west of the Burrup Peninsula)	✓	✓
	Internesting buffer	Eighty Mile Beach Cape Thouin/ Mundabullangana/ Cowrie Beach Dampier Archipelago (islands to the west of the Burrup Peninsula) Delambre Island Dixon Island Intercourse Island Lacepede Island Legendre Island, Huay Island Montebello Islands – Hermite Island, Northwest Island, Trimouille Island North Turtle Island Cemetery Beach, Port Headland Paradise Beach, Port Headland Pretty Pool, Port Headland Thevernard Island – South Coast West of Cape Lambert	✓	✓
	Mating	Barrow Island Coral reef habitat west of the Montebello group. Extends the entire length of Montebellos Dampier Archipelago (islands to the west of the Burrup Peninsula) Montebello Islands – Hermite Island, Northwest Island, Trimouille Island	✓	✓
	Migration corridor	Dampier Archipelago (islands to the west of the Burrup Peninsula)	✓	✓
	Nesting	Eighty Mile Beach Barrow Island Dampier Archipelago (islands to the west of the Burrup Peninsula) Delambre Island Intercourse Island	✓	✓

Species	BIA	Area/ Location	Presence	
			MEZ	EMBA
		Legendre Island, Huay Island Montebello Islands – Hermite Island, Northwest Island, Trimouille Island North Turtle Island Cemetery Beach, Port Headland Thevernard Island – South Coast		
Olive Ridley turtle	Foraging	Western Joseph Bonaparte Depression		✓

Table 4-7 Habitat critical to the survival of marine turtles within the MEZ and EMBA

Species	Habitat critical to the survival of species		Presence	
			MEZ	EMBA
Loggerhead turtle	Nesting	Exmouth and Ningaloo coast Gnaraloo Bay and beaches Shark bay, all coastal and island beaches out the to the northern tip of Dirk Hartog Island	✓	✓
	Internesting	20 km radius out from the nesting beaches	✓	✓
Green turtle	Nesting	Ashmore Reef and Cartier Reef Scott Reef Dampier Archipelago Barrrow Island, Montebello Islands, Serrier Island and Thevenard Island Exmouth Gulf and Ningaloo Coast	✓	✓
	Internesting	20 km radius out from the nesting beaches	✓	✓
Hawksbill turtle	Nesting	Cape Preston to mouth of Exmouth Gulf (including Montebello Islands and Lowendal Islands) Dampier Archipelago (including Delambre Island and Rosemary Island)	✓	✓
	Internesting	20 km radius out from the nesting beaches	✓	✓
Flatback turtle	Nesting	Eighty Mile beach Cemetary Beach Mundabullangana Beach Dampier Archipelago, including Delambre and Huay Island Barrow Island, Montebello Islands, coastal islands from Cape Preston to Locker Island	✓	✓
	Internesting	60 km radius out from the nesting beaches	✓	✓

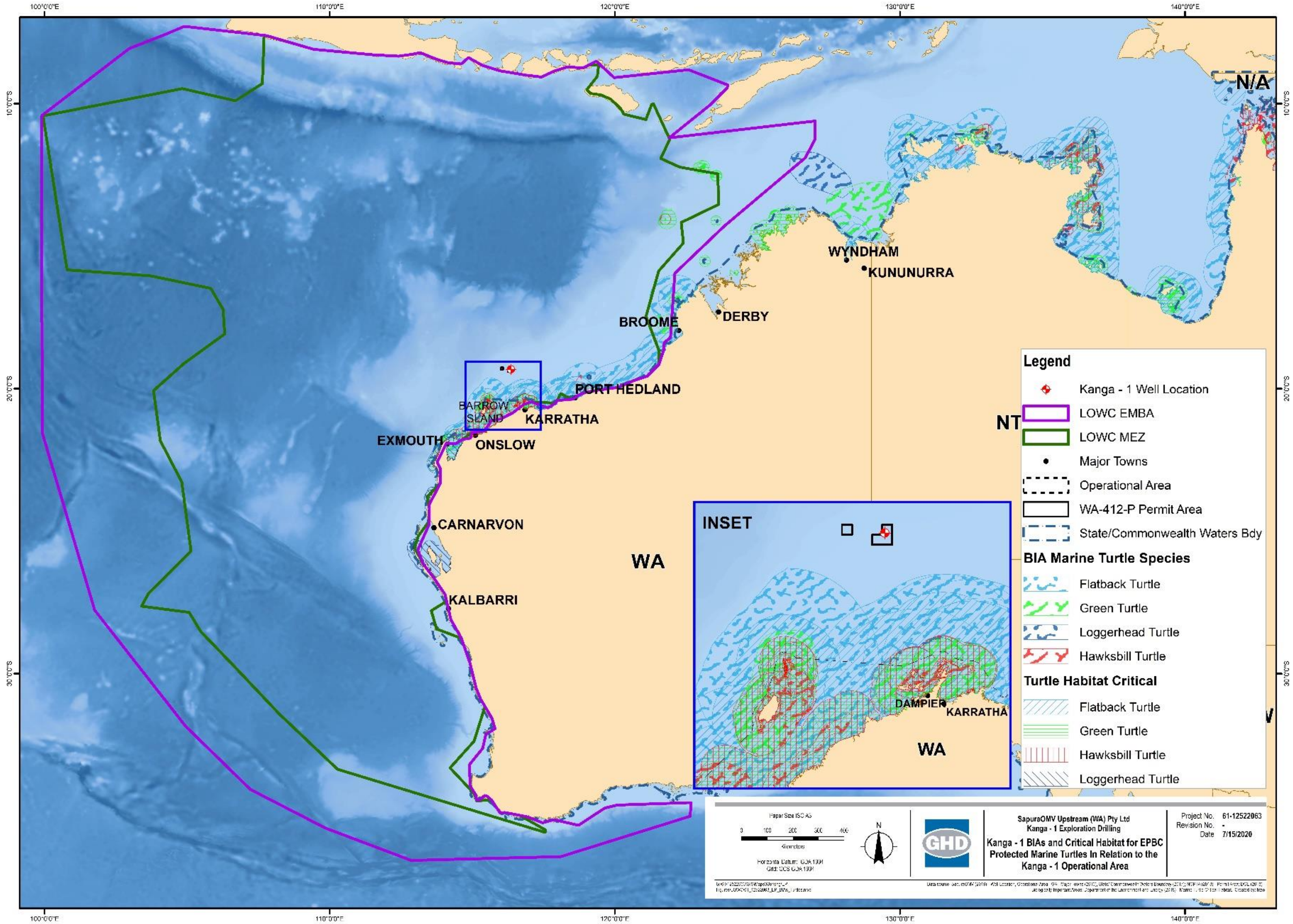


Figure 4-2 BIAs and critical habitat for marine turtles in the vicinity of the MEZ and EMBA

4.4.3.1 Loggerhead Turtle (Endangered, Migratory)

Loggerhead turtles (*Caretta caretta*) occur in the waters off coral and rocky reefs, seagrass beds and muddy bays throughout eastern, northern and western Australia (DAWE, 2020a). The WA population of loggerhead turtles have been reported as the largest population in Australia, one of only four populations in the Indian Ocean and represents the third or fourth largest population in the world (DAWE, 2020a). Loggerhead turtles nest on open, sandy beaches. Nesting is concentrated in southern Queensland and from Shark Bay to the North West Cape in WA. The WA distribution of sandy beach nesting areas extends from Shark Bay to the southern area of the NWS, with occasional late summer nesting crawls recorded as far north as Barrow and Varanus Island and the Lowendal and Rosemary Islands (DSEWPaC, 2012d). Major nesting locations include the Muiron Islands, the Ningaloo Coast south to Carnarvon and the islands around Shark Bay, which includes Dirk Hartog Island, one of the principal nesting and inter-nesting sites in WA (Limpus, 2008a). Foraging areas for loggerhead turtles are more widely distributed and migration from nesting to feeding grounds can stretch thousands of kilometres (Limpus, 2008a). The WA stock forage from Shark Bay, Western Australia through to Arnhem Land, Gove and into the Java Sea of Indonesia (DAWE, 2020a). Loggerhead nesting and breeding occurs from November to March, with a peak in late December/early January (Limpus, 2008a). BIAs and habitat critical to the survival of loggerhead turtles that overlap the MEZ/EMBA are presented in **Table 4-6, Table 4-7** and **Figure 4-2**.

4.4.3.2 Green Turtle (Vulnerable, Migratory)

Green turtles (*Chelonia mydas*) are found in tropical and subtropical waters throughout the world (Marquez, 1990; Bowen et al. 1992). The species feeds in intertidal and subtidal habitats such as seagrass meadows, coral and rocky reefs, algal turfs and sand and mud flats (Limpus et al. 1992).

Nesting of green turtles has been recorded from August to March on Serrurier Island (Woodside, 2002) and from December to March along coast adjacent to Ningaloo (CALM, 2005). On Barrow Island, mating aggregations may commence from October, with peak nesting from December to January, and hatchlings emerging through summer and early autumn. However, nesting on Barrow Island has been recorded all year round (Chevron, 2005 and 2008; Pendoley, 2005). Nesting on the Scott Reef-Sandy Islet and Browse Island has been observed all year round with peaks between December and January (DoEE, 2017a). Satellite tracking studies have shown that green turtles migrate between breeding beaches and feeding grounds off the northwest coast (Pendoley, 2005). However, during the internesting periods green turtles are known to remain within 10 km of nesting beaches (Waayers et al. 2011). BIAs and habitat critical to the survival of green turtles that overlap the MEZ/EMBA are presented in **Table 4-6, Table 4-7** and **Figure 4-2**.

4.4.3.3 Leatherback Turtle (Endangered, Migratory)

The leatherback turtle (*Dermochelys coriacea*) has the widest distribution of any marine turtle, and can be found in tropical, subtropical and temperate waters throughout the world (Marquez, 1990). They are planktivorous throughout their life, feeding on jellyfish and large planktonic ascidians (e.g. sea squirts) in the water column (Limpus, 2009). Small numbers of leatherback turtles nest on the Cobourg Peninsula and there have been unconfirmed accounts of leatherback turtles nesting in WA (DoEE, 2017a). Leatherback turtles are known to forage and migrate throughout Australia, but are more commonly found in Australian waters along the east coast and in Bass Strait (DoEE, 2017a). No BIAs and habitat critical to the survival of leatherback turtles overlap with the MEZ/EMBA.

4.4.3.4 Hawksbill Turtle (Vulnerable, Migratory)

Hawksbill turtles (*Eretmochelys imbricate*) are found in nearshore and offshore reef habitats, and are omnivorous, feeding on algae, sponges, soft coral and other soft-bodies invertebrates

(Whiting et al. 2014). The most significant breeding areas are around sandy beaches within the Dampier Archipelago, Montebello Islands, Lowendal Islands and Barrow Island (Pendoley, 2005; Limpus, 2009). BIAs and habitat critical to the survival of hawksbill turtles that overlap the MEZ/EMBA are presented in **Table 4-6, Table 4-7** and **Figure 4-2**.

4.4.3.5 Olive Ridley Turtle (Endangered)

The Olive Ridley turtle (*Lepidochelys olivacea*) has a worldwide tropical and sub-tropical distribution and is known to occur in both WA and the NT (DSEWPaC, 2012c). Whilst nesting has been recorded in WA, it is far more common in the NT (DSEWPaC, 2012a). Although Olive Ridley turtles nest all year round, nesting activity peaks around April to November, with the majority of nesting occurring from the Arnhem Land coast (including Bathurst Island, a BIA) to the northwestern coast of Cape York Peninsula (DSEWPaC, 2012c). After nesting, Olive Ridley turtles are known to migrate up to 1,050 km to various foraging areas (DAWE, 2020a). Adult turtles forage for crabs, shrimp, tunicates, jellyfish, salps and algae in depths ranging from several metres to over 100 m (DAWE, 2020a). No BIAs and habitat critical to the survival of Olive Ridley turtles overlap with the MEZ. One BIA overlaps the EMBA (**Table 4-6**).

4.4.3.6 Flatback Turtle (Vulnerable, Migratory)

The flatback turtle (*Natator depressus*) is endemic, and found in the tropical waters of northern Australia. They are the second most abundant species of turtle on the NWS. Flatback turtles forage across the Australian continental shelf and into the continental waters off Indonesia and Papua New Guinea. They are primarily carnivorous, feeding on soft-bodied invertebrates (DoEE, 2017a).

This species migrates between the Pilbara region of WA to the northern reaches of the state and Irian Jaya (Whittock et al. 2016). Studies indicate that flatback turtles generally have a broader internesting distribution than other turtles (Waayers et al. 2011), travelling at least 26 km from their nesting beach, but have been recorded up to 48 km (Waayers et al. 2011). BIAs and habitat critical to the survival of flatback turtles that overlap the MEZ/EMBA are presented in **Table 4-6, Table 4-7** and **Figure 4-2**.

4.4.4 Marine Reptiles – Seasnakes

Details of the two threatened seasnakes that are known/ likely to occur within the MEZ/EMBA are discussed below.

4.4.4.1 Short-nosed Seasnake (Critically Endangered)

The short-nosed seasnake (*Aipysurus apraefrontalis*) is endemic to WA and occurs throughout the NWS and Eastern Indian Ocean (DAWE, 2020a). This fully aquatic species can grow up to 90 cm in length and prefers shallow coastal reef habitats. Cartier Island and Ashmore Reef are internationally significant for their abundance and diversity of seasnakes (DAWE, 2020a).

4.4.4.2 Leaf-scale seasnake (Critically Endangered)

The only known populations of the leaf-scale seasnake (*Aipysurus foliosquama*) inhabit the shallow reef habitats of the Sahul Shelf and Ashmore Reef (Minton and Heatwole, 1975). It occurs in shallow water (less than 10 m in depth), in the protected parts of the reef flat, adjacent to living coral and on coral substrates (DAWE, 2020a). The leaf-scaled seasnake forages by searching in fish burrows on the reef flat (DAWE, 2020a).

4.4.5 Marine Mammals

An EPBC Protected Matters Search Tool (PMST) report (**Appendix C**) identified seven listed threatened marine mammal species (five of which are migratory) and and additional 12 listed migratory species as having the potential to occur within the MEZ/EMBA (**Table 4-8**). **Table 4-9** summarises the Recovery Plans and Conservation Advices relevant to those species identified by the EPBC Protected Matters searches (**Table 4-8**) as potentially occurring within or using habitat in the MEZ/EMBA.

Table 4-8 Threatened and/or migratory marine mammals potentially occurring within the MEZ and EMBA

Common Name	Species Name	EPBC Act Status		Presence	
		Threatened	Migratory	MEZ	EMBA
Sei whale	*Balaenoptera borealis*	Vulnerable	Migratory	✓	✓
Blue whale	*Balaenoptera musculus*	Endangered	Migratory	✓	✓
Fin whale	*Balaenoptera physalus*	Vulnerable	Migratory	✓	✓
Humpback whale	*Megaptera novaeangliae*	Vulnerable	Migratory	✓	✓
Bryde's whale	*Balaenoptera edeni*		Migratory	✓	✓
Killer whale	*Orcinus orca*		Migratory	✓	✓
Sperm whale	*Physeter macrocephalus*		Migratory	✓	✓
Spotted bottlenose dolphin (Arafura/Timor Sea)	*Tursiops aduncus*		Migratory	✓	✓
Southern right whale	*Eubalaena australis*	Endangered	Migratory	✓	✓
Australian sea lion	*Neophoca cinerea*	Vulnerable		✓	✓
Antarctic minke whale	*Balaenoptera bonaerensis*		Migratory	✓	✓
Bryde's whale	*Balaenoptera edeni*		Migratory	✓	✓
Pygmy right whale	*Caperea marginata*		Migratory	✓	✓
Dugong	*Dugong dugon*		Migratory	✓	✓
Dusky dolphin	*Lagenorhynchus obscurus*		Migratory	✓	✓
Australian snubfin dolphin	*Orcaella heinsohni*		Migratory	✓	✓
Australasian humpback dolphin	*Sousa chinensis*		Migratory	✓	✓

Table 4-9 Threatened species Recovery Plans, Management Plans and Conservation Advice relevant to the Activity

Receptor	Recovery Plan, Management Plan or Conservation Advice	Threats Identified as Relevant to the Activity	Relevant EP Section
All vertebrate fauna	Threat Abatement Plan for Impacts of Marine Debris on Vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018)	Marine debris	**Section 8.5**
Sei whale	Approved Conservation Advice for *Balaenoptera borealis* (sei whale) (TSSC, 2015a)	Anthropogenic noise and acoustic disturbance	**Section 7.4**
		Habitat degradation including pollution	**Sections 7.6, 7.7, 8.1, 8.2**
		Pollution (persistent toxic pollutants)	**Sections 8.1, 8.2**
		Vessel strike	**Section 8.6**
Blue whale	Blue Whale Conservation Management Plan 2015 - 2025 (DoE, 2015a)	Noise interference	**Section 7.4**
		Habitat modification	**Section 8.1**
		Vessel disturbance	**Section 8.1**

Receptor	Recovery Plan, Management Plan or Conservation Advice	Threats Identified as Relevant to the Activity	Relevant EP Section
Fin whale	Approved Conservation Advice for *Balaenoptera physalus* (fin whale) (TSSC, 2015b)	Anthropogenic noise and acoustic disturbance	**Section 7.4**
		Habitat degradation including pollution	**Sections 7.6, 7.7, 8.1, 8.2**
		Pollution (persistent toxic pollutants)	**Sections 8.1, 8.2**
		Vessel strike	**Section 8.1**
Humpback whale	Approved Conservation Advice for *Megaptera novaeangliae* (humpback whale) (TSSC, 2015c)	Noise interference	**Section 7.4**
		Vessel strike	**Section 8.6**
		Habitat degradation	**Sections 8.1, 8.2**
Southern right whale	Conservation Management Plan for the Southern Right Whale 2011 – 2021 (DSEWPaC, 2012c)	Vessel disturbance	**Section 8.6**
		Habitat modification	**Sections 8.1, 8.2**
		Noise interference	**Section 7.4**
Australian sea lion	Recovery Plan for the Australian Sea Lion (*Neophoca cinerea*) (DSEWPaC, 2013a)	Noise interference	**Section 7.4**
		Human disturbance and direct killing	**Section 8.1**
		Habitat degradation	**Sections 8.1**

4.4.6 Marine Mammals – Cetaceans

BIAs for cetaceans that overlap the MEZ/EMBA are presented in **Table 4-10** and **Figure 4-3**. A comprehensive description of the threatened and/or migratory cetaceans likely to be present within the MEZ are discussed in **Sections 4.4.6.1** to **4.4.6.14**.

Table 4-10 BIAs for cetaceans within the MEZ and EMBA

Species	BIA	Area/ Location	Presence	
			MEZ	EMBA
Pygmy blue whale	Migration	Augusta to Derby (tend to pass along the shelf edge at depths of 500 m to 1,000 m; appear close to coast in the Exmouth-Montebello Islands area on southern migration). Indonesia - Banda Sea	✓	✓
	Foraging	Scott Reef Ningaloo Outer continental shelf from Cape Naturaliste to south of Jurien Bay Perth Canyon Outer Perth Canyon Head of the Perth Canyon	✓	✓
Southern right whale	Calving buffer	Perth to Kangaroo Island	✓	✓
	Seasonal calving habitat	Coast east of Flinders Bay area to Torbay Bay area Coast Cape Naturaliste to Cape Leeuwin	✓	✓
Humpback whale	Migration (north)	Cape Leeuwin to Houtman Abrolhos Esperance to Cape Leeuwin Flinders Bay North of Houtman Abrolhos	✓	✓

Species	BIA	Area/ Location	Presence	
			MEZ	EMBA
	Migration (north and south)	Cape Naturaliste to Cape Leeuwin Houtman Abrolhos Islands West coast – Lancelin to Kalbarri West coast –Bunbury to Lancelin including Rottnest Island *The migration corridor extends from the coast to out to approximately 100 km off shore in the Kimberley region extending south to Northwest Cape. From Northwest Cape to south of shark Bay the migration corridor is reduced to approximately 50 km.	✓	✓
	Resting	Exmouth Gulf Shark Bay	✓	✓
	Nursing	Kimberley/Coastal North Lacepede Island, Camden Sound		✓
	Calving	Kimberley/Coastal North Lacepede Island, Camden Sound		✓
Sperm whale	Foraging	Albany Canyons - Immediately south of the continental shelf edge extending over the continental slope, to include the area of the ‘Albany Canyons’ Western end of Perth Canyon	✓	✓

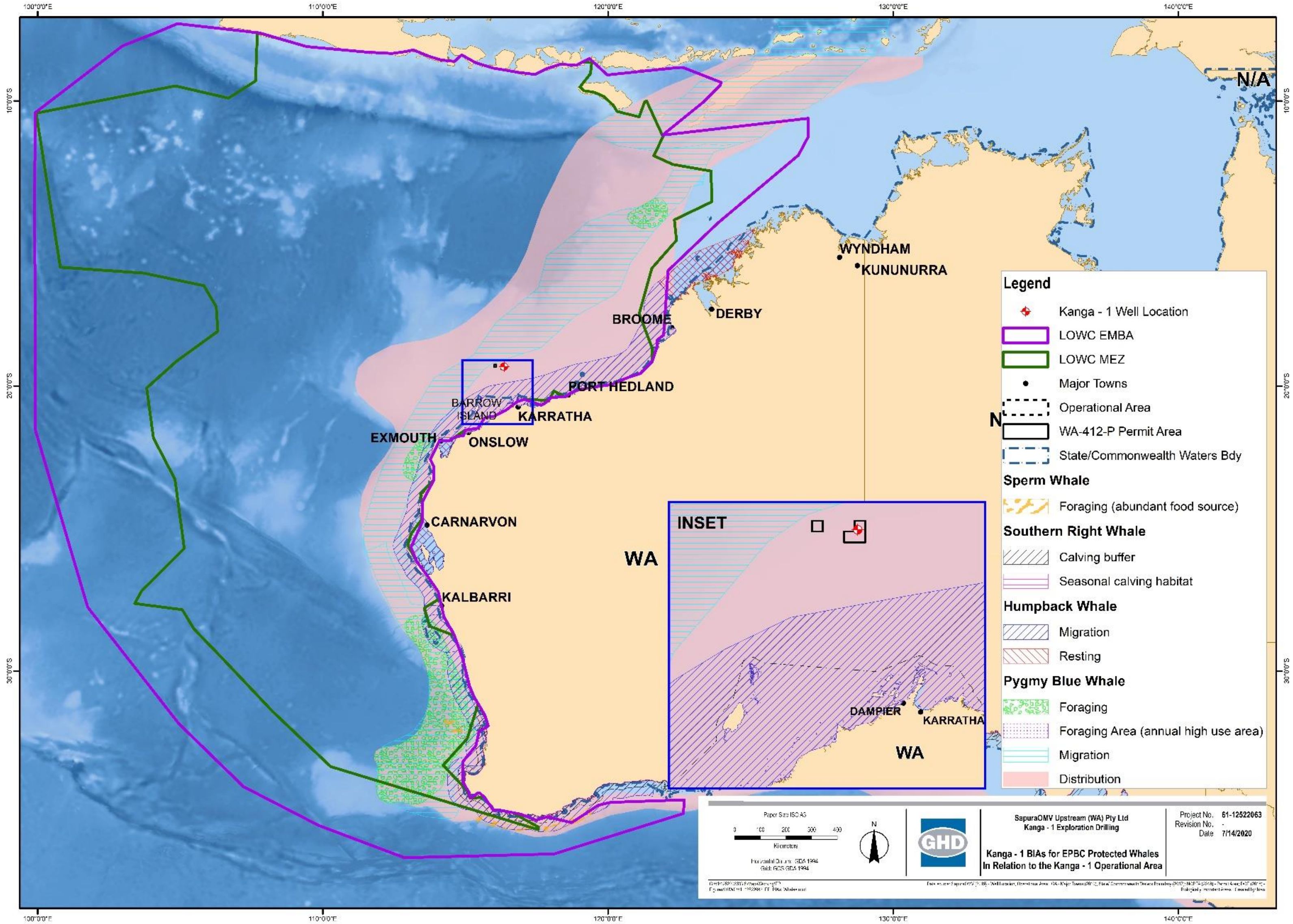


Figure 4-3 BIAs for whale species in the vicinity of the MEZ and EMBA

4.4.6.1 Sei Whale (Vulnerable, Migratory)

The sei whale (*Balaenoptera borealis*) has a worldwide oceanic distribution, and can be found in predominantly deep waters or near continental slopes of temperate to subpolar waters (Prieto et al*.* 2014). The species is expected to seasonally migrate between low latitude wintering areas and high latitude summer feeding grounds (Bannister et al. 1996; Prieto et al. 2012). In Australia, migratory routes are between Australian waters and Antarctic feeding areas, but movements are unpredictable and not well documented. Sei whales have been infrequently recorded in Australia, and very rarely seen in inshore waters, with the exclusion of the Bonney Upwelling (Bannister et al. 1996). There are no known mating or calving areas (Bannister et al*.* 1996; Parker, 1978).

4.4.6.2 Blue Whale (Endangered, Migratory)

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, any blue whales present in the MEZ would be expected to be pygmy blue whales. The 2015 Conservation Management Plan for the Blue Whale (DoE, 2015a) defines the distribution of blue whales in Australian waters and identifies a number of BIAs (i.e. migratory corridor and foraging BIAs).

Pygmy blue whale migration is thought to follow deep oceanic routes (DEWHA, 2008a). More recently, the migration route has been defined as along the shelf edge at depths between 500 m to 1,000 m (DoE, 2015a), where they are likely to feed opportunistically on ephemeral krill aggregations (DEWHA, 2008a). Satellite tagging established that the general distribution of pygmy blue whales was offshore in water depths >200 m and commonly >1,000 m (Double et al. 2012). This data was revisited in 2014 and showed that whales travelled relatively near to the Australian coastline (~100 km) until reaching North West Cape, after which they travelled offshore (~240 km). Once away from the Australian coast, the water depths of recorded pygmy blue whale presence exceeded 4,000 m (Double et al. 2014).

More recent acoustic and satellite tracking surveys at various locations along the WA coast have further delineated pygmy blue whale migration from McCauley and Jenner (2010) as an annual north-bound migration past Exmouth and the Montebello Islands between April and August (peak period between May and June), and southbound migration from October to the end of January, peaking in late November to early December (Double et al. 2014). BIAs for pygmy blue whales that overlap the MEZ/EMBA are presented in **Table 4-10** and **Figure 4-3**.

4.4.6.3 Fin Whale (Vulnerable, Migratory)

Fin whales (*Balaenoptera physalus*) are the second largest baleen whale species, and inhabit polar to tropical waters globally. Like other baleen whales, fin whales migrate annually between high latitude summer feeding grounds and lower latitude over-wintering areas (Bannister et al. 1996). Areas of upwelling and interfaces between mixed and stratified waters may be an important feature of fin whale feeding habitat. In the Antarctic, the species is seen feeding both at the ice edge and further to the north in areas of complex bathymetry (DEH, 2005a).

There is insufficient data to define migration times for fin whales, but recent sightings in Australian waters include summer and autumn months (DAWE, 2020a). It is likely that fin whales pass through Australian waters between calving grounds in Indonesia and feeding grounds in the subantarctic and Antarctic (DAWE, 2020a). In Australia, there are confirmed records of fin whales for all coastal waters except in New South Wales and the NT, but the available information suggests that the species is more commonly present in deeper water (DEH, 2005a).

4.4.6.4 Southern Right Whale (Endangered, Migratory)

The southern right whale (*Eubalaena australis*) is present in the southern hemisphere between approximately 30° and 60°S. The species feeds in the Southern Ocean in summer, moving close to the Australian shore in winter.

In Australian waters, the southern right whales distribution range from Perth, along the southern coastline, to Sydney. Sightings have been recorded as far north as Exmouth although these are rare (Bannister et al. 1996). BIAs including calving and aggregation areas are recorded for this species along the southern coastline of Australia (DAWE, 2020a). The MEZ/EMBA overlaps with several calving BIAs for this species (see **Table 4-10** and **Figure 4-3**).

4.4.6.5 Humpback Whale (Vulnerable, Migratory)

Humpback whales (*Megaptera novaeangliae*) have a worldwide distribution, and are known to migrate north from their Antarctic feeding grounds around May each year, and reach the waters of the NWMR in early June (DEWHA, 2008a). The precise timing of migration however varies from year to year by up to six weeks, influenced by water temperature, sea ice distribution, predation risk, prey abundance and the location of feeding grounds (DEWR, 2007). Humpback whales travel northbound from North West Cape, along the continental shelf and pass the west of the Muiron, Barrow and Montebello Islands, peaking in late July (Jenner et al*.* 2001). Southbound migrations are more diffuse and irregular with no obvious peak. The southerly migration extends parallel to the coast on the 20 – 30 m depth contour from Lacepede Islands (north of Broome) (Jenner et al*.* 2001, DEWHA, 2008a). An increase in southerly migrating individuals may be observed between the North West Cape and the Montebello Islands around November (Jenner et al*.* 2001).

Studies identify extended humpback whale calving range along WA coast. Breeding and calving occur between August and September with breeding and calving grounds extending south from Camden Sound to the North West Cape (Irvine et al*.* 2018). This coincides with the start of the southern migration (DEWHA, 2008a). Exmouth Gulf and Shark Bay are important resting areas for migrating humpbacks (DEWHA, 2008a).The largest population of humpback whales worldwide, the Breeding Stock D (BSD) population (estimated at ~20,000–30,000) (Salgado Kent et al*.* 2012), feeds in Antarctic Management Area IV (70°E–130°E) and there is evidence that these are the animals that migrate along the west coast of Australia (Franklin et al. 2017). This population has been increasing at a rate of 10%–13% each year (Bannister and Hedley, 2001, Salgado Kent et al*.* 2012)

The humpback whale migration (north and south) BIA is located in the MEZ. Other BIAs for this species that overlap the MEZ/EMBA are presented in **Table 4-10** and **Figure 4-3**.

4.4.6.6 Antarctic Minke Whale (Migratory)

The Antarctic minke whale (*Balaenoptera bonaerensis*) is distributed throughout the Southern Hemisphere from 55°S to the Antarctic ice edge during the austral summer and has been recorded in all Australian States (Bannister et al. 1996; Perrin and Brownell, 2002). Detailed information on timing and location of migrations and breeding grounds on the west coast of Australia is largely unknown. However, it is believed that the Antarctic minke whale migrates up the WA coast to approximately 20°S during Australian winter to feed and possibly breed (Bannister et al*.* 1996).

4.4.6.7 Bryde's Whale (Migratory)

Bryde's whales (*Balaenoptera edeni*) are the second smallest of the baleen whales. Two provisional subspecies were recently recognized, *B.edeni edeni* and *B.edeni brydei*, referring to the small, coastal form (limited to the 200 m depth isobar) and larger, oceanic form (500 m to 1000 m) respectively (Kershaw et al. 2013; Rosel and Wilcox, 2014). Bryde's whales are found in the Atlantic, Pacific, and Indian Oceans in warm temperate and sub-tropical waters. Populations are bounded by latitudes 40° N and 40° S and the 20° C isotherm (Bannister et al. 1996), and they have been recorded from all Australian states except the NT (Bannister et al. 1996).

Bryde's whales do not undertake the long-range seasonal migrations typically associated with most other baleen whales, but they may travel widely throughout ocean basins as they move through tropical and warm-temperate waters (Kato and Perrin, 2018). Bryde's whales feed almost exclusively on pelagic fish (pilchard, mackerel, herring, and anchovies), pelagic crustaceans (shrimp, crabs, and lobsters), and cephalopods (octopus, squid, and cuttlefish).

4.4.6.8 Pygmy Right Whale (Migratory)

Pygmy right whale (*Caperea marginate*) is the smallest and least conspicuous baleen whale (Kemper, 2002a) and is the only right whale with a dorsal fin (DAWE, 2020a). The pygmy right whale is found in temperate and sub-Antarctic waters of the Southern Hemisphere between about 19 °C and 52 °C (Kemper, 2002b). There is no information regarding movement patterns of pygmy right whales, however young pygmy right whales appear to be restricted to shallow coastal waters (Kemper, 2002a) and weaned juveniles head south of 41° into waters with higher prey abundance (Kemper, 2002a).

4.4.6.9 Dusky Dolphin (Migratory)

The dusky dolphins (*Lagenorhynchus obscurus*) occur throughout the Southern hemisphere, mostly in temperate and sub-Antarctic zones between 55° and 26° S. They are presumed to be inshore species, although they are also known to be pelagic (Gill et al. 2000; Ross, 2006). Dusky dolphins are recognised to be able to move between Australia and other countries as deep water is not considered a barrier for this species (DAWE, 2020a). They typically occur in groups of 100 individuals in summer and less than 20 in winter (Wursig et al. 1997). Dusky dolphins are generally considered to be surface feeders, often found feeding in aggregations with sea birds. Their prey include schooling fish especially southern anchovy, and midwater and benthic prey such as squid and lanternfish (DAWE, 2020a).

4.4.6.10 Australian Snubfin Dolphin (Migratory)

The Australian snubfin dolphin (*Orcaella heinsohni*), also know as Irrawaddy dolphin is known to mainly occur in shallow coastal and estuarine waters of Queensland, Northern Territory and north WA (DAWE, 2020a). Surveys have indicated that the species is typically found in protected shallow nearshore waters, generally less than 20 m deep, adjacent to river and creek mouths close to seagrass beds (DAWE, 2020a). The Australian Snubfin Dolphin has been found in the shallow coastal waters and estuaries along the Kimberley coast, while Beagle and Pender Bays on the Dampier Peninsula and tidal creeks around Yampi Sound and between Kuri Bay and Cape Londonderry are also important areas (DAWE, 2020a). Australian snubfin dolphins feed on fish typically associated with shallow coastal waters and estuaries in tropical regions (DAWE, 2020a).

4.4.6.11 Orca/ Killer Whale (Migratory)

The killer whale (*Orcinus orca*) is a cosmopolitan marine mammal found in all oceans of the world, from shallow coastal waters to deep offshore waters (Ford, 2002). In Australia, killer whales have been sighted in all state and territory waters. Higher concentrations have been reported off southern Australia, from southern New South Wales to western Victoria (Mustoe, 2008), and off WA, from the far south-east to mid-north coast (Wellard et al. 2015; Pitman et al. 2015). Killer whales off WA have been observed preying on neonatal humpback whales during the humpback whale northern migration to calving grounds (Pitman et al. 2015; V. Brosig pers. comm.). Nonetheless, there is limited knowledge of their distribution, movements, habitat use and population status. To date, there has been no reliable estimate of the population size of killer whales in Australian waters.

4.4.6.12 Sperm Whale (Migratory)

Sperm whales (*Physeter microcephalus*) are the largest of the toothed whales and are distributed worldwide in deep waters (greater than 200 m) off continental shelves and sometimes near shelf edges (Bannister et al. 1996). They are most common in submarine canyons at the edges of the continental shelf, but they also occur in mid-ocean. Sperm whales have been recorded in all Australian state waters; female and juvenile sperm whales may not undergo extensive latitudinal migrations, but older, larger male sperm whales are generally found near the edge of the Antarctic pack-ice, occasionally returning to the warm water breeding area (DAWE, 2020a).

Off the WA coast, where the continental shelf slopes less steeply, sperm whales appear to be less concentrated close to shelf edge and more widely dispersed offshore (Bannister et al. 1996). In WA, one key locality includes the area between Cape Leeuwin and Esperance, close to the edge of the continental shelf (averaging 20–30 nm offshore). Two foraging BIAs for sperm whales have been identified; located at the western end of Perth canyon and at Albany canyons (inside the MEZ/EMBA; **Table 4-10** and **Figure 4-3**) (DAWE, 2020b).

4.4.6.13 Australian Humpback Dolphin (Migratory)

Australian humpback dolphins (*Sousa chinensis*) are found primarily in coastal waters and feed mainly on fishes associated with coastal-estuarine waters (DAWE, 2020a). Australian humpback dolphins are mainly found in water less than 20 km from the nearest river mouth, mangroves, seagrass beds, tidal channels and inshore reefs. They are known to have resident groups that forage, feed, breed and calve in state and territory waters. Calves may be born throughout the year, but peaks in summer and spring have been reported (DAWE, 2020a).

4.4.6.14 Spotted Bottlenose Dolphin (Arafura/ Timor Sea) (Migratory)

The Indian Ocean bottlenose dolphin (*Tursiops aduncus*), also referred to as the spotted bottlenose dolphin, mainly occurs in four regions around Australia: Eastern Indian Ocean, Tasman Sea, Coral Sea and Arafura/Timor seas (DAWE, 2020a). Only the Arafura/Timor Sea populations are considered migratory. They tend to occur in inshore areas such as bays and estuaries, nearshore waters, open coast environments, and shallow offshore waters including coastal areas around oceanic islands (DAWE, 2020a). Calving peaks are in spring and summer or spring and autumn (DSEWPaC, 2012).

4.4.7 Marine Mammals - Dugong

Dugongs (*Dugong dugon*) are known to favour shallow waters with a high abundance of seagrass. Dugongs are common in shallow waters in the Exmouth Gulf, the Dampier Archipelago and Kimberley region, and shallow waters surrounding a number of offshore islands (including Barrow Island, Montebello Islands, and Ashmore Reef and Cartier Island). The MEZ/EMBA overlaps with several BIAs for this species (see **Table 4-11** and **Figure 4-4**).

Table 4-11 BIAs for dugongs within the MEZ and EMBA

BIA	Area/ Location	Presence	
		MEZ	EMBA
Breeding	Dirk Hartog Island, Shark Bay Exmouth Gulf	✓	✓
Calving	Exmouth Gulf	✓	✓
Nursing	Exmouth Gulf	✓	✓
Foraging	Dirk Hartog Island, Shark Bay Exmouth Gulf South Passage, Shark Bay	✓	✓

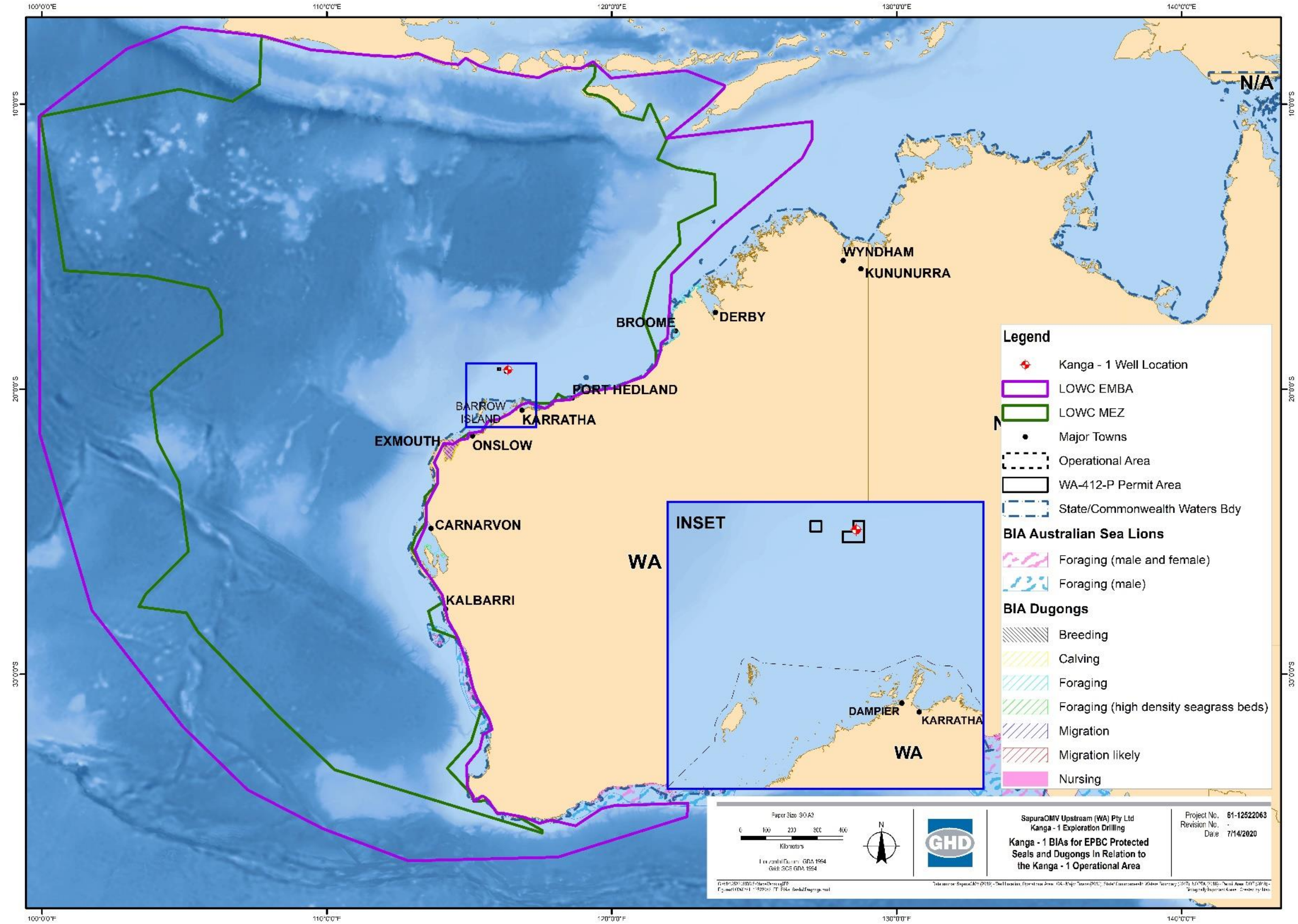


Figure 4-4 BIAs for dugongs and seals in the vicinity of the MEZ and EMBA

4.4.8 Marine Mammals – Pinnipeds

An EPBC Protected Matters Search Tool (PMST) report (**Appendix C**) identified one threatened pinniped species as potentially occurring in the MEZ/EMBA – the Australian sea lion.

4.4.8.1 Australian Sea Lion (Vulnerable)

The Australian sea lion (*Neophoca cinerea*) is the only pinniped endemic to Australia. They use a wide variety of habitats for breeding, and during non-breeding season, for haul-out (rest stops, which are also useful for predator avoidance, thermal regulation and social activity) (DAWE, 2020a). The breeding range extends from Houtman Abrolhos Islands in WA to the Pages Island, east of Kangaroo Island in South Australia (DAWE, 2020a). The species has also been recorded at Shark Bay (DAWE, 2020a).

Australian sea lions feed on cephalopods, fish, shark, rock lobsters and sea birds (DAWE, 2020a). Male Australian sea lions have been recorded foraging in areas up to 60 km away from their birth colonies, with potentially larger dispersal ranges up to 180 km (Hamer et al. 2011). However, female Australian sea lions have restricted home ranges, with high rates of natal site fidelity (only breeding at the site they were born) and limited gene flow with other regions (Campbell, 2005). The MEZ/EMBA overlaps with foraging BIAs for this species (see **Table 4-12** and **Figure 4-4**).

Table 4-12 BIAs for Australian sea lions within the MEZ and EMBA

BIA	Area/ Location	Presence	
		MEZ	EMBA
Foraging (male and female)	Houtman Abrolhos Islands Mid west coast, includes Beagle Island, Fisherman Island, Jurien Bay, Cervantes and Buller Colonies	✓	✓

4.4.9 Marine Birds

An EPBC Protected Matters Search Tool (PMST) report (**Appendix C**) identified 33 listed threatened marine bird species (21 of which are also migratory) and 44 listed migratory species as having the potential to occur within the MEZ. An additional three migratory species were identified as potentially occurring in the EMBA (**Table 4-13**). **Table 4-14** summarises the Recovery Plans and Conservation Advices relevant to those species identified by the EPBC Protected Matters searches (**Table 4-13**) as potentially occurring within or using habitat in the MEZ/EMBA. BIAs for marine birds that overlap the MEZ/EMBA are presented in **Table 4-15** and **Figure 4-5**.

Table 4-13 Threatened and/or migratory marine bird species potentially occurring within the MEZ and EMBA

Common Name	Species Name	EPBC Act Status		Presence	
		Threatened	Migratory	MEZ	EMBA
Red knot	*Calidris canutus*	Endangered	Migratory	✓	✓
Eastern curlew	*Numenius madagascariensis*	Critically Endangered	Migratory	✓	✓
Common noddy	*Anous stolidus*		Migratory	✓	✓
Streaked shearwater	*Calonectris leucomelas*		Migratory	✓	✓
Lesser frigatebird	*Fregata ariel*		Migratory	✓	✓
Great frigatebird	*Fregata minor*		Migratory	✓	✓

Common Name	Species Name	EPBC Act Status		Presence	
		Threatened	Migratory	MEZ	EMBA
Common sandpiper	*Actitis hypoleucos*		Migratory	✓	✓
Sharp-tailed sandpiper	*Calidris acuminata*		Migratory	✓	✓
Pectoral sandpiper	*Calidris melanotos*		Migratory	✓	✓
Australian lesser noddy	*Anous tenuirostris melanops*	Vulnerable		✓	✓
Australasian bittern	*Botaurus poiciloptilus*	Endangered		✓	✓
Curlew sandpiper	*Calidris ferruginea*	Critically Endangered	Migratory	✓	✓
Great knot	*Calidris tenuirostris*	Critically Endangered	Migratory	✓	✓
Greater sand plover	*Charadrius leschenaultii*	Vulnerable	Migratory	✓	✓
Lesser sand plover	*Charadrius mongolus*	Endangered	Migratory	✓	✓
Amsterdam albatross	*Diomedea amsterdamensis*	Endangered	Migratory	✓	✓
Antipodean albatross	*Diomedea antipodensis*	Vulnerable	Migratory	✓	✓
Tristan albatross	*Diomedea dabbenena*	Endangered	Migratory	✓	✓
Southern royal albatross	*Diomedea epomophora*	Vulnerable	Migratory	✓	✓
Wandering albatross	*Diomedea exulans*	Vulnerable	Migratory	✓	✓
Northern royal albatross	*Diomedea sanfordi*	Endangered	Migratory	✓	✓
Christmas Island frigatebird	*Fregata andrewsi*	Endangered	Migratory	✓	✓
Blue petrel	*Halobaena caerulea*	Vulnerable		✓	✓
Western Alaskan bar-tailed godwit	*Limosa lapponica baueri*	Vulnerable		✓	✓
Northern Siberian bar-tailed godwit	*Limosa lapponica menzbieri*	Critically Endangered		✓	✓
Southern giant petrel	*Macronectes giganteus*	Endangered	Migratory	✓	✓
Northern giant petrel	*Macronectes halli*	Vulnerable	Migratory	✓	✓
Fairy prion (southern)	*Pachyptila turtur subantarctica*	Vulnerable		✓	✓
Abbott's booby	*Papasula abbotti*	Endangered		✓	✓
Christmas Island white-tailed tropicbird	*Phaethon lepturus fulvus*	Endangered		✓	✓
Sooty albatross	*Phoebetria fusca*	Vulnerable	Migratory	✓	✓
Round Island petrel	*Pterodroma arminjoniana*	Critically Endangered		✓	✓
Soft-plumaged petrel	*Pterodroma mollis*	Vulnerable		✓	✓
Australian painted snipe	*Rostratula australis*	Endangered		✓	✓
Australian fairy tern	*Sternula nereis nereis*	Vulnerable		✓	✓
Indian yellow-nosed albatross	*Thalassarche carteri*	Vulnerable	Migratory	✓	✓
Shy albatross	*Thalassarche cauta*	Endangered	Migratory	✓	✓
White-capped albatross	*Thalassarche steadi*	Vulnerable	Migratory	✓	✓

Common Name	Species Name	EPBC Act Status		Presence	
		Threatened	Migratory	MEZ	EMBA
Campbell albatross	*Thalassarche impavida*	Vulnerable	Migratory	✓	✓
Black-browed albatross	*Thalassarche melanophris*	Vulnerable	Migratory	✓	✓
Flesh-footed shearwater	*Ardenna carneipes*		Migratory	✓	✓
Sooty shearwater	*Ardenna grisea*		Migratory	✓	✓
Wedge-tailed shearwater	*Ardenna pacifica*		Migratory	✓	✓
Caspian tern	*Hydroprogne caspia*		Migratory	✓	✓
Bridled tern	*Onychoprion anaethetus*		Migratory	✓	✓
White-tailed tropicbird	*Phaethon lepturus*		Migratory	✓	✓
Red-tailed tropicbird	*Phaethon rubricauda*		Migratory	✓	✓
Roseate tern	*Sterna dougallii*		Migratory	✓	✓
Little tern	*Sternula albifrons*		Migratory	✓	✓
Masked booby	*Sula dactylatra*		Migratory	✓	✓
Brown booby	*Sula leucogaster*		Migratory	✓	✓
Red-footed booby	*Sula sula*		Migratory	✓	✓
Oriental reed-warbler	*Acrocephalus orientalis*		Migratory		✓
Ruddy turnstone	*Arenaria interpres*		Migratory	✓	✓
Sanderling	*Calidris alba*		Migratory	✓	✓
Red-necked stint	*Calidris ruficollis*		Migratory	✓	✓
Long-toed stint	*Calidris subminuta*		Migratory	✓	✓
Double-banded plover	*Charadrius bicinctus*		Migratory		✓
Oriental plover	*Charadrius veredus*		Migratory	✓	✓
Swinhoe's snipe	*Gallinago megala*		Migratory	✓	✓
Pin-tailed snipe	*Gallinago stenura*		Migratory	✓	✓
Oriental pratincole	*Glareola maldivarum*		Migratory	✓	✓
Broad-billed sandpiper	*Limicola falcinellus*		Migratory	✓	✓
Asian dowitcher	*Limnodromus semipalmatus*		Migratory	✓	✓
Bar-tailed godwit	*Limosa lapponica*		Migratory	✓	✓
Black-tailed godwit	*Limosa limosa*		Migratory	✓	✓
Little curlew	*Numenius minutus*		Migratory	✓	✓
Whimbrel	*Numenius phaeopus*		Migratory	✓	✓
Osprey	*Pandion haliaetus*		Migratory	✓	✓
Red-necked phalarope	*Phalaropus lobatus*		Migratory		✓
Ruff (Reeve)	*Philomachus pugnax*		Migratory	✓	✓
Pacific golden plover	*Pluvialis fulva*		Migratory	✓	✓
Grey plover	*Pluvialis squatarola*		Migratory	✓	✓

Common Name	Species Name	EPBC Act Status		Presence	
		Threatened	Migratory	MEZ	EMBA
Crested tern	*Thalasseus bergii*		Migratory	✓	✓
Grey-tailed tattler	*Tringa brevipes*		Migratory	✓	✓
Wood sandpiper	*Tringa glareola*		Migratory	✓	✓
Common greenshank	*Tringa nebularia*		Migratory	✓	✓
Marsh sandpiper	*Tringa stagnatilis*		Migratory	✓	✓
Common redshank	*Tringa totanus*		Migratory	✓	✓
Terek sandpiper	*Xenus cinereus*		Migratory	✓	✓

Table 4-14 Threatened species Recovery Plans, Management Plans and Conservation Advice relevant to the Activity

Receptor	Recovery Plan, Management Plan or Conservation Advice	Threats Identified as Relevant to the Activity	Relevant EP Section
All vertebrate fauna	Threat Abatement Plan for Impacts of Marine Debris on Vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018)	Marine debris	**Section 8.5**
All Seabirds and Shorebirds	National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (DoEE, 2020)	Light pollution	**Section 7.3**
Giant-petrels and albatrosses	National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016 (DSEWPaC, 2011c)	Marine pollution	**Section 8.1**
Red knot	Approved Conservation Advice *Calidris canutus* (Red Knot) (TSSC, 2016a)	Habitat loss, disturbance and modifications	**Section 8.1**
		Direct mortality (bird strike)	**Section 8.6**
Eastern curlew	Approved Conservation Advice for *Numenius madagascariensis* (Eastern Curlew) (DoE, 2015c)	Habitat loss and degradation from pollution	**Section 8.1**
Australian fairy tern	Approved Conservation Advice for *Sternula nereis nereis* (Fairy Tern) (DSEWPaC, 2011d)	Habitat loss, disturbance and modifications	**Section 8.1**
		Oil spills affecting breeding habitat	
Australian lesser noddy	Approved Conservation Advice for *Anous tenuirostris melanops* (Australian lesser noddy) (TSSC, 2015e)	Habitat loss disturbance and modifications	**Section 8.1**
Australasian bittern	Approved Conservation Advice for *Botaurus poiciloptilus* (Australasian bittern) (TSSC, 2019)	Habitat loss disturbance and modifications	**Section 8.1**
Curlew sandpiper	Approved Conservation Advice for *Calidris ferruginea* (Curlew Sandpiper) (DoE, 2015d)	Habitat loss and degradation from pollution	**Section 8.1**
Great knot	Approved Conservation Advice *Calidris tenuirostriss* (Great knot) (TSSC, 2016b)	Habitat loss and degradation from pollution	**Section 8.1**
Greater sand plover	Approved Conservation Advice *Charadrius leschenaultii* (Greater sand plover) (TSSC, 2016c)	Habitat loss and degradation from pollution	**Section 8.1**
Lesser sand plover	Approved Conservation Advice *Charadrius mongolus* (Lesser sand plover) (TSSC, 2016d)	Habitat loss and degradation from pollution	**Section 8.1**

Receptor	Recovery Plan, Management Plan or Conservation Advice	Threats Identified as Relevant to the Activity	Relevant EP Section
Christmas Island frigatebird	Approved Conservation Advice *Fregata andrewsi* (Christmas Island Frigatebird (TSSC, 2016e) National recovery plan for the Christmas Island Frigatebird (*Fregata andrewsi*) (Hill and Dunn, 2004)	Habitat loss, disturbance and modifications	**Section 8.1**
Blue petrel	Approved Conservation Advice *Halobaena caerulea* (Blue petrel) (TSSC, 2015f)	Habitat loss, disturbance and modifications	**Section 8.1**
Western Alaskan bar-tailed godwit	Approved Conservation Advice for *Limosa lapponica baueri* (Bar-tailed godwit (western Alaskan)) (TSSC, 2016f)	Habitat loss, disturbance and modifications	**Section 8.1**
Northern Siberian bar-tailed godwit	Approved Conservation Advice *Limosa lapponica menzbieri* (Bar-tailed godwit (northern Siberian)) (TSSC, 2016g)	Habitat loss, disturbance and modifications	**Section 8.1**
Fairy prion (southern)	Approved Conservation Advice *Pachyptila turtur subantarctica* fairy prion (southern) (TSSC, 2015f)	Habitat loss, and degradation from pollution	**Section 8.1**
Abbott's booby	Approved Conservation Advice for *Papasula abbotti* (Abbott's booby) (TSSC, 2015g)	Habitat loss, disturbance and modifications	**Section 8.1**
Christmas Island White-tailed tropicbird	Approved Conservation Advice for *Phaethon lepturus fulvus* white-tailed tropicbird (Christmas Island) (DoE, 2014d)	Oil spills	**Section 8.1**
Round Island petrel	Approved Conservation Advice for *Pterodroma arminjoniana* Round Island petrel (TSSC, 2015h)	Oil spills	**Section 8.1**
Soft-plumaged petrel	Approved Conservation Advice for *Pterodroma mollis* (Soft-plumaged petrel) (TSSC, 2015i)	Habitat loss, disturbance and modifications	**Section 8.1**
Australian painted snipe	Approved Conservation Advice for *Rostratula australis* (Australian painted snipe) (DSEWPaC, 2013c)	Habitat loss, disturbance and modifications	**Section 8.1**
Shy Albatross	Approved Conservation Advice for *Thalassarche cauta* (Shy Albatross) (TSSC, 2020)	Marine debris	**Section 8.5**

Table 4-15 BIAs for marine bird species within the MEZ and EMBA

Species	BIA	Area/ Location	Presence	
			MEZ	EMBA
Australian lesser noddy	Foraging (provisioning young)	Houtman Abrolhos Islands	✓	✓
Soft-plumaged petrel	Foraging (in high numbers)	In WA found in seas north to 21º30'S.	✓	✓
Fairy tern	Breeding	Pilbara and Gascoyne coasts and islands	✓	✓
	Foraging (in high number)	Found in the vicinity of lower northwest coast (north to Dampier Archipelag), west coast (south to Peel Inlet) and south coast (from Flinders Bay east to Israelite Bay), including islands (as far offshore as Trimouille Island and Houtman Abrolhos.	✓	✓

Species	BIA	Area/ Location	Presence	
			MEZ	EMBA
Indian yellow-nosed albatross	Foraging (in high number)	Throughout offshore waters of south-west marine region, north to Shark Bay and extending east into Bass Strait	✓	✓
Common noddy	Foraging	Around Lancelin Island	✓	✓
	Foraging (provisioning young)	Around Houtman Abrolhos	✓	✓
Flesh-footed shearwater	Foraging (in high number)	Foraging from Cape Naturaliste to Eyre, 1-150 km offshore. Pre departure zone in some years from Rottnest Island to Bunbury.	✓	✓
	Aggregation	Pre-migration. From Cape Naturaliste to Eyre, 1-150 km offshore. Pre departure zone in some years from Rottnest Island to Bunbury		✓
Wedge-tailed shearwater	Breeding	Kimberley, Pilbara and Gascoyne coasts and islands including Ashmore Reef	✓	✓
	Foraging (in high numbers)	Breeding (in hundreds of thousands) off west coast from Ashmore Reef (12º15'S) to Carnac Island (32º07'S), and ranging in western seas between 12º00'S and 33º20'S.	✓	✓
Lesser frigatebird	Breeding	Kimberley and Pilbara coasts and islands, also Ashmore Reef.	✓	✓
Greater frigatebird	Breeding	Kimberley and Ashmore Reef	✓	✓
Caspian tern	Foraging (provisioning young)	In Western Australia found on most coasts, mainly islands (as far offshore as Adele, Bedout, Trimouille and the Houtman Abrolhos) and at Lake Argyle, Lake Gregory and Lake MacLeod; accidental elsewhere in the interior	✓	✓
Bridled tern	Foraging (in high numbers)	West coast of Western Australia and around to Recherche Archipelago including offshore waters	✓	✓
White-tailed tropicbird	Breeding	Kimberley, Pilbara and Gascoyne coasts and islands including Ashmore Reef	✓	✓
Roseate tern	Breeding	Kimberley, Pilbara and Gascoyne coasts and islands including Ashmore Reef	✓	✓
	Foraging and foraging (provisioning young)	Northwestern and west coasts and islands from Sir Graham Moore Island (13º50'S), south to Mandurah (32º32'S) and as far offshore as Ashmore Reef, Bedout Island and the Houtman Abrolhos.	✓	✓
	Resting	Eighty Mile Beach (northern end)	✓	✓
Little tern	Breeding and resting	Kimberley, Pilbara and Gascoyne coasts and islands including Ashmore Reef	✓	✓
Brown bobby	Breeding	Kimberley and northern Pilbara coasts and islands also Ashmore Reef	✓	✓
Red-footed booby	Breeding	North west Kimberley and Ashmore reef	✓	✓
Great-winged petrel	Foraging (provisioning young)	Offshore south of Shark Bay, extending around south-west corner of WA and east past Kangaroo Island	✓	✓

Species	BIA	Area/ Location	Presence	
			MEZ	EMBA
Lesser crested tern	Breeding	Kimberley, Pilbara and Gascoyne coasts and islands including Ashmore Reef	✓	✓
Little penguin	Foraging (provisioning young)	South-west WA from Augusta to Twiglight Cove	✓	✓
Little shearwater	Foraging (in high number)	From Kalbarri to Eucla including offshore waters	✓	✓
Pacific gull	Foraging (in high number)	West coast and islands from Point Quobba (24º30'S) south to Wedge I. (formerly south to Warnbro Sound and at Cape Naturaliste); casual further north (Point Cloates and Lake MacLeod). South coast and islands, west to Cape Leeuwin. Common around Albany and Esperance and in the Archipelago of the Recherche.	✓	✓
Sooty tern	Foraging	Timor Sea S to 14º30, off NW coast from Lacepede I SW to 117ºE inc Abrolhos, Fisherman & Lancelin Is, accidental on lower west coast to Hamelin Bay. Breeding visitor (late Aug - early May) Abrolhos & Lancelin Is; casual winter (Nov - Apr) to Fisherman	✓	✓
White-faced storm petrel	Foraging (in high numbers)	Offshore areas of the south-west marine region and into the adjacent south-east marine region and the northwest marine region to north of Shark Bay	✓	✓
Short-tailed shearwater	Foraging (in high numbers)	Found in the archipelago of the Recherche and ranging west to the lower west coast north to 33º40'S		✓

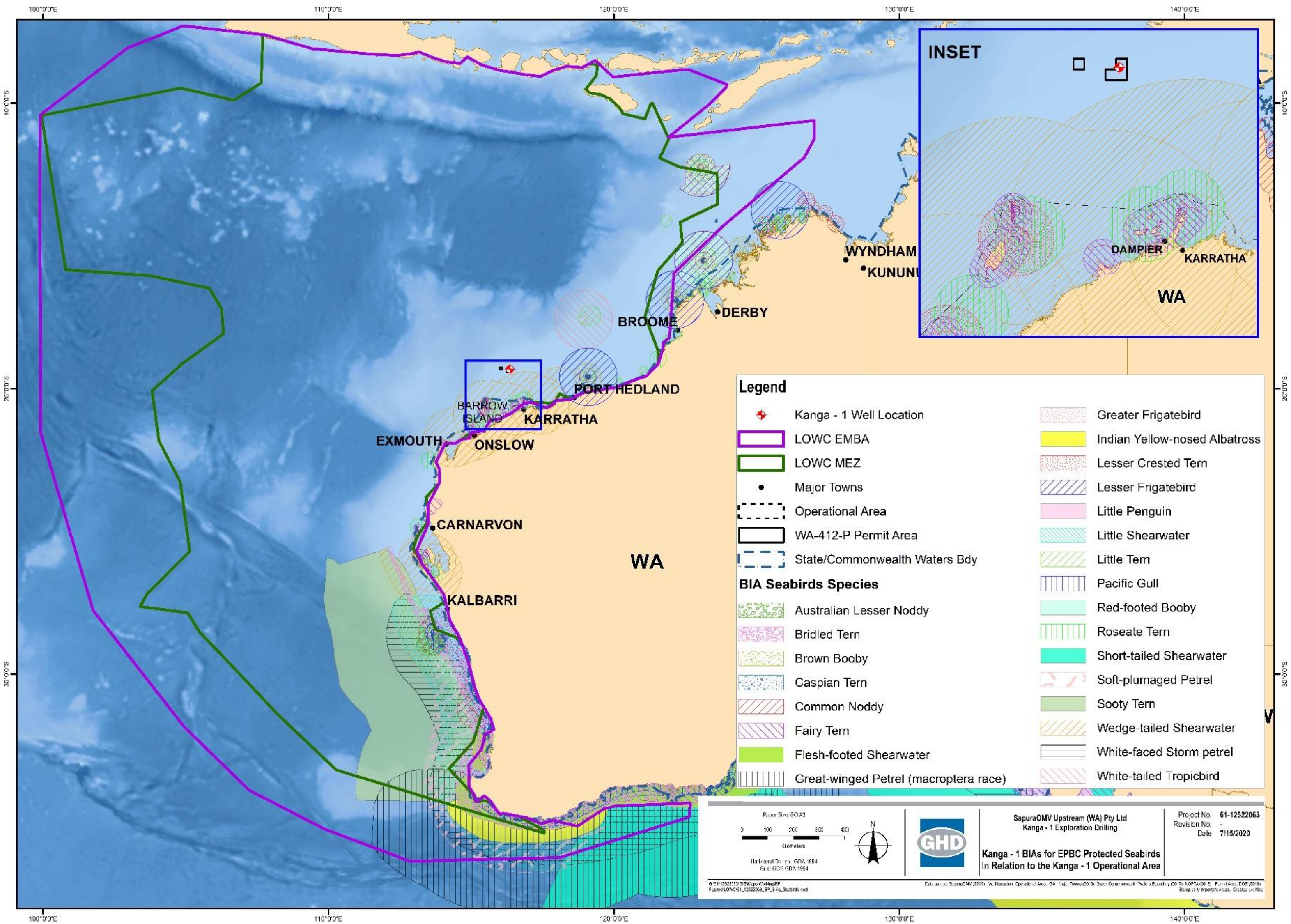


Figure 4-5 BIAs for marine bird species in the vicinity of the MEZ and EMBA

4.4.10 Marine Birds – Seabirds

A comprehensive description the threatened and/or migratory seabirds likely to be present within the MEZ are discussed below.

4.4.10.1 Australian Lesser Noddy

The Australian lesser noddy (*Anous tenuirostris melanops*) is endemic to Australia and nests on the Abrolhos Islands, Ashmore Reef and various other islands throughout tropical and sub-tropical northwest Australia (DAWE, 2020a). They may forage out to sea or close inshore to breeding islands, including outside fringing reefs, feeding on small squid and fish (DoEH, 2005). They roost mainly in mangroves, and sometimes rest on the beaches (DoEH, 2005). The MEZ/EMBA overlaps with a foraging (provisioning young) BIA for the Australian lesser noddy as presented in **Table 4-15** and **Figure 4-5**.

4.4.10.2 Curlew Sandpiper

In Australia, curlew sandpipers (*Calidris ferruginea*) is a migratory shorebird that breeds in north Siberia and spends the non-breeding season from western Africa to Australia (Bamford et al. 2008). The curlew sandpiper occurs around the coasts with prefered habitats including coastal brackish lagoons, tidal mud and sand flats, estuaries, saltmarshes and less often inland, in smaller numbers (DAWE, 2020a). Their diet comprises of polychaete worms, molluscs and crustaceans (Higgins and Davies, 1996).

4.4.10.3 Amsterdam Albatross

The Amsterdam albatross (*Diomedea amsterdamensis*) is a non-resident visitor to Australia, and may occur in south-west and south Australian waters (Pizzey and Knight, 1999). The Amsterdam albatross is a marine, pelagic seabird that forages in open water, mainly in the Indian Ocean (DAWE, 2020a). It feeds on squid, fish and crustaceans (DAWE, 2020a).

4.4.10.4 Antipodean Albatross

The antipodean albatross (*Diomedea antipodensis*) is a migratory, marine, pelagic and aerial species that sleeps and rests on ocean waters when not breeding (DAWE, 2020a). The antipodean albatross feeds primarily on cephalopods, fish and crustaceans (DAWE, 2020a).

4.4.10.5 Tristan Albatross

The Tristan albatross (*Diomedea dabbenena*) is a large albatross with poorly defined Australian at-sea distribution. There is currently only one definitive record of the Tristan albatross in Australian waters (DAWE, 2020a). The Tristan albatross is a marine, pelagic seabird that forages in open water in the Atlantic Ocean near the Cape of Good Hope, South Africa. It sleeps and rests on ocean waters when not breeding (Marchant and Higgins, 1990). The Tristan albatross feeds on squid, fish and crustacea (Marchant and Higgins, 1990).

4.4.10.6 Southern Royal Albatross

The southern royal albatross (*Diomedea epomophora*) have a circumpolar distribution within the Southern ocean, foraging from 36°S to 63°S, while spending most of their time south at 47°S. Southern royal albatrosses spend 35% of their time sitting on the water. They range over the waters off southern Australia at all times of the year, but especially between July and October. They have been recorded in Byron Bay in the east to south-west WA (DSEWPaC, 2011c).

4.4.10.7 Wandering Albatross

The wandering albatross (*Diomedea exulans*) is a marine, pelagic and aerial species that has a circumpolar distribution. It occurs where water surface temperatures range from -2° to 24°C

(DAWE, 2020a). The wandering albatross feeds mainly in pelagic, offshore and inshore waters and eats mainly squid and fish. They feed from the sea surface or just below it, or make shallow dives from heights of 2-5 m. They also feed on crustaceans and carrion (Marchant and Higgins, 1990).

4.4.10.8 Northern Royal Albatross

The northern royal albatross (*Diomedea sanfordi*) is migratory, and possibly circumpolar (Robertson and Kinsky, 1972). They are marine, pelagic and aerial and inhibits subantarctic, subtropical and occasionally Antarctic waters (Marchant and Higgins, 1990). The northern royal albatross feeds primarily on cephalopods, fish, crustaceans and salps (pelagic tunicates) with most food taken by surface seizing and rarely by surface plunging (DAWE, 2020a).

4.4.10.9 Christmas Island Frigatebird

The Christmas Island frigatebird (*Fregata andrewsi*) is a very large seabird. Christmas Island is the only place in the world where the Christmas Island frigatebird breeds and nests in the forest canopy (DAWE, 2020a). This species primarily forages in the ocean for food, scooping marine organisms such as fish and squid (DAWE, 2020a).

4.4.10.10Blue Petrel

The blue petrel (*Halobaena caerulea*) is marine species of the Sub Antarctic and Antarctic seas. In summer, it occurs mainly over waters of -2 to 2° C in surface temperature, but it also ranges south to the edge of the pack-ice and north to approximately 30° south, or further north over cool currents (DAWE, 2020a). In the Antarctic, it generally avoids the pack-ice, and only occasionally approaches the edge of the ice.

4.4.10.11Southern Giant Petrel

The southern giant petrel (*Macronectes giganteus*) is the largest petrel. They are a highly migratory bird with a large natural range. This species occurs from Antarctic to subtropical waters and breeds on the Antarctic continent, peninsular and islands and on subantarctic islands and South America. Breeding occurs annually between August and March (DAWE, 2020a). The southern giant petrel is an opportunistic scavenger and predator that scavenge on penguin carcasses and feed on seals and carrions. It also eats a wide variety of seabirds, penguin chicks, crustacean, kelp, fish, jellyfish and rabbits.

4.4.10.12Northern Giant Petrel

The northern giant petrel (*Macronectes halli*) occupies the Antarctic Polar Front (DAWE, 2020a). In summer, it occurs predominantly in sub-Antarctic to Antarctic waters, usually between 40 and 64° The northern giant-petrel breeds on sub-Antarctic islands and visits areas off the Australian mainlaind mainly during winter months (May – October) (DAWE, 2020a). Its breeding range extends into the Antarctic zone at South Georgia. It nests in coastal areas where vegetation or broken terrain offers shelter, on sea-facing slopes, headlands, in the lee of banks, under or against vegetation clumps, below cliffs or overhanging rocks, or in hollows. The Northern Giant-Petrel eats seal, whale, and penguin carrion, and seal placentae. It often attends and follow ships to obtain offal. It also eats substantial quantities of euphausiids (krill) and other crustaceans, cephalopods (octopus and squid), fish and a wide variety of seabirds (DAWE, 2020a).

4.4.10.13Fairy Prion (Southern)

The fairy piron (*Pachyptila turtur subantarctica*) is distributed off the cold-water coasts of Antarctica and southern Australia and New Zealand. The southern subspecies is known to breed on Macquarie Island, Langdon Point, Davis Point and Bishop and Clerk islands (Garnett and

Crowley, 2000). It is estimated that the population of the fairy piron (southern) is a little over 50 pairs (Brothers, 1984).

4.4.10.14Abbott’s Booby

Abbott's booby (*Papasula abbotti*) is only known to breed on Christmas Island and to forage in the waters surrounding the island (DAWE, 2020a). Within Christmas Island, most nests are found in the tall plateau forest on the central and western areas of the island, and in the upper terrace forest of the northern coast.

4.4.10.15Christmas Island White-tailed Tropicbird

The Christmas Island white-tailed tropicbird (*Phaethon lepturus fulvus*) is endemic to Christmas Island and leaves the island to forage in the warm waters of the Indian Ocean (Garnett et al. 2011). The white-tailed tropicbird roots at sea; only incubating or brooding adults remain on nests on the island at night (Stokes, 1988).

4.4.10.16Sooty Albatross

The sooty albatross (*Phoebetria fusca*) is a marine and pelagic species. They are a rare but regular migrant to Australia, and occurs in the north to south-east Queensland, NSW, Victoria, Tasmania and South Australia (Pizzey and Knight, 1999). The sooty albatross occurs singly or in small groups at sea. It usually nests in loose colonies or small groups, and occasionally solitarily (Marchant and Higgins, 1990). The sooty albatross eats cephalopods (fish and octopuses), fish, crustaceans, siphonophores and penguin carrion on the high seas (Marchant and Higgins, 1990).

4.4.10.17Round Island Petrel

The Round Island petrel (*Pterodroma arminjoniana*) are widely distributed in the tropics and sub-tropics, with some species breeding in the subantarctic zone (Warham, 1990). In Australia, this species has only been recorded on North Keeling Island, where it may breed (PAN, 2020). It generally glides to the surface of the waterand take food from near the surface of the sea (PAN, 2020).

4.4.10.18Soft-plumaged Petrel

The soft-plumaged petrel (*Pterodroma mollis*) is generally found over temperate and subantarctic waters in the South Atlantic, Southern Indian and western South Pacific Oceans. The species breeds colonially on islands in the southern oceans. Breeding occurs from August to May (Marchant & Higgins, 1990). One foraging BIA for this species overlaps with the MEZ/EMBA (see **Table 4-15** and **Figure 4-5)**.

4.4.10.19Australian Fairy Tern

The Australian fairy tern (*Sternula nereis nereis*) occurs on the coast of WA as far north as Dampier Archipelago (DSEWPaC, 2012a). Fairy terns utilise a variety of habitats including offshore, estuarine or lacustrine (lake) islands, wetlands, beaches and spits (DSEWPaC, 2011b). The fairy tern mostly breeds from July-September and may be present during the non-breeding season. Fairy terns nest on sites where the substrate is sandy and the vegetation low and sparse (DSEWPaC, 2011b). The fairy tern forages in inshore waters, around island archipelagos and on the mainland. It feeds almost entirely on fish (Higgins and Davies, 1996). A breeding and foraging BIA for this species overlaps the MEZ/EMBA. These are described in **Table 4-15** and **Figure 4-5**.

4.4.10.20Indian Yellow-nosed Albatross

The Indian yellow-nosed albatross (*Thalassarche carteri*) occurs in the southern Indian Ocean. The Indian yellow-nosed albatross forages mostly in the southern Indian Ocean and is particularly abundant off WA (Marchant & Higgings, 1990). They feed on cephalopods (squid) and fish

(DAWE, 2020a). The offshore waters throughout south-west marine region, northn to Shark Bay and extending east into Bass Straits is a foraging BIA for this species that overlaps with the MEZ/EMBA (**Table 4-15** and **Figure 4-5**).

4.4.10.21Shy Albatross

The shy albatross (*Thalassarche cauta*) travels between Australia and South Africa in search of food (Birdlife, 2020a). Their breeding colonies are however restricted to just three islands off Tasmania (Birdlife, 2020a). The shy albatross breeds annually in colonies. Eggs are mostly laid in the second half of September and hatch in December. The chicks then fledge mostly in April (Birdlife, 2020a). The shy albatross usually forage singly and have been observed taking prey from the surface or occasionally making surface plunges or shallow dives (Birdlife, 2020a). Breeding nests are typically a mound of soil, grass and roots, and are located on rock islands. Shy albatross mainly feeds on fish and cephalopods, with crustaceans and tunicates also forming a part of the diet (Birdlife, 2020a), It is also a ship-follower and fish discharge comprises a significant proportion of its diet (Birdlife, 2020a).

4.4.10.22White-capped Albatross

The white-capped albatross (*Thalassarche steadi*) occurs in subantarctic and subtropical waters and is common off the coast of south-east Australia throughout the year. This species is endemic to offshore islands of New Zealand where it reportedly breeds biennially (Birdlife, 2020b). Eggs are usually laid mid-November and hatch in February. Chicks then depart the breeding site in June at the latest. Some adults have been reported to remain near the colonies year-round (Birdlife, 2020b). Breeding colonies for this species are generally located on rock islands. White-capped albatross mainly feeds on fish, cephalopods, crustaceans and tunicates. It is also a ship-follower and fish discharge comprises a significant proportion of its diet. This species are generally surface feeders, but may undertake shallow surface dives (Birdlife, 2020b).

4.4.10.23Campbell Albatross

The Campbell albatross (*Thalassarche impavida*) is a non-breeding visitor to Australian waters is common during the non-breeding period in continental shelf waters around Australia, New Zealand and the Pacific Islands (DAWE, 2020a). The Campbell albatross breeds only on the northern and western coastline of Campbell Island aand the tiny offshore islet (Jeanette Marie) in New Zealand. This species breeds annually and is present in colonies from September to May. Eggs are laid from September to early October and hatch mostly in early December. Chicks then fledge from mid April to May (Birdlife, 2020c). Breeding Campbell albatross nests on ledges and steep slopes covered in low native grasses, tussocks and mud. This species mainly feeds on fish, squid, crustaceans, gelatinous organisms and carrion (Birdlife, 2020c).

4.4.10.24Black-browed Albatross

The black-browed albatross (*Thalassarche melanophris*) inhibits Antarctic, subantarctic and temperate waters and occasionally enters the tropics (DAWE, 2020a). It forages around breaks of continental shelves and across nearby underwater banks. The diet of the black-browed albatross primarily consists of a combination of fish, molluscs (mostly cephalopods) and crustaceans (mostly krill), but also includes other items such as carrion, jellyfish and salps that are taken less frequently (DAWE, 2020a).

4.4.10.25Common Noddy

In Australia, the common noddy (*Anous stolidus*) occurs mainly in ocean off the Queensland coast, but the species also occurs off the northwest and central Western Australia coast (DAWE, 2020a). During the breeding season, the common noddy usually occurs on or near islands, on rocky islets and stacks with precipitous cliffs, or on shoals or cays of coral or sand, with individuals remaining close to the nest, foraging in the surrounding waters. Breeding can occur throughout the year at some sites, but at others there is a peak of breeding in spring and another in autumn (Pizzey and Knight, 2012). During the non-breeding season the species occurs throughout the pelagic zone (DAWE, 2020a). It is a wide-ranging species, but there is no seasonal migration associated with breeding. It is probably dispersive from colonies in March and April (Pizzey and Knight, 2012). The common noddy feeds mainly on fish, although they are known to also take squid, pelagic molluscs, medusa and aquatic insects. The MEZ/EMBA overlaps with two foraging BIAs for this species (see **Table 4-15** and **Figure 4-5**).

4.4.10.26Flesh-footed Shearwater

The flesh-footed shearwater (*Ardenna carneipes*) mainly occurs in the subtropics over continental shelves and slopes, and occasionally inshore waters. Individuals also pass through the tropics and over deeper water when on migration. The flesh-footed shearwater is a locally common visitor to waters of the continental shelf and continental slope off south-western Western Australia. This species have been identified to breed on 41 islands off the coast of south-western WA and almost entirely within conservation reserves. The species breeds from late August to mid May on approximately 60 islands across the southern Indian and south-western Pacific Oceans (DAWE. 2020a). The flesh-footed shearwater feeds on small fish, cephalopod molluscs (squid, cuttlefish, nautilus and argonauts), crustaceans (barnacles and shrimp), other soft-bodied invertebrates and offal (DAWE, 2020a). The MEZ/EMBA overlaps with a foraging BIA for this species and the EMBA overlaps the aggregation BIA (see **Table 4-15** and **Figure 4-5**).

4.4.10.27Sooty Shearwater

The sooty shearwater (*Ardenna grisea*) is found in the southern hemisphere during summer. This species breeds around New Zealand, southern Australia and southern South America (DAWE, 2020a). In winter, these birds move to the North Pacific Ocean, but some move into the North Atlantic Ocean, or remain in the southern hemisphere (DAWE, 2020a). It feeds on a wide variety of pelagic prey, including cephalopods, fish and crustaceans.

4.4.10.28Wedge-tailed Shearwater

The wedge-tailed shearwater (*Ardenna pacifica*) is a medium-sized seabird, and inhabits oceanic waters off of WA except when roosting in colonies. Foraging at sea, the species feeds mostly on fish, cephalopods, insects, jellyfish and prawns. Ashmore Reef has been identified as an important area for this species (DEWHA, 2008a). The MEZ/EMBA overlaps with breeding and foraging BIAs for this species (see **Table 4-15** and **Figure 4-5**).

4.4.10.29Streaked Shearwater

Streaked shearwaters (*Calonectris leucomelas*) are found in the western pacific, breeding on the coast and offshore islands. It migrates south during winter and can be found off the coast of Australia between November and March (Yamamoto *et al.*, 2010). This species can be found in both pelagic and inshore waters. It feeds mainly on fish and squid which it catches by surface-seizing and shallow plunges (Birdlife, 2020d).

4.4.10.30Lesser Frigatebird

The lesser frigatebird (*Fregata ariel*) is the most widespread frigatebird in Australia, found throughout the temperate waters of the Indian Ocean (DEWHA, 2008a). The species feeds mostly on fish (taken in flight) and sometimes indulges in kleptoparasitism. Lesser frigate birds generally forage close to breeding colonies (DEWSPaC, 2012a).

Within the NWMR, the lesser frigatebird is known to breed on Adele, Bedout and West Lacepede islands, Ashmore Reef and Cartier Islands (DSEWPaC, 2012a). Breeding occurs between March and September along the Kimberley and Pilbara coasts and islands (DAWE, 2020b). The

MEZ/EMBA overlaps with the Kimberley and Pilbara coasts and islands (including Ashmore Reef) breeding BIA for this species (**Table 4-15** and **Figure 4-5**).

4.4.10.31Great Frigatebird

The great frigatebird (*Fregata minor*) has a wide distribution throughout the world's tropical seas. Great frigatebirds undertake regular migrations across their range, both regular trips and more infrequent widespread dispersals.

The closest breeding colonies identified occur on Ashmore Reef and Adele Island (DAWE, 2020b). Breeding occurs from May – June and August (DAWE, 2020b). The great frigatebird forages in pelagic waters within 80 km of the breeding colony or roosting areas (ALA, 2020). Flying fish are the most common item in the diet; other fish species and squid may be eaten as well. Prey is snatched while in flight, either from just below the surface or from the air in the case of flying fish flushed from the water. Like all frigatebirds they will not alight on the water surface and are usually incapable of taking off should they accidentally do so. The MEZ/EMBA overlaps with the Kimberley and Ashmore Reef breeding BIAs for this species (**Table 4-15** and **Figure 4-5**).

4.4.10.32Caspian Tern

The Caspian tern (*Hydroprogne caspia*) is the largest of the terns found in Australia, occurring in both coastal areas (including islands) and inland habitats (Higgins & Davies, 1996). 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 Australia. The Caspian tern is mostly found in sheltered coastal embayments such as harbours, lagoons, inlets, bays, estuaries and river deltas (DAWE, 2020a). Birds may move from coastal breeding colonies to inland. The MEZ/EMBA overlaps with a foraging BIA for this species (see **Table 4-15** and **Figure 4-5**).

4.4.10.33Bridled Tern

The bridled tern (*Onychoprion anaethetus*) is found throughout tropical and sub-tropical regions of Australia (DAWE, 2020a). The species is most common on offshore islands as opposed to coastal areas and forages 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) (DAWE, 2020a). Breeding populations exist at Ashmore Reef and Cartier 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 MEZ/EMBA overlaps with a foraging BIA for this species (see **Table 4-15** and **Figure 4-5**).

4.4.10.34White-tailed Tropicbird

White-tailed tropicbirds (*Phaethon lepturus*) are predominantly pelagic, and hence rarely come to shore except to breed (DSEWPaC, 2012d). The tropicbird forages in warm waters and over long distances, moving many kilometres away from its breeding sites. It has been recorded to disperse as far as ~1,600 km from Christmas Island during foraging trips (Dunlop *et al.*, 2001). The white-tailed tropicbird lays one egg in nests on the ground under bushes, grass and overhanging rock. The species is highly susceptible to disturbance at its nesting sites. It feeds on fish and cephalopods by plunge-diving (Marchant and Higgins, 1990). A breeding BIA for white-tailed tropicbird overlaps with the MEZ/EMBA (see **Table 4-15** and **Figure 4-5**).

4.4.10.35Red-tailed Tropicbird

The red-tailed tropicbird (*Phaethon rubricauda*) is the most pelagic of the tropicbirds, with its diet consisting of fish and cephalopods (Marchant and Higgins 1990). This bird is normally found in tropical and sub-tropical seas around northern Australia. Nests are usually little more than a scrape on the ground. Breeding occurs within the MEZ/EMBA at Ashmore Reef (DEWHA, 2008a).

4.4.10.36Roseate Tern

The roseate tern (*Sterna dougallii*) occurs throughout various coastal habitats including beaches, reefs and sandy/coral islands. It is a specialist forager for small pelagic fish (BirdLife, 2020e). The terns prefer nesting sites adjacent to clear shallow hunting areas. Nests are generally a bare scrape in sand, shingle or coral rubble. The species breeds in large mixed-species colonies from April to June, with breeding populations located around Ashmore Reef, Cartier Island and Scott Reef (DEWHA, 2008a). Little information is available about migratory movements or timing throughout the northwest and southwest of Australia. The MEZ/EMBA overlaps with several BIAs for this species (see **Table 4-15** and **Figure 4-5)**.

4.4.10.37Little Tern

The little tern (*Sternula albifrons*) is a small and slender tern that is found throughout the coast from Broome to the NT. Breeding sites are widely distributed across the northwest of WA, with breeding occurring in late April-July and September to early January. Significant migration information is lacking, however recorded numbers of the species are lowest in the dry season. The MEZ/EMBA overlaps with the Kimberley, Pilbara and Gascoyne coasts and islands including Ashmore Reef breeding and resting BIAs for this species (see **Table 4-15** and **Figure 4-5)**.

4.4.10.38Masked Booby

The masked booby (*Sula dactylatra*) is the largest and heaviest of the booby family. Its distribution ranges from the Dampier Archipelago in WA to along the entire north coast of Australia. Breeding pairs have been located on Ashmore Reef (DEWHA, 2008a), but few records have been made in the NT. The diet of the booby is primarily comprised of fish with some cephalopods. Food is obtained by deep plunging in the ocean to depths exceeding 3 m.

4.4.10.39Brown Booby

The brown booby (*Sula leucogaster*) is the smallest of the booby family. The species feeds either individually or in flocks, generally around inshore waters and use both marine and terrestrial habitats. They forage by either plunge diving or by snatching prey from the surface. The MEZ/EMBA overlaps with the Kimberley, Pilbara and Gascoyne coasts and islands including Ashmore Reef breeding BIAs for this species (see **Table 4-15** and **Figure 4-5)**.

4.4.10.40Red-footed Booby

The red-footed booby (*Sula sula*) is a slender bird with conspicuous red feet. Its distribution is confined to tropical waters between 30°N and 30°S in the Indian Ocean. In WA a small breeding population has been recorded on Ashmore Reef (DEWHA, 2008a). It mostly feeds on fish, especially flying fish, and also cephalopods, and feeding is by plunge diving in groups to shallow depths (DAWE, 2020a). The MEZ/EMBA overlaps with the Northwest Kimberley and Ashmore Reef breeding BIAs for this species (see **Table 4-15** and **Figure 4-5**).

4.4.10.41Osprey

The breeding range of the osprey (*Pandion haliaetus*) extends around the northern coast of Australia (including many offshore islands) from Albany in WA to Lake Macquarie in NSW (DAWE, 2020a). Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland (DAWE, 2020a). Ospreys occupy large territories that are used for breeding and at least some foraging (Marchant and Higgins, 1993). Territories are attended throughout the year although visits may be only intermittent in the non-breeding season. Ospreys mainly feed on fish and usually forage diurnally.

4.4.10.42Crested Tern

The crested tern (*Thalasseus bergii*) 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. Its diet consists predominantly of pelagic fish, although it will also feed on crustaceans, insects and hatchling turtles, opportunistically (Birdlife, 2020f). 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 (Birdlife, 2020f). Breeding is known to occur at Ashmore Reef (DEWHA, 2008a).

4.4.11 Marine Birds - Shorebirds

A comprehensive description the threatened and/or migratory shorebirds likely to be present within the MEZ are discussed below.

4.4.11.1 Australasian Bittern

The Australasian bittern (*Botaurus poiciloptilus*) is a large, stocky, thin-necked, heron-like bird (TSSC, 2019). In WA, the Australasian bittern has been recorded in the south-west, where it reportedly occurs on the western coastal plain between Lancelin and Busselton, in the southern coastal region from Augusta to the east of Albany and inland to some wetlands in the Jarrah forest belt, with small and isolated populations in swamps from west of Esperance eastward to near Cape Arid (TSSC, 2019). The diet of the Australasian bittern includes aquatic animals such as small fish, frogs, freshwater crayfish, spiders, insects and small reptiles. Breeding occurs from October to February (TSSC, 2019).

4.4.11.2 Red Knot

The red knot (*Calidris canutus*) is a migratory shorebird and undertakes long distance migrations from breeding grounds in Siberia, where it breeds during the boreal summer, to the southern hemisphere during the austral summer. Both Australia and New Zealand host significant numbers of red knots during their non-breeding period (Bamford et al. 2008).

As with other migratory shorebirds, this species occurs in coastal wetland and intertidal sand or mudflats, where they feed on intertidal invertebrates, especially shellfish (Garnet et al. 2011). They are likely to be found in these habitats throughout the MEZ/EMBA.

4.4.11.3 Great Knot

The great knot (*Calidris tenuirostris*) has been recorded around the entire Australian coast and spends non-breeding periods in Australia (DAWE, 2020a). The greatest numbers of this species are found in northern Australia, and most commonly on the coast of the Pilbara and Kimberley, from the Dampier Archipelago to the NT border, and in the NT from Darwin and Melville Island, through Arnhem Land to the southeast Gulf of Carpentaria (DAWE, 2020a). This species typically prefers sheltered coastal habitats with large intertidal mudflats or sandflats (DAWE, 2020a). The great knot feeds on snails, worms and crustaceans, and forages on intertidal mudflats, estuaries, and in mangroves.

4.4.11.4 Greater Sand Plover

The greater sand plover (*Charadrius leschenaultia*) occurs in coastal areas throughout Australia with the greatest populations between the NW Cape and Roebuck Bay (DAWE, 2020a). The plover spends almost all its time in coastal habitats. Their diet consists mainly of molluscs, worms, crustaceans and insects (DAWE, 2020a). The species breeds in the northern hemisphere and migrates south for the boreal winter (DAWE, 2020a). The greater sand plover is one of the first migratory waders to return to the northwestern Australia, usually arriving in late July and departs mid to late April (DAWE, 2020a).

4.4.11.5 Lesser Sand Plover

The lesser sand plover (*Charadrius mongolus*) spends non-breeding periods in Australia. The species is widespread in coastal regions, and has been recorded in all states within Australia but mainly occurs in northern and eastern Australia (DAWE, 2020a). The species feeds mostly on extensive, freshly-exposed areas of intertidal sandflats and mudflats in estuaries or beaches, or in shallow ponds in saltworks (DAWE, 2020a). They also occasionally forage on coral reefs and on sandy or muddy river margins (DAWE, 2020a). The lesser sand plover roost near foraging areas, on beaches, banks and spits, banks of sand and shells, and occasionally on rocky spits, isles or reefs (DAWE, 2020a).

4.4.11.6 Western Alaskan Bar-tailed Godwit

The western Alaskan bar-tailed godwit (*Limosa lapponica baueri)* is a large migratory shorebird (TSSC, 2016e). The western Alaskan bar-tailed godwit has been recorded in the coastal areas of all Australian states, while in WA it is widespread around the coast, from Eyre to Derby (TSSC, 2016e). The bar-tailed godwit is also a regular migrant to Christmas Island (TSSC, 2016e). This species does not breed in Australia. It breeds in the northern hemisphere and migrates southwards for the boreal winter (TSSC, 2016e). It usually forages near the edge of water or in shallow water, mainly in tidal estuaries and harbours. The western Alaskan bar-tailed godwit is mainly carnivorous with a diet consisting of worms, molluscs, crustaceans, insects and some plant material (TSSC, 2016e). At Roebuck Bay in WA, the birds have been observed feeding on bivalves which had been exposed by cyclone (Jessop and Collins, 2000).

4.4.11.7 Northern Siberian Bar-tailed Godwit

The northern Siberian bar-tailed godwit (*Limosa lapponica menzbieri*) is a large migratory shorebird (TSSC, 2016f). The northern Siberian bar-tailed godwit spends non-breeding periods in Australia and is found in all Australian states and territories (TSSC, 2016f). Populations have been recorded in northern Australia, from Darwin east to the Gulf of Carpentia. This species forages near the edge of water or in shallow water, mainly on muddy coastlines, estuaries, inlets and mangroves feeding on worms, molluscs, crustaceans, insects and plant material (TSSC, 2016f).

4.4.11.8 Eastern Curlew

The eastern curlew (*Numenius madagascariensis*) is the largest migratory shorebird in the world. Within Australia, the eastern curlew has a primarily coastal distribution. The species is found in all states, particularly the north, east, and south-east regions. They have a continuous distribution from Barrow Island and Dampier Archipelago, WA, through the Kimberley and along the NT, Queensland, and NSW coasts and the islands of Torres Strait (DoE, 2015d).

The eastern curlew does not breed in Australia but it is estimated that 73% of the population spends the non-breeding season in Australia (DoE, 2015d). The species is present in Australia between August and December. During the non-breeding season in Australia, the eastern curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats (DoE, 2015d).

4.4.11.9 Australian Painted Snipe

The Australian painted snipe (*Rostratula australis*) is a wader, and is found in wetlands throughout all states and territories of Australia (DAWE, 2020a). The species generally inhabits freshwater wetlands, although can inhabit brackish water, saltmarshes and claypans (DAWE, 2020a). It feeds on vegetation, seeds, insects, worms, molluscs, crustaceans and other invertebrates (DAWE, 2020a).

4.4.11.10Common Sandpiper

The common sandpiper (*Actitis hypoleucos*) is a small, migratory bird with a very large range through which it migrates annually between breeding grounds in the northern hemisphere (Russia) and non-breeding areas in the Asia-Pacific region (Bamford et al*.* 2008).

This species is a full migrant. It breeds in Europe and Asia within the period April to August, with the southward migration from July - November. Individuals arrive from July onwards in South Australia, Western Australia and the Northern Territory (DAWE, 2020a). Northward migration is from February-May, or early June (DAWE, 2020a).

In Australia, the common sandpiper is found in coastal or inland wetlands, both saline and fresh. It is found mainly on muddy edges or rocky shores. Given the species distribution and prefered habitat, their presence in the MEZ is likely to be restricted to these habitats throughout the MEZ/EMBA.

4.4.11.11Ruddy Turnstone

The ruddy turnstone (*Arenaria interpres*) is a 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. Ashmore Reef and Cartier Island has been identified as an important staging point for this species (DEWHA, 2008).

4.4.11.12Sharp-tailed Sandpiper

The sharp-tailed sandpiper (*Calidris acuminate*) is a migratory wading shorebird, and spend their non-breeding season in Australian waters. The species is widespread across West Australian waters and coastlines inhabiting both freshwater and saline areas (DAWE, 2020a). Roosting on sandy beaches and muddy flats the omnivorous species feeds on seeds, crustaceans, molluscs, and insects (Higgins and Davies, 1996).

The species may occur in Australia from mid-August when they start arriving, until April when they depart for their breeding grounds. Very few are reported to remain to winter in Australia.

4.4.11.13Sanderling

Sanderlings (*Calidris alba*) 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 (DAWE, 2020a). 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 (DAWE, 2020a). 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 (DAWE, 2020a).

4.4.11.14Pectoral Sandpiper

The pectoral sandpiper (*Calidris melanotos*) is a medium-small migratory wader that breeds in the northern hemisphere and migrates to the southern hemisphere during the boreal winter.

Therefore, it does not breed, but can be found throughout Australia, although numbers in WA are limited (DAWE, 2020a). The species forages in shallow waters and mud flats, and is present in Australia from September - June in coastal or near coastal habitats feeding on algae, seeds and insects (DAWE, 2020a).

4.4.11.15Red-necked Stint

One of the smallest shorebirds in Australia, the red-necked stint (*Calidris ruficollis*) 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. Ashmore Reef and Cartier Island have been identified as an important staging point for this species (DEWHA, 2008).

4.4.11.16Long-toed Stint

The long-toed stint (*Calidris subminuta*) is a very small sandpiper, and is found mainly along the WA and NT coast (DAWE, 2020a). In WA the species is found mainly along the coast, with a few scattered inland records. In the south coast, this species is found from Esperance to Albany. It has also been occasionally recorded in the Gascoyne Region. It is widespread around the Pilbara region and the Kimberley Division between Karratha and Wyndham-Kununurra (DAWE, 2020a). They prefer shallow freshwater or brackish wetlands including lakes, swamps, river floodplains, streams, lagoons and sewage ponds; feeding on seeds, molluscs, crustaceans and insects (DAWE, 2020a).

4.4.11.17Oriental Plover

The oriental plover (*Charadrius veredus*) is a non-breeding visitor to Australia (DAWE, 2020a). It occurs in both coastal and inland areas, mostly in northern Australia between Exmouth Gulf and Derby, WA (DAWE, 2020a). 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. Some may fly south across the continent, where they stay before leaving to return to their breeding grounds between February and April.

4.4.11.18Swinhoe’s Snipe

The swinhoe’s snipe (*Gallinago megala*) is a medium sized member of the Gallinagoniae family (DAWE, 2020a). Few definite records exist for swinhoe's snipe in Australia. The species has been recorded in the north between the Kimberley Divide and Cape York Peninsula (DAWE, 2020a). In WA the species has been recorded in Pilbara, the Kimberley region, Mount Goldsworthy, Mount Blaize and in the northwest regions around the Mitchell Plateau (DAWE, 2020a). Habitat specific to Australia includes the dense clumps of grass and rushes round the edges of fresh and brackish wetlands (DAWE, 2020a). This includes swamps, billabongs, river pools, small streams and sewage ponds. Swinhoe's snipe is migratory, breeding in central Siberia and Mongolia and moving south for the boreal winter (DAWE, 2020a).

4.4.11.19Pin-tailed Snipe

The pin-tailed snipe (*Gallinago stenura*) is found in the Pilbara region, where the species inhabits wetlands and clay pans (DAWE, 2020a). The species arrives in Australia from late September to early March (DAWE, 2020a). The species departs for breeding grounds from April onwards, with no observations in Australia throughout the winter (DAWE, 2020a).

4.4.11.20Oriental Pratincole

The oriental pratincole (*Glareola maldivarum*) is a medium-sized bird which is almost exclusively insectivorous and widespread in northwest Australia and is prominent in the Pilbara coastal region

(DAWE, 2020a). This species does not breed in Australia and is known to inhabit mudflats, beaches and coastal lagoons (DAWE, 2020a).

4.4.11.21Broad-billed Sandpiper

The broad-billed sandpiper (*Limicola falcinellus*) is most commonly found on the coasts of the Pilbara and Kimberley regions between Broome and Onslow, and the Darwin region (DAWE, 2020a). Commonly sighted individually, the sandpiper favours estuarine mudflats, saltworks, exposed flats and estuaries (DAWE, 2020a). Mature individuals arrive in Australia from August to early September, with juvenile birds arriving later in September (DAWE, 2020a). The species departs Australian foraging grounds by April (DAWE, 2020a).

4.4.11.22Asian Dowitcher

The Asian dowitcher (*Limnodromus semipalmatus*) is a regular visitor to the north-west between Port Hedland and Broome (DAWE, 2020a). The Asian dowitcher is found in sheltered coastal environments such as lagoons, mud flats, estuaries and tidal creeks (DAWE, 2020a). The species arrives in Australian non-breeding locations from August (DAWE, 2020a). Movements throughout Australia are not well documented; however, the species has been recorded at Ashmore Reef (DEWHA, 2008a). Departure for breeding grounds is known to occur in mid-April (DAWE, 2020a).

4.4.11.23Bar-tailed Godwit

The bar-tailed godwit (*Limosa lapponica*) is a large wader recorded in coastal areas of all states and territories of Australia (DAWE, 2020a). The species is found in coastal habitats such as large intertidal sand and mudflats, banks, estuaries, harbours, bays and coastal lagoons where it forages when the tide is out. Their diet consists of worms, molluscs, crustaceans, insects and some plant material (DAWE, 2020a). This species breeds in the northern hemisphere and migrates south for the winter, arriving in northwest Australia from August and departs before the end of April (DAWE, 2020a).

4.4.11.24Black-tailed Godwit

The black-tailed godwit (*Limosa limosa*) is a large wader that 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, NT, as well as the Pilbara region and towards Eighty Mile Beach (DAWE, 2020a). The species is commonly found in sheltered bays, estuaries and lagoons with large intertidal mud and sandflats, and occasionally on rocky coasts (DAWE, 2020a). Their diet consists of worms, crustaceans, bivalves and fish eggs. The black-tailed godwit does not breed in Australia (DAWE, 2020a). They arrive in north-west Australia from late August and depart during March and April to breed in the northern hemisphere (DAWE, 2020a).

4.4.11.25Little Curlew

The little curlew (*Numenius minutus*) is the smallest curlew and spends non-breeding period from Port Hedland northward and in the Darwin region, inhabiting fringing coastal regions, wetlands, salt marshes and grassy vegetated regions (DAWE, 2020a). The species is often observed in significant numbers of up to 200 individuals. Populations in Australia increase in size until October, then begin to decrease from November to December (DAWE, 2020a).

4.4.11.26Whimbrel

The whimbrel (*Numenius phaeopus*) is a medium-sized curlew which is a regular non-breeding migrant to Australia and New Zealand (DAWE, 2020a). 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 northwest Kimberley and Darwin region (DAWE, 2020a). The whimbrel forages on intertidal mudflats, along muddy banks of estuaries and in coastal lagoons and mangroves (DAWE, 2020a). 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 (DAWE, 2020a).

4.4.11.27Ruff (Reeve)

The ruff (*Philomachus pugnax*) is a medium sized wader and a rare but regular visitor Australia (DAWE, 2020a). In Australia the ruff is found on generally fresh, brackish of saline wetlands with exposed mudflats at the edges; terrestrial wetlands including lakes, swamps, pools, lagoons, tidal rivers, swampy fields and floodlands; sheltered coasts, in harbours, estuaries, seashores and are known to visit sewage farms and saltworks. In WA, the species is mostly found in the south-west region (DAWE, 2020a). The ruff is insectivorous throughout the breeding grounds, and omnivorous elsewhere. It is diurnal and nocturnal (DAWE, 2020a).

4.4.11.28Pacific Golden Plover

The Pacific golden plover (*Pluvialis fulva*) is a medium-sized plover that has been recorded in coastal areas of all Australian states and territories, but is more abundant on the east and south coasts (DAWE, 2020a). In WA, Eighty Mile Beach is considered a nationally important site for the species (due to abundance). The plover forages on sandy or muddy shores including mudflats and sandflats, estuaries and lagoons (DAWE, 2020a). They usually roost on sandy beaches, spits, exposed reefs, mangroves, or low saltmarshes, near foraging areas. They do not breed in Australia (DAWE, 2020a).

4.4.11.29Grey Plover

The grey plover (*Pluvialis squatarola*) is a medium-sized plover that is found solitary, in small flocks, and larger flocks at communal roosts often with other waders (DAWE, 2020a). 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 (DAWE, 2020a). Their diet consists of mostly molluscs, insects, crustaceans and polychaete worms (DAWE, 2020a). 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 (DAWE, 2020a).

4.4.11.30Grey-tailed Tattler

The grey-tailed tattler (*Tringa brevipes*) is a medium-sized wader found in most coastal regions in Australia, but primarily in the north (DAWE, 2020a). In WA, the species is widespread from Houtman Abrolhos and mainland to the Kimberley region. The bird is often found on sheltered coasts with reefs and rock platforms or intertidal muds (DAWE, 2020a). 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 (DAWE, 2020a).

4.4.11.31Wood Sandpiper

Wood sandpipers (*Tringa glareola*) are small thin wader that live in well-vegetated, shallow, freshwater wetlands such as swamps, billabongs, lakes, pools and waterholes (DAWE, 2020a). The largest number of wood sandpipers in Australia have been recorded in north-west Australia, with all areas of national importance located in WA (Watkins, 1993). The wood sandpiper does not breed in Australia. They are carnivorous and in Australia eat mainly insects and molluscs (DAWE, 2020a).

4.4.11.32Common Greenshank

The common greenshank (*Tringa nebularia*) does not breed in Australia; however, occurs in all types of wetlands throughout Australia (DAWE, 2020a). In WA, this species inhabits most of the coast from Cape Arid in the south to Carnarvon in the northwest (DAWE, 2020a). Arrivals in Australia begins from August with numbers increasing in November and the species returning to their nesting grounds from March to April (DAWE, 2020a). The species is known to forage at edges of wetlands, in soft mud on mudflats, in channels, or in shallows around the edges of water often among pneumatophores of mangroves or other sparse, emergent or fringing vegetation, such as sedges or saltmarsh while occasionally feeding on exposed seagrass beds (DAWE, 2020a).

4.4.11.33Marsh Sandpiper

The marsh sandpiper (*Tringa stagnatilis*) is a monotypic species is found on coastal and inland wetlands throughout Australia (DAWE, 2020a). Birds arrive in Australian roosting sites from September and spread southwards until December. Northward migration, returning to breeding grounds begins from March-April. The marsh sandpiper usually forages in shallow water at the edge of wetlands. They probe wet mud of mudflats or feed among marshy vegetation (Higgins and Davies, 1996).

4.4.11.34Common Redshank

The common redshank (*Tringa totanus*) is found at sheltered coastal wetlands such as bays, river estuaries, lagoons, inlets and saltmarsh (with bare open flats and banks of mud or sand). They are also found around saltlakes, freshwater lagoons, artificial wetlands and saltworks and sewage farms (Higgins and Davies, 1996). Common redshank has been recorded at scattered locations throughout Australia. In WA, the species is vargrant to the south-west with records at Peel Inlet, Coodanup, the Gascoyne region, Coral Bay and Carnarvon (Higgins and Davies, 1996). In the north-west, its distribution is regular and widespread, from the Dampier Saltfields to Roebuck Bay and Broome. The common redshank is carnivorous and known to consume worms, molluscs, crustaceans, spiders, insects, fish and tadpoles. The species is diurnal and nocturnal; they locate prey by sight during the day and use touch at night. They feed on rocky, sandy or muddy shores (Higgins and Davies, 1996).

4.4.11.35Terek Sandpiper

The terek sandpiper (*Xenus cinereus*) has primarily a coastal distribution in Australia, being more widespread and common in the north and east than in the south of Australia (DAWE, 2020a). In WA, the terek sandpiper is widespread in the Pilbara and Kimberley regions. The species prefers intertidal mudflats and has also been recorded on sandspits, near mangroves and also rocky areas (DAWE, 2020a). 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 (DAWE, 2020a).

5. Protected Areas

5.1 World and National Heritage Properties

World Heritage Properties represent the best examples of the world's cultural and natural heritage while National Heritage Properties are natural, historic and Indigenous places of outstanding significance to the nation. Six National Heritage Properties (two of which are also World Heritage Properties) occur in the MEZ/EMBA (**Table 5-1** and **Figure 5-1**). Their conservation values are described in **Sections 5.1.1** to **5.1.6**.

Note: heritage properties that are terrestrial and not linked to the shoreline, but occur in the EPBC Protected Matters search of the MEZ and EMBA, have been excluded as they are not relevant to consideration of potential affects from marine hydrocarbon spills.

Table 5-1 World and National Heritage Properties within the MEZ and EMBA

Name	Presence	
	MEZ	EMBA
North-West Marine Region		
Dirk Hartog Landing Site 1616 – Cape Inscription Area	✓	✓
Dampier Archipelago (including Burrup Peninsula)	✓	✓
Ningaloo Coast*	✓	✓
South-West Marine Region		
Batavia Shipwreck Site and Survivor Camps Area 1629 – Houtman Abrolhos	✓	✓
HMAS Sydney II and HSK Kormoran Shipwreck Sites	✓	✓
Shark Bay*	✓	✓

*Listed as World and National Heritage Property

5.1.1 Dirk Hartog Landing Site 1616 – Cape Inscription Area

The Dirk Hartog Landing Site 1616 – Cape Inscription Area covers an area of approximately 1,110 ha and is located 100 km south west of Carnarvon (DAWE, 2020c). Cape Inscription is the site of the oldest known landings of Europeans on the western coast of the Australian continent, and is associated with a series of landings and surveys by notable explorers over a 250 year period (DAWE, 2020c). 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, 2020c).

The site comprises the cleft in the rock of the cliff top in which Hartog, Vlamingh, Hamelin, King, and Denham left memorials, the beach at Turtle Bay on which St Allouarne landed and the Dampier landing site at the beach on the south-eastern side of Cape Levillain (DAWE, 2020c).

The Cape Inscription area displays uncommon aspects of Australia’s cultural history because of the cumulative effect its association with these explorers and surveyors had on growing knowledge of the great southern continent in Europe (DAWE, 2020c).

5.1.2 Dampier Archipelago (including Burrup Peninsula)

The Dampier Archipelago was included in the National Heritage List on 3 July 2007. The Burrup Peninsula made up of islands, reefs, shoals, channels and straits, and covering a land area of

~400 km^2. Many important native plants, animals and habitats are found in the area (DAWE, 2020c). This is a sacred place, home to Indigenous Australians for tens of thousands of years.

The Dampier Archipelago is home to the most ancient works created by man. This includes engravings and a high density of stone sites, containing standing stones, complex stone arrangements, fish traps, stone pits, hunting hides and stone cairns (DAWE, 2020c).

5.1.3 Ningaloo Coast

The Ningaloo Coast was included in the World Heritage List in June 2011. It covers an area of approximately 708,350 ha and comprises the Ningaloo Marine Park (State waters and adjoining Commonwealth waters section), the Muiron Islands Marine Management Area and Nature Reserve, the Jurabi and Bundegi Coastal Parks and the Cape Range National Park, in addition to Crown leasehold and freehold land (DEWHA, 2010).

The outstanding value of the Ningaloo Coast derives from its functionally integrated reef and karst system lying along an arid coastline. The Ningaloo Coast is also treasured for the rich record it offers of past life and landscapes (DAWE, 2020c). The Ningaloo Coast is unusual and important in a number of ways:

- biologically, through the combination of high terrestrial endemism and a rich marine environment;
- structurally, as a large nearshore coral reef off a limestone karst system;
- climatically, for the juxtaposition of a tropical marine setting and an arid coast; and
- topographically, as a barrier reef lying alongside a steep limestone range (DAWE, 2020c).

5.1.4 Batavia Shipwreck Site and Survivor Camps Area 1629 – Houtman Abrolhos

The Batavia Shipwreck Site covers an area of approximately 5400 ha, and is located approximately 90 km north west of Geraldton (DAWE, 2020c). The wreck of the Batavia occurred after a long and arduous voyage where considerable hardship had already been experienced by the passengers and crew. The vessel ran aground at night on a coral reef that provided little by way of shelter and sustenance to the survivors. Their only hope of assistance was from an isolated Dutch outpost 900 nautical miles away, and to fetch this assistance required a superb feat of seamanship by the Captain, Fransisco Pelsaert, in open boats under considerable hardship (DAWE, 2020c).

The Batavia and its associated sites hold an important place in the discovery and delineation of the Western Australian coastline. The wreck of the Batavia, and other Dutch ships like her, convinced the VOC (Dutch East India Company) of the necessity of more accurate charts of the coastline and resulted in the commissioning of Vlamingh's 1696 voyage (DAWE, 2020c).

5.1.5 HMAS Sydney II and HSK Kormoran Shipwreck Sites

The naval battle fought between the Australian warship HMAS Sydney II and the German commerce raider HSK Kormoran off the WA coast during World War II was a defining event in Australia's cultural history. The battle between HMAS Sydney II and HSK Kormoran had far reaching consequences for the development of the process of the defence of Australia. The tragic loss of HMAS Sydney II along with its entire crew of 645 following the battle with HSK Kormoran, remains as Australia's worst naval disaster (DAWE, 2020c).

The two areas that make up the place are located approximately 290 km WSW of Carnarvon and 211 km off the coast of WA. The shipwrecks of the HMAS Sydney II and HSK Kormoran are within the place and are located on the seabed approximately 22 km apart.

The shipwreck sites of HMAS Sydney II and HSK Kormoran have outstanding heritage value to the nation because of their strong and special association with particular communities and the Australian community as a whole (DAWE, 2020c).

5.1.6 Shark Bay

Shark Bay is one of the few properties inscribed on the World Heritage List for all four natural universal values. The Shark Bay region represents a meeting point of three major climatic regions and forms a transition zone between two major botanical provinces. The number of species that reach the end of their range is a major feature of the region's flora (DAWE, 2020e).

Shark Bay is also an area of major zoological importance, primarily due to habitats on peninsulas and islands being isolated from disturbance that has occurred elsewhere. Its official values (i.e. National Heritage criterion) include:

- events and processes;
- rarity;
- research;
- principal characteristics of a class of places; and
- aesthetic characteristics.

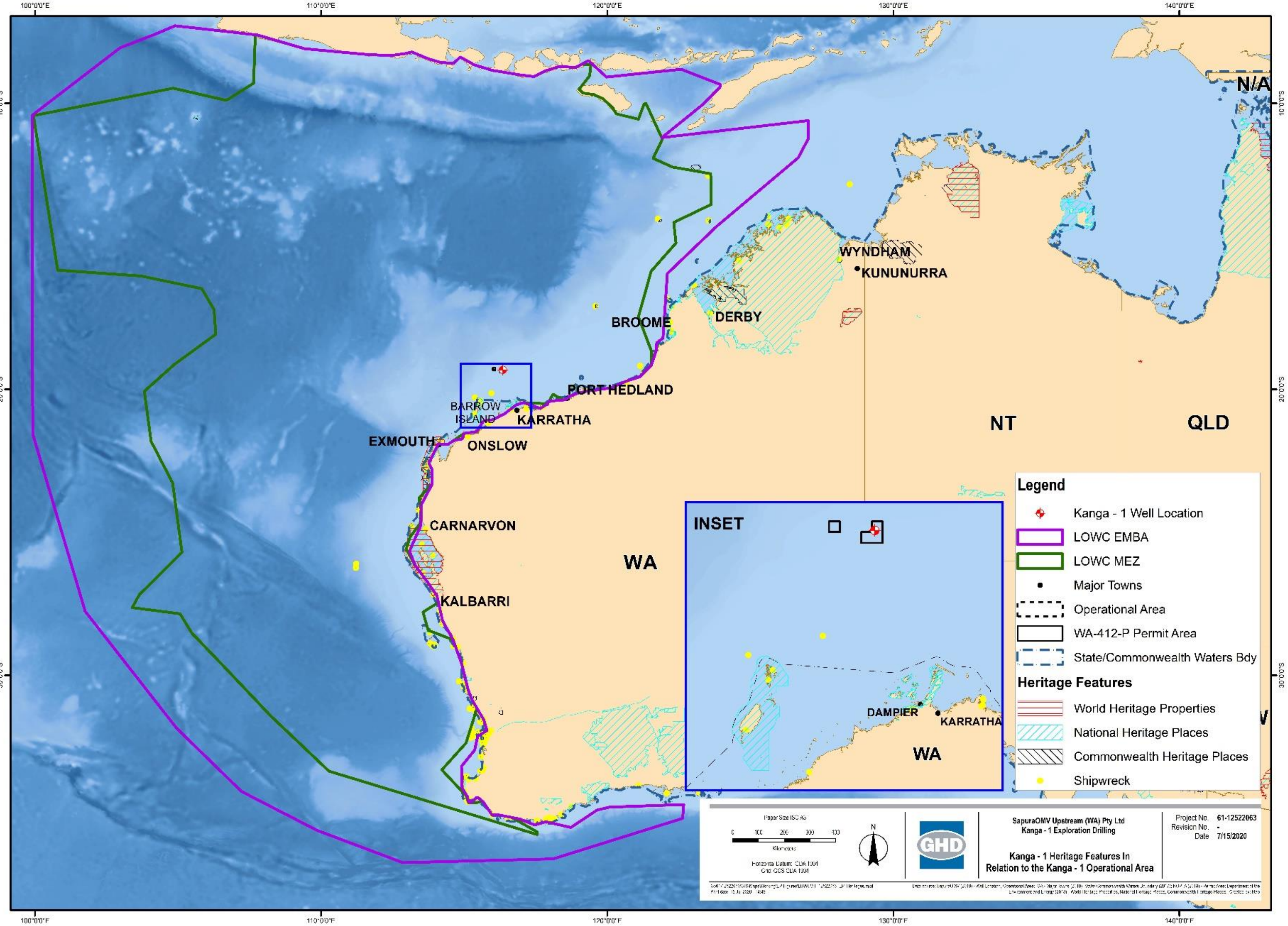


Figure 5-1 Heritage places in the vicinity of the MEZ and EMBA

5.2 Commonwealth Heritage Places

The Commonwealth Heritage Places are indigenous, history and natural heritage places owned or controlled by the Australian Government. These include places connected to defence, maritime safety, communications, customs and other government activities that also reflect Australia's development as a nation. Five Commonwealth Heritage Places occur in the MEZ, with one additional place identified in the EMBA (see **Table 5-2** and **Figure 5-1)**. A description of the conservation values of those places identified in the MEZ are described in Sections **5.2.1** to **5.2.5**.

Note: heritage places that are terrestrial and not linked to the shoreline, but occur in the EPBC Protected Matters search of the MEZ and EMBA, have been excluded as they are not relevant to consideration of potential affects from marine hydrocarbon spills.

Table 5-2 Commonwealth Heritage Places within the MEZ and EMBA

Name	Presence	
	MEZ	EMBA
North-West Marine Region		
Mermaid Reef – Rowley Shoals	✓	✓
Ningaloo Marine Area – Commonwealth Waters	✓	✓
Scott Reef and surrounds – Commonwealth Area	✓	✓
Ashmore Reef National Nature Reserve		✓
South-West Marine Region		
HMAS Sydney II and HSK Kormoran Shipwreck Sites	✓	✓
Other		
Christmas Island Natural Areas	✓	✓

5.2.1 Mermaid Reef – Rowley Shoals

See Mermaid Reef Marine Park (**Section 7.8**).

5.2.2 Ningaloo Marine Area – Commonwealth Waters

See Ningaloo Coast World and National Heritage Property (**Section 5.1.3**).

5.2.3 Scott Reef and surrounds – Commonwealth Area

Scott Reef and surrounds is approximately 7710 ha, 400 km NNW of Derby, comprising the Commonwealth Marine Area wholly within the WA Coastal Waters surrounding North and South Scott Reef (DAWE, 2020e). It was included on the Commonwealth Heritage List on 22 June 2004, in the 'Natural' Class (DAWE, 2020e).

Scott Reef is a significant component of a disjunct chain of shelf edge reefs separated from Indonesia by the Timor Trough. The place is regionally significant both because of its high representation of species not found in coastal waters off WA and for the unusual nature of its fauna which has affinities with the oceanic reef habitats of the Indo-West Pacific as well as the reefs of the Indonesian region. Scott Reef is important for its contribution to understanding long term geomorphological and reef formation processes and past environments as a result of its sedimentary sequence that extends back to include Triassic sediments (DAWE, 2020e).

Scott Reef is characterised by environmental conditions which are rare for shelf atolls and include clear, deep oceanic water and large tidal ranges. The sand cays of the place are important habitat for migrating animals and they are an important staging area for birds, particularly migrants to and from Australia. Of the 25 bird species identified on Scott Reef, 17 are listed on the China-Australia Migratory Bird Agreement or the Japan-Australia Migratory Bird Agreement (DAWE, 2020e).

5.2.4 HMAS Sydney II and HSK Kormoran Shipwreck Sites

See HMAS Sydney II and HSK Kormoran Shipwreck Sites National Heritage Property (**Section 5.1.5**)

5.2.5 Christmas Island Natural Areas

Christmas Island is located is approximately 1,500 km from Exmouth and is approximately 2,200 ha above Low Water and 3,600 ha below Low Water in the Indian Ocean. The island is an uplifted coral atoll with its characteristic steep series of rainforest-covered terraces and sheer limestone cliffs. It was registered in 2004 based on various fauna, vegetation, geological and cultural heritage values. The evolutionary significance of Christmas Island is demonstrated both by its high level of endemism and by its unique assemblage of plant and animal species. The island hosts seventeen endemic plant species and rich endemic fauna includes three mammal species, ten bird species, five reptile species, one crab species, two insects, three marine fish species and several marine sponge species (DAWE, 2020e).

Christmas Island has a distinct biota which includes unique assemblage of plants and animals. This biota is both rich and diverse and includes a significant variety and number of seabirds (DAWE, 2020e).

The island has three notable endemic seabirds, which include the endangered Abbott's booby, which is now recognised as the oldest of the sulids and belongs to its own genus. The other two notable endemic seabirds are the vulnerable Christmas Island frigate bird and a sub-species the golden bosun or white-tailed tropicbird (DAWE, 2020e).

5.3 Wetlands of International Importance (Ramsar)

Under the Ramsar Convention, wetlands are selected on account of their international significance in terms of the biodiversity and uniqueness of their ecology, botany, zoology or other natural process. Four Ramsar wetlands overlap the MEZ/EMBA (**Table 5-3** and **Figure 5-2**) and their conservation values are further described in **Sections 5.3.1** to **5.3.4**.

Note: wetlands that are not linked to the shoreline, but occur in the EPBC Protected Matters search of the MEZ and EMBA, have been excluded as they are not relevant to consideration of potential affects from marine hydrocarbon spills.

Table 5-3 Wetlands of International Importance within the MEZ

Name	Presence	
	MEZ	EMBA
North-West Marine Region		
Ashmore Reef Commonwealth Marine Reserve	✓	✓
Eighty-mile Beach	✓	✓
Other		
Hosnies Spring	✓	✓
The Dales	✓	✓

5.3.1 Ashmore Reef Commonwealth Marine Reserve

Ashmore Reef Commonwealth Marine Reserve was listed as a Ramsar site on 21 October 2002 and covers an area of approximately 58,300 ha (DAWE, 2020f). Ashmore is the largest of the atolls in the Timor Province bioregion. The three islands within the site are also the only vegetated islands in the bioregion. Each of the wetland types present are in near natural condition and the site has the largest seagrass coverage in the bioregion (DAWE, 2020f).

Ashmore Reef supports 64 species of internationally and nationally threatened species. This includes 41 species of hard reef forming coral, eight fish, six reptiles (including endangered and critically endangered sea turtles and seasnakes), five sea cucumbers, two giant clams, one soft coral and the dugong (DAWE, 2020f).

Ashmore Reef plays a primary role in the maintenance of biodiversity in reef systems in the region. The Reserve supports 275 species of reef building coral, 13 species of sea cucumbers, and high numbers of mollusc species. There are over 760 fish species, 13 species of sea snake and 99 species of decapod crustacean (DAWE, 2020f).

Ashmore Reef supports 47 species of waterbird listed as migratory under international treaties. It supports breeding of 20 species of waterbirds including the brown booby, lesser frigatebird, crested tern, bridled tern, sooty tern and common noddy. The Ramsar site is also important for feeding for green turtles, hawksbill turtle and loggerhead turtle and critical nesting and inter-nesting habitats for green and hawksbill turtles (DAWE, 2020f).

5.3.2 Eighty-mile Beach

Eighty-mile Beach was listed as a Ramsar site on 7 June 1990 and covers an area of 175,487 ha (DAWE, 2020f). Eighty-mile Beach represents the greatest extent of continuous intertidal mudflat in excellent condition within the Northwest (IMCRA) bioregion. In addition, Mandora Salt Marsh contains an important and rare group of wetlands within the arid North Western Plateau bioregion In particular the peat mound springs can be considered both bioregionally rare and outstanding examples of this wetland type in Western Australia (DAWE, 2020f).

The Mandora Salt Marsh contains temporary and permanent wetlands in a predominantly arid bioregion (Western Plateau) and has been recognised as important refugia for biological diversity in arid Australia. The inland grey mangroves lining Salt Creek represent the most inland occurrence of this species (DAWE, 2020f).

The Eighty-mile Beach Ramsar site is considered one of the most important sites for stop-over and feeding by migratory shorebirds in Australia; second only to Roebuck Bay in the total number of migratory species for which it is considered internationally important. Furthermore, Eighty-mile Beach represents the most important site internationally (in terms of total number of individuals) for nine species of migratory shorebird in the East Asian-Australasian flyway. Mandora Salt Marsh supports the critical life stage of breeding for at least 13 species of waterbird, including large numbers of Australian pelicans and black swans. In addition, the site is significant for the breeding of at least one species of marine turtle (flatback) (DAWE, 2020f).

Eighty-mile Beach is considered to regularly support in excess of 500,000 birds. Total counts (summer) for just a 60 km stretch of the 220 km intertidal site are generally more than 200,000. There is a record of 2.88 million oriental pratincoles on the beach in February 2004 (DAWE, 2020f). It also supports more than 1% of the flyway population (or 1% of the Australian population for resident species) of 21 waterbirds, including 17 migratory species and four Australian resident. (DAWE, 2020f).

The site also supports the flatback turtle, listed as vulnerable under the EPBC Act (DAWE, 2020f).

5.3.3 Hosnies Spring

Hosnies Spring was listed as a Ramsar site on 11 December 1990 and covers an area of approximately 202 ha (DAWE, 2020f). Hosnies Spring Ramsar site is an example of a highly unusual wetland that is unique to Christmas Island.

The mangrove forest present at the site is unique within the bioregion and possibly worldwide. The stand comprises two mangrove species both of which usually occur in intertidal zones, but here grows at a height of 24-37 metres above sea level. The Ramsar site includes surrounding terrestrial areas with rainforest grading to coastal scrub, and includes an area of shoreline and coral reef (DAWE, 2020f).

5.3.4 The Dales

The Dales was listed as a Ramsar site on 21 October 2002 and covers an area of approximately 583 ha (DAWE, 2020f). It is located in the Christmas Island Integrated Marine and Coastal Regionalisation of Australia (IMCRA) bioregion, and is made up of many wetland types in a near-pristine state, including surface and subterranean karst systems. This system of wetlands, particular the karst wetlands, is unique to the bioregion (DAWE, 2020f).

The Dales provide essential habitat for two wetland-dependent nationally threatened species, the Abbott's booby and the Christmas Island frigatebird (DAWE, 2020f). It is also a significant migratory route for red crabs, blue crabs and robber crabs. The freshwater streams provide critical habitat for the blue crabs as the larvae emerge from the ocean and return inland. In addition the site provides important habitat for land crab spawning, with all 20 species which occur in the site, migrating to the ocean to spawn with their larval stages being marine (DAWE, 2020f).

The mass spawning and development of the larvae of red crabs corresponds to the arrival and aggregation of juvenile whale sharks off shore of Christmas Island to feed on the immature stages of red crabs. The offshore waters of The Dales are believed to provide an important habitat and feeding area for the whale sharks (DAWE, 2020f).

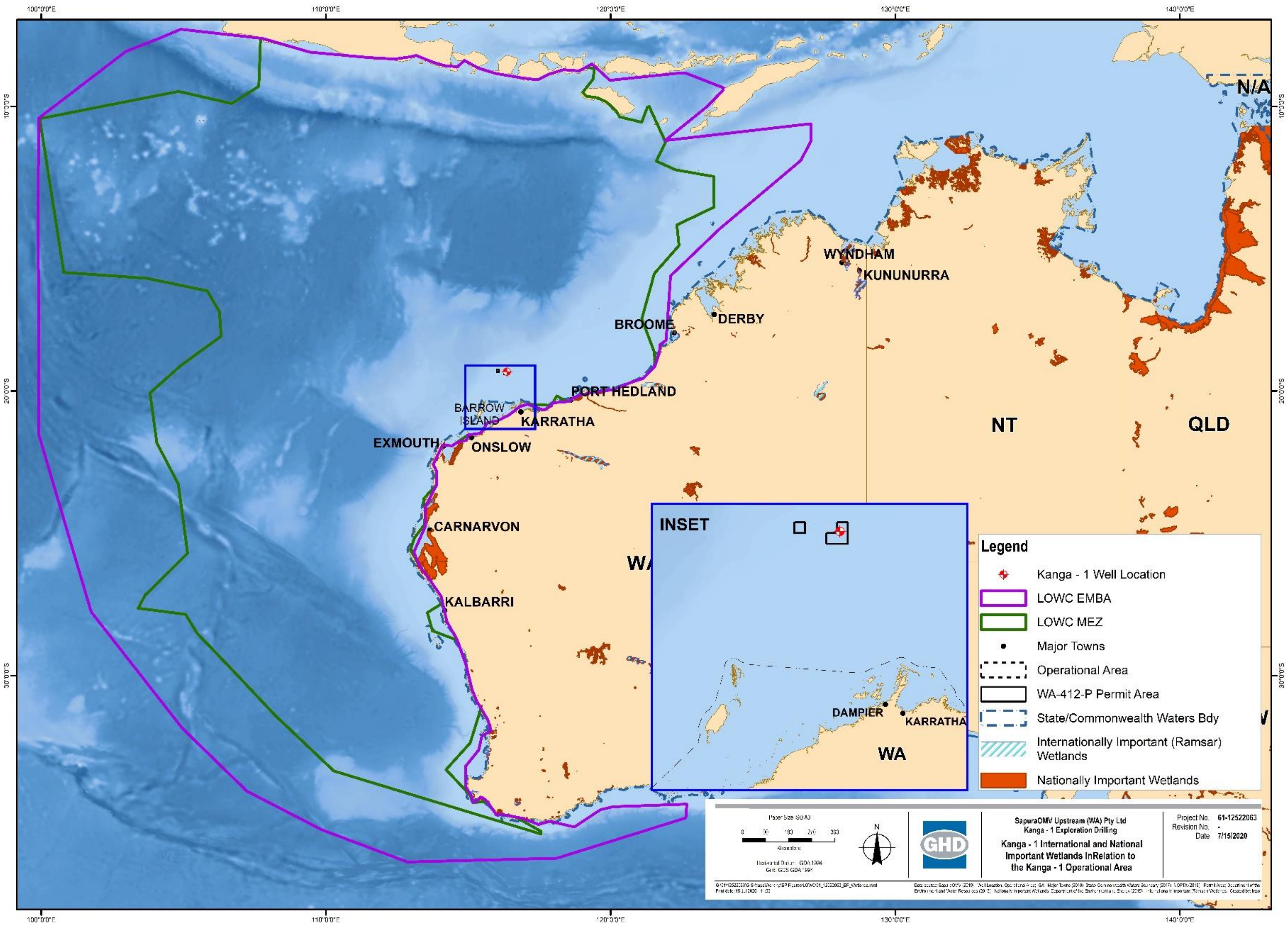


Figure 5-2 Wetlands in the vicinity of the MEZ and EMBA

5.4 Wetlands of National Importance

Wetlands of national importance are wetlands that are a good example in a particular area, an important habitat for native species, or that have outstanding heritage or cultural significance. The EMBA overlaps with six wetlands of national importance, of which five are also within the MEZ (**Table 5-4** and **Figure 5-2**). The conservation values of those wetlands identified in the MEZ is described in **Sections 5.4.1** to **5.4.5**.

Note: wetlands that are not linked to the shoreline, but occur in the EPBC Protected Matters search of the MEZ and EMBA, have been excluded as they are not relevant to consideration of potential affects from marine hydrocarbon spills.

Table 5-4 Wetlands of National Importance within the MEZ

Name	Presence	
	MEZ	EMBA
North-West Marine Region		
Eighty-mile Beach System	✓	✓
Learmonth Air Weapons Range – Saline Coastal Flats	✓	✓
Leslie (Port Headland) Saltfields System	✓	✓
Mermaid Reef	✓	✓
Shark Bay East	✓	✓
Ashmore Reef		✓

5.4.1 Eighty-mile Beach System

This site comprises Eighty Mile Beach between Cape Missiessy and Cape Keraudren and adjoining tidal mudflats; also the coastal plain with distinct swamps, immediately inland of the beach, mainly near Anna Plains Homestead (DAWE, 2020d).

This site is one of the most important migration stop-over areas for shorebirds in East Asia - Australasia, supporting more than 300,000 birds. It is one of the most important sites in the world for migration of great knot and it supports at least 1% of the national population of 21 shorebird species (DAWE, 2020d). It is an outstanding example of a major beach with associated inter-tidal flats and coastal floodplain, located in the arid tropics (DAWE, 2020d).

5.4.2 Learmonth Air Weapons Range – Saline Coastal Flats

Very little is known about this site, except that it represents typical saline coastal flats subject to inundation and ponding. This vegetation type typically has low species richness, but its floristic composition and structure is highly distinctive and supports habitat specific fauna. The wetland extends for some 300 ha and is likely to possess a relatively diverse community, with several species present (DAWE, 2020d).

5.4.3 Leslie (Port Hedland) Saltfields System

This site comprises a large saltfield, fringing coastal flats, and tidal creeks (Ridley River, Catfish Creek and Rock Cod Hole Creeks) and mudflats between the saltfields and the Indian Ocean (DAWE, 2020d). It is a good example of coastal flats and associated tidal coast in north-western Australia (DAWE, 2020d).

This system is major migration stop-over area for shorebirds in the East Asia-Australasia Flyway; possibly the most important stop-over site in the Flyway for the broad-billed sandpiper and an important site for oriental plover. It is recorded as the most important site in Australia for Asian dowitcher and red-necked phalarope (DAWE, 2020d).

5.4.4 Mermaid Reef

Mermaid Reef is the most north-easterly atoll of the Rowley Shoals, which comprises three distinct reef systems arising from depths of between 300 and 700 m along the edge of the continental shelf. The other two reefs, Imperieuse and Clerke Reefs, are protected by the WA Rowley Shoals Marine Park (DAWE, 2020d). All are emergent annular shelf reefs with a north-south orientation, and are considered to be representative of the progressive stages in platform reef formation, with Mermaid Reef representative of the early stage of shelf reef development (DAWE, 2020d).

The major marine habitats of Mermaid Reef have been mapped and classified as sand cay, lagoon, submerged sand, deep reef flat, and emergent areas (DAWE, 2020d). Fauna surveys show that Mermaid Reef and the other Rowley Shoals reefs have a rich and diverse fauna which is regionally important, and which includes some endemics and species not occurring elsewhere in WA. The reefs have biogeographic value due to the presence of species which are at or close to the limit of their distribution. The coral communities are one of the special values of Mermaid Reef (DAWE, 2020d).

5.4.5 Shark Bay East

Shark Bay East comprises tidal wetlands, and marine waters (up to 10 km from shore) less than 6 m deep at low tide, in the east arm of Shark Bay, from the mouth of the Gascoyne River (Carnarvon) south to latitude 26° S (DAWE, 2020d).

Shark Bay east is an outstanding example of a very large, shallow marine embayment, with particularly extensive occurrence of seagrass beds and substantial areas of intertidal mud/sand-flats and mangrove swamp (DAWE, 2020d). The site supports what is probably the world's largest discrete population of dugong; it is also a major nursery and/or feeding area for turtles, rays, sharks, other fishes, prawns and other marine fauna; and is a major migration stop-over area for shorebirds (DAWE, 2020d).

5.5 Threatened Ecological Communities

An ecological community is a naturally occurring group of native plants, animals and other organisms that are interacting in a unique habitat. An ecological community is considered threatened when it is at risk of extinction; when the natural composition and function of the ecological community have been significantly depleted across its full range. The Subtropical and Temperate Coastal Saltmarsh is the only threatened ecological community likely to occur within the MEZ/EMBA.

5.5.1 Subtropical and Temperate Coastal Saltmarsh

Subtropical and Temperate Coastal Saltmarsh community is listed as vulnerable under the EPBC Act (DSEWPaC, 2013). This community occurs within the subtropical and temperate climatic zones and is present in coastal areas under regular or intermittent tidal influences and occurs over six State jurisdictions (South-western Queensland, New South Wales, Victoria, Tasmania and South-western WA) (DSEWPaC, 2013). In WA it occurs from the south coast up to the southern part of Shark Bay. The community is made up of mainly salt tolerant vegetation which include halophytes as well as a number of non-vascular plant species. The community is listed as vulnerable under the EPBC Act (DSEWPaC, 2013).

6. Key Ecological Features

Key Ecological Features (KEFs) are elements of the Commonwealth marine environment that are considered to be of regional importance for either a region's biodiversity or its ecosystem function and integrity. The criteria used to identify KEFs are:

- A species, group of species or community with a regional important ecological role, where there is specific knowledge about why the species or species group is important to the ecology of the region, and the spatial and temporal occurrence of the species or species group is known;
- A species, group or species or community that is nationally or regionally important for biodiversity, where there is specific knowledge about why the species or species group is regionally or nationally important for biodiversity, and the spatial and temporal occurrence of the species or species group is known;
- An area or habitat that is nationally or regionally important for:
    - Enhanced or high biological productivity;
    - Aggregation of marine life; and
    - Biodiversity and endemism.
- A unique seafloor feature with ecological properties of regional significance.

The MEZ overlaps 20 KEFs, with an additional five in the EMBA (**Table 6-1** and **Figure 6-1**). The conservation values of those KEFs identified in the MEZ are described in **Sections 6.1** to **6.20**.

Table 6-1 KEFs within the MEZ and EMBA

Name	Presence	
	MEZ	EMBA
North-West Marine Region		
Ancient coastline at 125 m depth contour	✓	✓
Ashmore Reef and Cartier Island and surrounding Commonwealth waters	✓	✓
Canyons linking the Argo Abyssal Plain and Scott Plateau	✓	✓
Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	✓	✓
Carbonate bank and terrace system of the Sahul Shelf		✓
Commonwealth waters adjacent to Ningaloo Reef	✓	✓
Continental Slope Demersal Fish Communities	✓	✓
Exmouth Plateau	✓	✓
Glomar Shoals	✓	✓
Mermaid Reef and Commonwealth waters surrounding Rowley Shoals	✓	✓
Pinnacles of the Bonaparte Basin		✓
Seringapatam Reef and Commonwealth waters in the Scott Reef complex	✓	✓
Wallaby Saddle	✓	✓

South-West Marine Region		
Albany Canyons group and adjacent shelf break	✓	✓
Ancient coastline at 90-120m depth	✓	✓
Cape Mentelle upwelling	✓	✓
Commonwealth marine environment surrounding the Houtman Abrolhos Islands (and adjacent shelf break)	✓	✓
Commonwealth marine environment surrounding the Recherche Archipelago		✓
Commonwealth marine environment within and adjacent to Geographe Bay		✓
Commonwealth marine environment within and adjacent to the west coast inshore lagoons	✓	✓
Diamantina Fracture Zone		✓
Naturaliste Plateau	✓	✓
Perth Canyon and adjacent shelf break, and other west-coast canyons	✓	✓
Western demersal slope and associated fish communities of the Central Western Province	✓	✓
Western rock lobster	✓	✓

6.1 Ancient coastline at 125 m depth contour

The ancient coastline at 125 m depth contour KEF is a unique seafloor feature with ecological properties of regional significance. The spatial boundary of this KEF, as defined in the Conservation Values Atlas, is defined by depth range 115–135 m in the Northwest Shelf Province and Northwest Shelf Transition IMCRA provincial bioregions (DAWE, 2020a).

The ancient submerged coastline provides areas of hard substrate and therefore may provide sites for higher diversity and enhanced species richness relative to surrounding areas of predominantly soft sediment. 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 NWS bioregion (DAWE, 2020a).

The escarpment may also facilitate increased availability of nutrients off the Pilbara by interacting with internal waves and enhancing vertical mixing of water layers. Enhanced productivity associated with the sessile communities and increased nutrient availability may attract larger marine life such as whale sharks and large pelagic fish (DAWE, 2020a).

6.2 Ashmore Reef and Cartier Island and surrounding Commonwealth Waters

Ashmore Reef and Cartier Island and surrounding Commonwealth waters are defined as a KEF for their high productivity, biodiversity and aggregation of marine life, in both the benthic and pelagic habitats within this feature (DAWE, 2020a).

Ashmore Reef and Cartier Island are situated on the shallow upper slope of the Sahul Shelf, north of Scott and Seringapatam reefs. Rising from a depth of more than 100 m, the Ashmore reef platform is at the edge of the NWS and covers an area of 239 km^2, and the Ashmore Reef Commonwealth Marine Reserve encloses an area of about 583 km^2 of seabed (DAWE, 2020a).

Cartier Island Marine Reserve is located in the West Sahul region of the Indian Ocean. It contains one unvegetated sand cay and mature reef flat with two shallow pools to the north-east of the cay and covers 167 km^2 (DAWE, 2020a).

Sandy beaches provide important habitat for nesting green and hawksbill turtles throughout the year. Seagrasspresent at Ashmore Reef provides critical breeding (April–May) and foraging (throughout the year) habitat fora genetically distinct population of dugong with their range probably extending to other submerged shoals within the area (DAWE, 2020a).

The emergent habitat at Ashmore also provides important nesting sites for seabirds, many of which are migratory. Ashmore's islands are regarded as supporting some of the most important seabird rookeries on the NWS seasonally supporting up to 50,000 seabirds (26 species) and up to 2,000 waders (30 species, representing almost 70% of wader species that regularly migrate to Australia) (DAWE, 2020a).

Large colonies of sooty terns, crested terns, bridled terns and common noddies breed on the east and middle islands. Smaller breeding colonies of little egrets, eastern reef egrets, black noddies and possibly lesser noddies also occur. Migratory wading birds include eastern curlews, ruddy turnstones, whimbrels, bar-tailed godwits, common sandpipers, Mongolian plovers, red-necked stints and tattlers, during October–November and March–April as part of the migration between Australia and the Northern Hemisphere (DAWE, 2020a).

6.3 Canyons linking the Argo Abyssal Plain and Scott Plateau

The spatial boundary of this KEF includes the three canyons, adjacent to the south-west corner of Scott Plateau. They are defined as a KEF for their high productivity and aggregations of marine life (DAWE, 2020a). These values apply to both the benthic and pelagic habitats within the feature.

The canyons cut deeply into the south-west margin of the Scott Plateau at an approximate depth of 2,000–3,000 m, and act as conduits for transport of sediments to depths of more than 5500 metres on the Argo Abyssal Plain. The water masses at these depths are deep Indian Ocean water on the Scott Plateau and Antarctic bottom water on the Argo Abyssal Plain. Both water masses are cold, dense and nutrient-rich (DAWE, 2020a).

6.4 Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula

The canyons linking Cuvier Abyssal Plain and the Cape Range Peninsula are unique seafloor features with ecological properties of regional significance, which apply to both the benthic and pelagic habitats within the feature. The largest canyons on the slope linking the Cuvier Abyssal Plain and Cape Range Peninsula are the Cape Range Canyon and Cloates Canyon which are located along the southerly edge of Exmouth Plateau adjacent to Ningaloo Reef. The canyons are unusual because their heads are close to the coast of North West Cape (DAWE, 2020a).

The canyons are thought to interact with the Leeuwin Current to produce eddies inside the heads of the canyons, resulting in waters from the Antarctic intermediate water mass being drawn into shallower depths and onto the shelf (Brewer et al. 2007). These waters are cooler and richer in nutrients and strong internal tides may also aid upwelling at the canyon heads (Brewer et al. 2007). The narrow shelf width (about 10 kilometres) near the canyons facilitates nutrient upwelling. This nutrient-rich water interacts with the Leeuwin Current at the canyon heads.

Aggregations of whale sharks, manta rays, humpback whales, sea snakes, sharks, large predatory fish and seabirds are known to occur in this area and are related to productivity (Sleeman et al. 2007). The canyons are also repositories for particulate matter deposited from the shelf and sides of the canyons and serve as conduits for organic matter between the surface, shelf and abyssal plains (DAWE, 2020a). The hard substrates of the canyons' sides provide habitat for deepwater snappers and other species (Brewer et al. 2007).

6.5 Commonwealth waters adjacent to Ningaloo Reef

The Commonwealth waters adjacent to Ningaloo reef is defined as a KEF for their high productivity and aggregations of marine life, which apply to both the benthic and pelagic habitats within the feature. The Commonwealth waters adjacent to Ningaloo reef include Ningaloo Commonwealth Marine Reserve (Commonwealth waters) and encompass an area of 2435 km². This feature lies adjacent to the Ningaloo Marine Park (state waters) margin at the 3 nm limit (DAWE, 2020a).

Ningaloo reef is globally significant as the only extensive coral reef in the world that fringes the west coast of a continent. It is also globally significant as a seasonal aggregation site for whale sharks (DAWE, 2020a). Upwellings associated with canyons on the adjacent slope and interactions between the Ningaloo and Leeuwin currents are thought to support the rich aggregations of large marine species present at Ningaloo reef. The narrow shelf means that the nutrients channelled to the surface via canyons are immediately available to reef species. Low terrestrial nutrient input means that this deepwater source is a major source of nutrients for Ningaloo Reef and therefore very important in maintaining this system (DEWHA, 2008a).

6.6 Continental slope demersal fish communities

The continental slope demersal fish communities are recognised as a KEF because of the biodiversity values, including high levels of endemism. The spatial boundary of this KEF is defined as the area of slope in the Northwest Province and Timor Province provincial bioregions, at the depth ranges of 220-500 m and 750-1,000 m (DAWE, 2020a).

Demersal fish species occupy two distinct demersal community types (biomes) associated with the upper slope (water depth of 225–500 metres) and the mid-slope (750–1000 metres). Higher-order consumers may include carnivorous fish, deepwater sharks, large squid and toothed whales (Brewer et al. 2007). Pelagic production is phytoplankton based, with hot spots around oceanic reefs and islands (Brewer et al. 2007).

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 Australian continental slope. The continental slope between North West Cape and the Montebello Trough has > 500 fish species, 76 of which are endemic, which makes it the most diverse slope bioregion in Australia (Last et al. 2005). The slope of the Timor Province and the Northwest Transition also contains > 500 species of demersal fish of which 64 are considered endemic (Last et al. 2005). The Timor Province and Northwest Transition bioregions are the second-richest areas for demersal fish across the entire continental slope (DAWE, 2020a).

6.7 Exmouth Plateau

The Exmouth Plateau is defined as a KEF as it is a unique seafloor feature with ecological properties of regional significance, which apply to both the benthic and pelagic habitats. The Exmouth Plateau is located in the Northwest Province and covers an area of 49,310 km² in water depths of 800–4000 metres (DAWE, 2020a).

The plateau's surface is rough and undulating at 900–1000 metres depth. The northern margin is steep and intersected by large canyons (e.g. Montebello and Swan canyons) with relief greater than 500 metres. The western margin is moderately steep and smooth and the southern margin is gently sloping and virtually free of canyons (Falkner et al. 2009). Satellite observations suggest that productivity is enhanced along the northern and southern boundaries of the plateau and along the shelf edge which in turn suggests that the plateau is a significant contributor to the productivity of the region (Brewer et al. 2007). Sediments on the plateau suggest that biological communities include scavengers, benthic filter feeders and epifauna. Fauna in the pelagic waters above the plateau are likely to include small pelagic species and nekton (Brewer et al. 2007).

It is believed that the large size of Exmouth Plateau and its expansive surface may modify deepwater flow and be associated with the generation of internal tides. Both may contribute to the upwelling of deeper, nutrient-rich waters closer to the surface (Brewer et al. 2007). The topography of the plateau (with valleys and channels), in addition to potentially constituting a range of benthic environments, may provide conduits for the movement of sediment and other material from the plateau surface through the deeper slope to the abyss.

6.8 Glomar Shoals

The Glomar Shoals are defined as a KEF for their high productivity and aggregations of marine life. They are a submerged littoral feature located approximately 150 km north of Dampier on the Rowley shelf at depths of 33–77 m (Falkner et al. 2009).

The shoals consist of a high percentage of marine-derived sediments with high carbonate content and gravels of weathered coralline algae and shells (McLoughlin and Young, 1985). The area's higher concentrations of coarse material in comparison to surrounding areas are indicative of a high-energy environment subject to strong sea-floor currents (Falkner et al. 2009). While the biodiversity associated with the Glomar Shoals has not been studied, 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 (Falkner et al. 2009; Fletcher and Santoro, 2009). These species have recorded high catch rates associated with the Glomar Shoals, indicating that the shoals are likely to be an area of high productivity.

6.9 Mermaid Reef and Commonwealth waters surrounding Rowley Shoals

The Mermaid Reef and Commonwealth waters surrounding Rowley Shoals is defined as a KEF for its enhanced productivity and high species richness, that apply to both the benthic and pelagic habitats within the feature. The Rowley Shoals are a collection of three atoll reefs, Clerke, Imperieuse and Mermaid, which are located about 300 km northwest of Broome. This KEF encompasses Mermaid Reef Commonwealth Marine Reserve as well as waters from 3 nm out to 6 nm surrounding Clerke and Imperieuse reefs (DAWE, 2020a). Mermaid Reef lies 29 km north of Clerke and Imperieuse reefs and is totally submerged at high tide. Mermaid Reef falls under Commonwealth jurisdiction. Clerke and Imperieuse reefs constitute the Rowley Shoals Marine Park, which falls under WA Government jurisdiction (DAWE, 2020a).

Mermaid Reef and Commonwealth waters surrounding Rowley Shoals are regionally important in supporting high species richness, higher productivity and aggregations of marine life associated with the adjoining reefs themselves (Done et al. 1994). The reefs provide a distinctive biophysical environment in the region as there are few offshore reefs in the northwest. They have steep and distinct reef slopes and associated fish communities. In evolutionary terms, the reefs may play a role in supplying coral and fish larvae to reefs further south via the southward flowing Indonesian Throughflow. Both coral communities and fish assemblages differ from similar habitats in eastern Australia (Done et al. 1994).

6.10 Seringapatam Reef and Commonwealth waters in the Scott Reef complex

The Seringapatam reef and Commonwealth waters in the Scott reef complex are defined as a KEF as they support diverse aggregations of marine life, have high primary productivity relative to other parts of the region, are relatively pristine and have high species richness, which apply to both the benthic and pelagic habitats within the feature (DAWE, 2020a).

Scott and Seringapatam reefs are part of a series of submerged reef platforms that rise steeply from the sea floor between the 300–700 m contours on the northwest continental slope and lie in the Timor Province (Falkner et al. 2009). Scott and Seringapatam reefs provide an important biophysical environment in the region as one of few offshore reefs in the northwest. The spatial boundary of this KEF includes both reefs plus the adjacent apron/fan features, and the canyon approximately 10 km to the west of Scott Reef. The southern edge of the KEF is defined by the state water boundary around Scott Reef (DAWE, 2020a).

As two of the few offshore reefs in the north-west, they provide an important biophysical environment in the region (DAWE, 2020a). The coral communities at Scott and Seringapatam reefs play a key role in maintaining the species richness and subsequent aggregations of marine life. Scott and Seringapatam reefs and the waters surrounding them attract aggregations of marine life including humpback whales and other cetacean species, whale sharks and several species of sea snake. Two species of marine turtle nest and forage during the summer months, and this KEF also provides foraging areas for various seabird species (DAWE, 2020a).

6.11 Wallaby Saddle

The Wallaby Saddle covers 7,880 km^2 of sea floor and is located within the Indian Ocean water mass. The Wallaby Saddle is an abyssal geomorphic feature that connects the northwest margin of the Wallaby Plateau with the margin of the Carnarvon Terrace on the upper continental slope at a depth of 4,000–4,700 m (Falkner et al. 2009). The Wallaby Saddle is defined as a KEF for its high productivity and aggregations of marine life. These values apply to both the benthic and pelagic habitats within the feature.

The Wallaby Saddle is regionally important in that it represents almost the entire area of this type of geomorphic feature in the NWMR. It is a unique habitat that neither occurs anywhere else nearby (within hundreds of kilometres) nor with as large an area (Falkner et al. 2009). Little is known about the Wallaby Saddle; however, the area is considered one of enhanced productivity and low habitat diversity (Brewer et al. 2007), and may have been associated with historical aggregations of sperm whales (DAWE, 2020a).

6.12 Albany Canyons group and adjacent shelf break

The Albany canyon group is immediately adjacent to and interacts with a large section of the continental shelf break (DAWE, 2020a) and is defined as a KEF for its high productivity, aggregations of marine life, and as a unique seafloor feature with ecological properties of regional significance. Both benthic and demersal habitats within the feature are of conservation value (DAWE, 2020a).

The Albany canyon group is immediately adjacent to, and interacts with, a large section of continental shelf break. The area is thought to be associated with small, periodic subsurface upwelling events that may drive localised regions of high productivity, contributing to the ecological functioning and integrity of this area (DAWE, 2020a).

The canyons are known to be a feeding area for the sperm whale and sites of orange roughy aggregations. Anecdotal evidence also indicates that this area supports fish aggregations that attract large predatory fish, sharks, and toothed, deep-diving whales such as sperm whale (DAWE, 2020a).

6.13 Ancient coastline at 90 and 120 m depth

The continental shelf of the SWMR contains several terraces and steps, reflecting the gradual increase in sea level across the shelf that occurred during the Holocene. A prominent escarpment occurs close to the middle of the continental shelf off the Great Australian Bight at a depth of approximately 90–120 m. This is the spatial boundary of this KEF (DAWE, 2020a).

The Ancient coastline between 90 and 120 m depth is defined as a KEF for its potential high productivity and aggregations of marine life, biodiversity and endemism. Both benthic habitats and associated demersal communities are of conservation value. While the ancient coastline is present throughout the region, it is particularly evident in the Great Australian Bight, where it provides complex habitat for a number of species. 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 (DAWE, 2020a).

6.14 Cape Mentelle upwelling

The Cape Mentelle upwelling is defined as a KEF for its high productivity and aggregation soft marine life (DAWE, 2020a). It draws relatively nutrient-rich water from the base of the Leeuwin Current, up the continental slope and onto the inner continental shelf, where it results in phytoplankton blooms at the surface (DAWE, 2020a).

The phytoplankton blooms provide the basis for an extended food chain characterised by feeding aggregations of small pelagic fish, larger predatory fish, seabirds, dolphins and sharks. The Cape Mentelle upwelling has a disproportionate influence on the overall-nutrient poor nature of the region’s water (DAWE, 2020a).

6.15 Commonwealth marine environment surrounding the Houtman Abrolhos Islands (and adjacent shelf break)

The Houtman Abrolhos Islands are a complex of 122 islands and reefs located at the edge of the continental shelf between 28°15’ S to 29° S, approximately 60 km offshore from the mid-west coast of WA. The spatial boundary of this KEF is based on the 12 nm territorial boundary around the Houtman Abrolhos Island group (DAWE, 2020a). The Commonwealth marine environment surrounding the Houtman Abrolhos Islands (and adjacent shelf break) is defined as a KEF for its high levels of biodiversity and endemism in benthic and pelagic habitats.

The Houtman Abrolhos Islands and surrounding reefs support a unique mix of temperate and tropical species, resulting from the southward transport of species by the Leeuwin Current over thousands of years. The area represents the southern limit in WA of many widespread Indo-Pacific tropical fish. The islands are the largest seabird breeding station in the eastern Indian Ocean. They support more than one million pairs of breeding seabirds, including sedentary and migratory species. Many of the islands’ biodiversity features rely on the benthic and pelagic ecosystems in deeper, offshore waters; most notably, seabirds and rock lobster (DAWE, 2020a).

6.16 Commonwealth marine environment within and adjacent to the west coast inshore lagoons

The Commonwealth marine environment within and adjacent to the west-coast inshore lagoons is defined as a KEF for its high productivity and aggregations of marine life. Both benthic and pelagic habitats within the feature are of conservation value (DAWE, 2020a). This environment consists of a chain of inshore lagoons of limestone reef (as deep as 30 m) extending along the

WA coast from south of Mandurah to Kalbarri. The mix of sheltered and exposed seabeds form a complex mosaic of habitats (DAWE, 2020a).

The lagoons are dominated by seagrass and epiphytic algae. Although macroalgae (principally Ecklonia spp.) and seagrass appear to be the primary source of production, scientists suggest that groundwater enrichment may supplement the supply of nutrients to the lagoons. The lagoons are associated with high biodiversity and endemism, containing a mix of tropical, subtropical and temperate flora and fauna.

The inshore lagoons are important areas for the recruitment of the commercially and recreationally important western rock lobster, dhufish, pink snapper, breaksea cod, baldchin and blue gropers, abalone and many other reef species. The area includes breeding and nursery aggregations for many temperate and tropical marine species (DAWE, 2020a).

Extensive schools of migratory fish visit the area annually, including herring, garfish, tailor and Australian salmon (DAWE, 2020a).

6.17 Naturaliste Plateau

The Naturaliste Plateau is defined as a KEF for its unique seafloor feature with ecological properties of regional significance (DAWE, 2020a). The Naturaliste Plateau is Australia’s deepest temperate marginal plateau and occurs an area where numerous water bodies and currents converge. It is also the only seafloor feature in the region that interacts with the subtropical convergence front (DAWE, 2020a). Although there is very little known about the marine life of the plateau, it is speculated that the combination of its structural complexity, mixed water dynamics and relative isolation indicate that it supports deep-water communities with high species diversity and endemism (DAWE, 2020a).

The Plateau acts as an underwater ‘biogeographical island’ on the edge of the abyssal plain, providing habitat for fauna unique to these depths. The Plateau is also within a deep eddy field that is thought to be associated with high productivity and aggregations of marine life (DAWE, 2020a). Proximity to the nearby subtropical convergence front is thought to have a significant influence on the biodiversity of the Plateau (DAWE, 2020a).

6.18 Perth Canyon and adjacent shelf break, and other west-coast canyons

The Perth Canyon is the largest canyon on the Australian margin and, together with numerous smaller submarine canyons that incise the continental slope of southern WA is expected to have high biodiversity values (DAWE, 2020a). The Perth Canyon forms a major biogeographical boundary and it is defined as a KEF because it is an area of higher productivity that attracts feeding aggregations of deep-diving mammals and large predatory fish. It is also recognised as a unique seafloor feature with ecological properties of regional significance (DAWE, 2020a).

Canyons can be characterised by higher productivity and species diversity than surrounding slope areas of similar depth or distance offshore. They are pathways for transporting sediments, nutrients and biota off the continental shelf and slope and onto the abyssal plain, either acting as a sink for this relatively organic-rich material or directing it into deeper water. They also function as conduits for upwelling and downwelling processes that influence environmental variables such as nutrient availability and water temperature (DAWE, 2020a). The west-coast canyons are believed to be associated with small periodic upwellings that locally increase productivity and attract aggregations of marine life (DAWE, 2020a). In the Perth Canyon marks the southern boundary for numerous tropical species groups on the shelf, including sponges, corals, decapods and xanthid crabs (DAWE, 2020a).

6.19 Western demersal slope and associated fish communities

The western demersal slope and associated fish communities (also referred to as the Demersal slope and associated fish communities of the Central Western Province) are recognised as a KEF for their high levels of biodiversity and endemism. The KEF extends from the edge of the shelf to the limit of the EEZ, between Perth and the northern boundary of the SWMR.

The western continental slope provides important habitat for demersal fish communities. In particular, the continental slope of the Central Western provincial bioregion supports demersal fish communities characterised by high diversity compared with other, more intensively sampled, oceanic regions of the world. Scientists have described 480 species of demersal fish that inhabit the slope of this bioregion, and 31 of these are considered endemic to the bioregion (DAWE, 2020a).

6.20 Western rock lobster

The spatial boundary of the western rock lobster KEF includes Commonwealth waters in the SWMR to a depth of 150 m, north of Cape Leeuwin (DAWE, 2020a). The western rock lobster is defined as a key ecological feature due to its presumed ecological role on the west coast continental shelf. It is likely to play an important role in ecosystem processes on the shelf waters of the region, where it can significantly reduce the densities of invertebrate prey. The species plays an important role in many of the inshore ecosystems on the inner shelf, particularly during the post-larval puerulus phase (juvenile lobsters) (DAWE, 2020a).

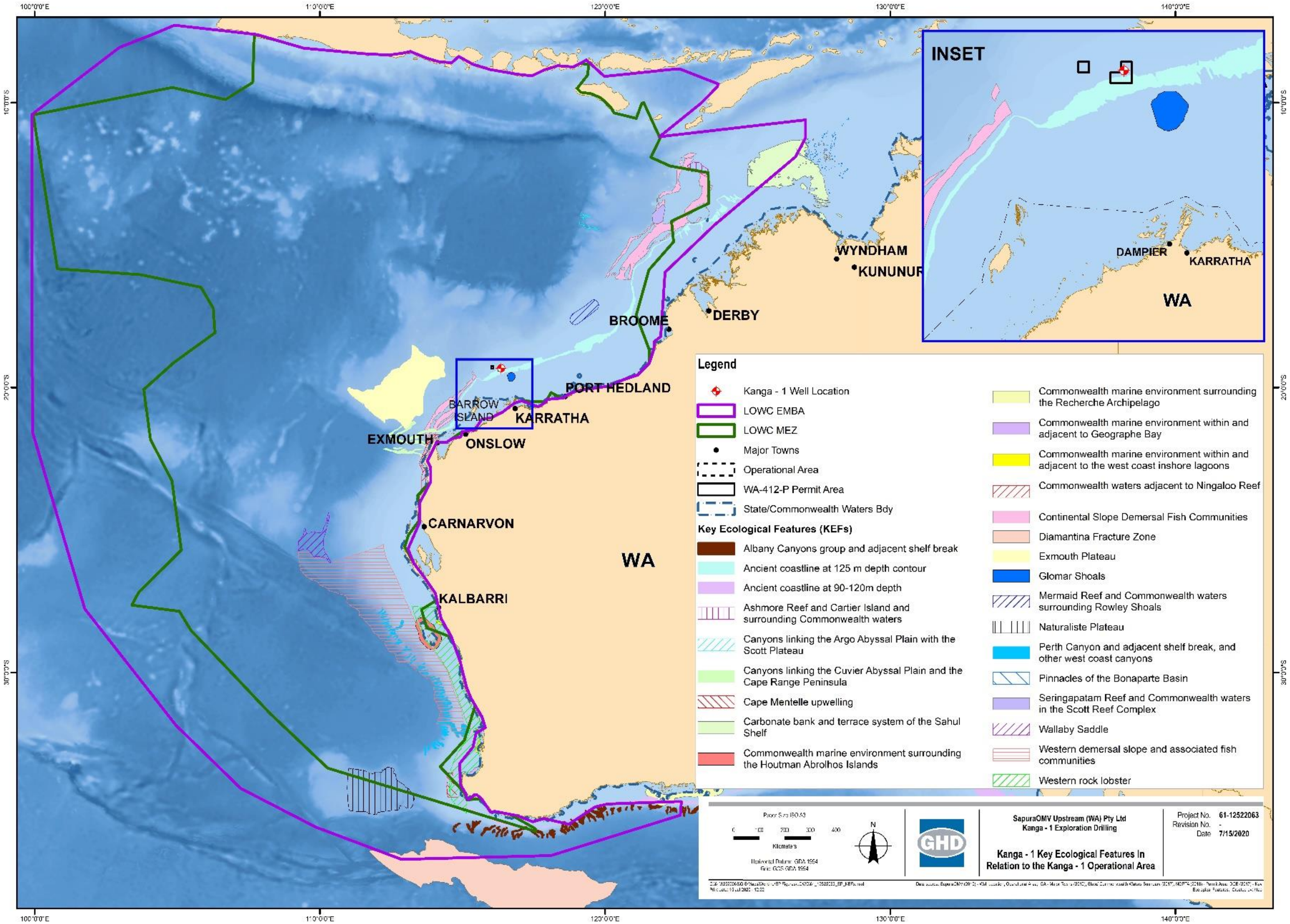


Figure 6-1 Key Ecological Features in the MEZ and EMBA

7. Australian Marine Parks

Australian Marine Parks (AMPs) (Commonwealth reserves proclaimed under the EPBC Act in 2007 and 2013) are located in Commonwealth waters that start at the outer edge of state and territory waters, generally three nautical miles (approximately 5.5 km) from the shore, and extend to the outer boundary of Australia's EEZ, 200 nautical miles (approximately 370 km) from the shore (DNP, 2018a).

- The Australian Marine Parks Network includes six marine regions; the Coral Sea, South-west, Temperate East, South-east, North and Northwest. Management plans have been developed and approved for each of these regions. These plans establish the management and zoning of the designated marine parks. Values identified within the respective management plans (DNP, 2018a; DNP, 2018b) for marine parks are broadly defined as:

- Natural - habitats, species and ecological communities within marine parks, and the processes that support their connectivity, productivity and function;
- Cultural - living and cultural heritage recognising Indigenous beliefs, practices and obligations for country, places of cultural significance and cultural heritage sites;
- Heritage - non-Indigenous heritage that has aesthetic, historic, scientific or social significance; and
- Socio-economic - the benefit of marine parks for people, businesses and the economy.

Zoning and related rules for managing activities are important tools for managing marine parks to ensure protection of marine habitats and species, while enabling use. Zones established by management plans are summarised in **Table 7-1**.

Table 7-1 Summary of zones in the Marine Parks

Special Purpose Zone (IUCN category VI)—managed to allow specific activities though special purpose management arrangements while conserving ecosystems, habitats and native species. The zone allows or prohibits specific activities.
Multiple Use Zone (IUCN category VI)—managed to allow ecologically sustainable use while conserving ecosystems, habitats and native species. The zone allows for a range of sustainable uses, including commercial fishing and mining where they are consistent with park values.
Habitat Protection Zone (IUCN category IV)—managed to allow activities that do not harm or cause destruction to seafloor habitats, while conserving ecosystems, habitats and native species in as natural a state as possible.
Recreational Use Zone (IUCN category IV)—managed to allow recreational use, while conserving ecosystems, habitats and native species in as natural a state as possible. The zone allows for recreational fishing, but not commercial fishing.
National Park Zone (IUCN category II)—managed to protect and conserve ecosystems, habitats and native species in as natural a state as possible. The zone only allows non-extractive activities unless authorised for research and monitoring.
Sanctuary Zone (IUCN category Ia)—managed to conserve ecosystems, habitats and native species in as natural and undisturbed a state as possible. The zone allows only authorised scientific research and monitoring.

Source: (DNP, 2018a)

The marine park networks pertinent to the MEZ and/orEMBA include:

- The North-west Marine Parks Network;

- The South-west Marine Park Network; and
- The North Marine Parks Network.

The North-west Marine Parks Network is aligned to the NWMR. The network covers 335,341 km^2 and comprises 13 AMPs (DNP, 2018a), of which the MEZ overlaps with 11 and the EMBA overlaps 12 (**Table 7-2** and **Figure 7-1**).

The South-west Marine Parks Network is aligned to the SWMR. The network covers 508,371 km^2 and includes 14 AMPs (DNP, 2018b), of which the MEZ overlaps with five and the EMBA overlaps six (**Table 7-2** and **Figure 7-1**).

The North Marine Parks Network is aligned to the North Marine Region (NMR). The network covers 157,480 km^2 and includes eight AMPs (DNP, 2018c), of which the EMBA overlaps with one (**Table 7-2** and **Figure 7-1**).

The conservation values of those AMPs identified in the MEZ are described in **Sections 0** to **7.16**.

Table 7-2 Australian Marine Parks within the MEZ and EMBA

Name	Zone or IUCN Classification	Presence	
		MEZ	EMBA
North Marine Region			
Oceanic Shoals Marine Park	Multiple Use Zone (IUCN VI)		✓
North-West Marine Region			
Argo-Rowley Terrace Marine Park	Multiple Use Zone (IUCN VI)	✓	✓
	National Park Zone (IUCN II)	✓	✓
	Special Purpose Zone (Trawl) (IUCN VI)	✓	✓
Ashmore Reef Marine Park	Recrational Use Zone (IUCN IV)		✓
	Sanctuary Zone (IUCN Ia)		✓
Carnarvon Canyon Marine Park	Habitat Protection Zone (IUCN IV)	✓	✓
Cartier Island Marine Park	Sanctuary Zone (IUCN Ia)	✓	✓
Dampier Marine Park	Habitat Protection Zone (IUCN IV)	✓	✓
	National Park Zone (IUCN II)	✓	✓
	Multiple Use Zone (IUCN VI)	✓	✓
Eighty Mile Beach Marine Park	Multiple Use Zone (IUCN VI)	✓	✓
Gascoyne Marine Park	Habitat Protection Zone (IUCN IV)	✓	✓
	National Park Zone (IUCNII)	✓	✓
	Multiple Use Zone (IUCN VI)	✓	✓
Kimberley Marine Park	Multiple Use Zone (IUCN VI)	✓	✓
	National Park Zone (IUCN II)		✓
Mermaid Reef Marine Park	National Park Zone (IUCN II)	✓	✓
Montebello Marine Park	Multiple Use Zone (IUCN VI)	✓	✓
Ningaloo Marine Park	Recreational Use Zone (IUCN IV)	✓	✓
	National Park Zone (IUCN II)	✓	✓

Name	Zone or IUCN Classification	Presence	
		MEZ	EMBA
Shark Bay Marine Park	Multiple Use Zone (IUCN VI)	✓	✓
South-West Marine Region			
Abrolhos Marine Park	National Park Zone (IUCN II)	✓	✓
	Multiple Use Zone (IUCN VI)	✓	✓
	Special Purpose Zone (IUCN VI)	✓	✓
	Habitat Protection Zone (IUCN IV)	✓	✓
Bremer Marine Park	Special Purpose Zone (mining Exclusion) (IUCN VI)		✓
	National Park Zone (IUCN II)		✓
Jurien Marine Park	National Park Zone (IUCN II)	✓	✓
	Special Purpose Zone (IUCN VI)	✓	✓
Perth Canyon Marine Park	Habitat Protection Zone (IUCN IV)	✓	✓
	Multiple Use Zone (IUCN VI)	✓	✓
	National Park Zone (IUCN II)	✓	✓
South-West Corner Marine Park	Special Purpose Zone (IUCN VI)	✓	✓
	National Park Zone (IUCN II)	✓	✓
	Special Purpose Zone (Mining Exclusion) (IUCN VI)	✓	✓
	Multiple Use Zone (IUCN VI)	✓	✓
	Habitat Protection Zone (IUCN IV)		✓
Two Rocks	Multiple Use Zone (IUCN VI)	✓	✓
	National Park Zone (IUCN II)		✓

Note: Although Oceanic Shoals AMP is part of the North Marine Region, it also overlaps the NWMR, where the EMBA extends.

7.1 Argo-Rowley Terrace Marine Park

The Argo-Rowley Marine Park covers an area of 146,003 km^2 and water depths between 220 m and 600 m. It is the largest in the Northwest Network, and is adjacent to the Mermaid Reef Marine Park and the WA Rowley Shoals Marine Park. It includes the deeper waters of the region and 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 and are associated with small, periodic upwellings that results in localised higher levels of biological productivity (DNP, 2018a).

The Argo–Rowley Marine Park is significant because it contains habitats, species and ecological communities associated with the Northwest Transition and Timor Province. It includes two KEFs:

- Canyons linking the Argo Abyssal Plain with the Scott Plateau and Mermaid Reef; and
- Commonwealth waters surrounding Rowley Shoals.

This AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the Marine Park include resting and breeding habitat for seabirds and a migratory pathway for the pygmy blue whale (DNP, 2018a).

Commercial fishing and mining are important activities in the marine park (DNP, 2018a).

7.2 Carnarvon Canyon Marine Park

The Carnarvon Canyon Marine Park covers an area of 6,177 km² and a water depth range of 1,500–6,000 m. It includes the Carnarvon Canyon, a single-channel canyon covering the entire depth range of the marine park (DNP, 2018a).

The Carnarvon Canyon Marine Park is significant because it contains habitats, species and ecological communities associated with the Central Western Transition. This includes deep-water ecosystems associated with the Carnarvon Canyon. The Marine Park lies within a transition zone between tropical and temperate species and is an area of high biotic productivity (DNP, 2018a).

Ecosystems of the marine park are influenced by tropical and temperate currents, deep-water environments and proximity to the continental slope and shelf. The soft-bottom environment at the base of the Carnarvon Canyon is likely to support species that are typical of the deep seafloor (e.g. holothurians, polychaetes and sea-pens) (DNP, 2018a).

The marine park supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. However, there is limited information about species' use of this AMP (DNP, 2018a).

Commercial fishing is an important activity in the marine park (DNP, 2018a).

7.3 Cartier Island Marine Park

The Cartier Island Marine Park covers an area of 172 km² and water depths range between less than 15 m and 500 m. It is located approximately 45 km south-east of Ashmore Reef Marine Park and in Australia's External Territory of Ashmore and Cartier Islands. It is also located within an area subject to the Memorandum of Understanding (MoU) between Indonesia and Australia known as the MoU Box (DNP, 2018a).

The Cartier Island Marine Park is significant because it contains habitats, species and ecological communities associated with the Timor Province. It includes two KEFs:

- Ashmore Reef and Cartier Island and surrounding Commonwealth waters; and
- Continental slope demersal fish communities.

The marine park supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the marine park include breeding and foraging habitat for seabirds, internesting, nesting and foraging habitat for marine turtles and foraging habitat for whale sharks (DNP, 2018a).

Scientific research is an important activitiy in the marine park (DNP, 2018a).

7.4 Dampier Marine Park

The Dampier Marine Park covers an area of 1,252 km² and a water depth range between less than 15 m and 70 m. It is significant because it contains habitats, species and ecological communities associated with the Northwest Shelf Province. The marine park provides protection for offshore shelf habitats adjacent to the Dampier Archipelago, and the area between Dampier and Port Hedland, and is a hotspot for sponge biodiversity. The Dampier Marine Park includes several submerged coral reefs and shoals including Delambre Reef and Tessa Shoals (DNP, 2018a).

The marine park supports a range of species including those listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the marine park include breeding and foraging habitat for seabirds, internesting habitat for marine turtles and a migratory pathway for humpback whales (DNP, 2018a).

The Ngarluma, Yindjibarndi, Yaburara, and Mardudhunera indigenous people have responsibilities for sea country in the Dampier Marine Park (DNP, 2018a). Port activities, commercial fishing and recreation (including fishing), are important activities in this AMP (DNP, 2018a).

7.5 Eighty Mile Beach Marine Park

The Eighty Mile Beach Marine Park covers an area of 10,785 km² and water depths range between less than 15 m and 70 m. It is located approximately 74 km north-east of Port Hedland, adjacent to the WA Eighty Mile Beach Marine Park (DNP, 2018a).

The Eighty Mile Beach Marine Park is significant because it contains habitats, species and ecological communities associated with the Northwest Shelf Province and consists of shallow shelf habitats, including terrace, banks and shoals. The marine park is adjacent to the Eighty Mile Beach Ramsar site, recognised as one of the most important areas for migratory shorebirds in Australia; and the WA Eighty Mile Beach Marine Park, providing connectivity between offshore and inshore coastal waters of Eighty Mile Beach (DNP, 2018a).

The marine park supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the marine park include breeding, foraging and resting habitat for seabirds, internesting and nesting habitat for marine turtles, foraging, nursing and pupping habitat for sawfish and a migratory pathway for humpback whales (DNP, 2018a).

The sea country of the Nyangumarta, Karajarri and Ngarla indigenous people extends into Eighty Mile Beach Marine Park (DNP, 2018a). Tourism, commercial fishing, pearling and recreation are important activities in this AMP (DNP, 2018a).

7.6 Gascoyne Marine Park

The Gascoyne Marine Park covers an area of 81,766 km² and water depths between 15 m and 6,000 m. It is significant because it contains habitats, species and ecological communities associated with the Central Western Shelf Transition, Central Western Transition, and Northwest Province. It 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.

The Gascoyne Marine Park includes some of the most diverse continental slope habitats in Australia, in particular the continental slope area between North West Cape and the Montebello Trough. Canyons in the marine park link the Cuvier Abyssal Plain to the Cape Range Peninsula and are important for their role in sustaining the nutrient conditions that support the high diversity of Ningaloo Reef. Ecosystems represented in the marine park are influenced by the interaction of the Leeuwin Current, Leeuwin Undercurrent and the Ningaloo Current (DNP, 2018a).

The marine park supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the marine park include breeding habitat for seabirds, internesting habitat for marine turtles, a migratory pathway for humpback whales, and foraging habitat and migratory pathway for pygmy blue whales (DNP, 2018a).

The Gnulli indigenous people have responsibilities for sea country in the Gascoyne Marine Park (DNP, 2018a). Commercial fishing, mining and recreation are important activities in this AMP (DNP, 2018a).

7.7 Kimberley Marine Park

The Kimberley Marine Park covers an area of 74,469 km² and water depths from less than 15 m to 800 m. It provides connectivity between deeper offshore waters, and the inshore waters of the adjacent WA North Kimberley Marine Park and Lalang-garram/Camden Sound Marine Park (DNP, 2018a).

The Kimberley Marine Park is significant because it includes habitats, species and ecological communities associated with the Northwest Shelf Province, Northwest Shelf Transition and Timor Province. It includes two KEFs:

- The ancient coastline at the 125-m depth contour; and
- Continental slope demersal fish communities.

The marine park supports a range of species, including protected species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the marine park include breeding and foraging habitat for seabirds, internesting and nesting habitat for marine turtles, breeding, calving and foraging habitat for inshore dolphins, calving, migratory pathway and nursing habitat for humpback whales, migratory pathway for pygmy blue whales, foraging habitat for dugong and foraging habitat for whale sharks (DNP, 2018a).

The Wunambal Gaambera, Dambimangari, Mayala, Bardi Jawi and the Nyul Nyul indigenous people's sea country extends into the Kimberley Marine Park. The Wunambal Gaambera people's country includes deep waters, with about 3,400 km^2 of their sea country located in the marine park (DNP, 2018a). Tourism, commercial fishing, mining, recreation, including fishing, and traditional use are important activities in this AMP (DNP, 2018a).

7.8 Mermaid Reef Marine Park

The Mermaid Reef Marine Park covers an area of 540 km² and water depths from less than 15 m to 500 m. It is significant because it contains habitats, species and ecological communities associated with the Northwest Transition. It includes one KEF: the Mermaid Reef and Commonwealth waters surrounding Rowley Shoals, and is one of three reefs forming the Rowley Shoals. The other two are Clerke Reef and Imperieuse Reef, to the south-west of the marine park, which are included in the WA Rowley Shoals Marine Park (DNP, 2018a).

Ecosystems of the marine park are associated with emergent reef flat, deep reef flat, lagoon, and submerged sand habitats. The Mermaid Reef Marine Park supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the marine park include breeding habitat for seabirds and a migratory pathway for the pygmy blue whale (DNP, 2018a).

Marine tourism such as charter fishing, snorkelling, diving and wildlife watching are also important commercial activities that occur around Mermaid Reef (DNP, 2018a).

7.9 Montebello Marine Park

The Montebello Marine Park covers an area of 3,413 km² and water depths from less than 15 m to 150 m. It is significant because it contains habitats, species and ecological communities associated with the Northwest Shelf Province. It includes one KEF: the ancient coastline at the 125-m depth contour. When tides are low, two coral reefs called Tryal Rocks emerge above the water (DNP, 2018a)

The marine park supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the marine park include breeding habitat for seabirds, internesting, foraging, mating, and nesting habitat for four species of marine turtles, a migratory pathway for humpback whales and foraging habitat for whale sharks (DNP, 2018a).

Tourism, commercial fishing, mining and recreation are important activities in this AMP (DNP, 2018a).

7.10 Ningaloo Marine Park

The Ningaloo Marine Park covers an area of 2,435 km² and a water depth range of 30 m to more than 500 m. It stretches approximately 300 km along the west coast of the Cape Range Peninsula, and is adjacent to the WA Ningaloo Marine Park and Gascoyne AMP.

The marine park provides connectivity between deeper offshore waters of the shelf break and coastal waters of the adjacent WA Ningaloo Marine Park. It includes some of the most diverse continental slope habitats in Australia, in particular the continental slope area between North West Cape and the Montebello Trough. Canyons in the marine park are important for their role in sustaining the nutrient conditions that support the high diversity of Ningaloo Reef (DNP, 2018a).

The Ningaloo Marine Park is located in a transition zone between tropical and temperate waters and sustains tropical and temperate plants and animals, with many species at the limits of their distributions. Ecosystems represented in the marine park are influenced by interaction of the Leeuwin Current, Leeuwin Undercurrent and the Ningaloo Current.

The marine park supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the marine park include breeding and or foraging habitat for seabirds, internesting habitat for marine turtles, a migratory pathway for humpback whales, foraging habitat and migratory pathway for pygmy blue whales, breeding, calving, foraging and nursing habitat for dugong and foraging habitat for whale sharks (DNP, 2018a).

The Ningaloo Marine Park is within the Ningaloo Coast World Heritage Property, recognised for its outstanding universal heritage values. Tourism and recreation, including fishing, are important activities in this AMP (DNP, 2018a).

7.11 Shark Bay Marine Park

The Shark Bay Marine Park covers an area of 7,443 km², extending from the WA state water boundary, and a water depth range between 15 m and 220 m. It is adjacent to the Shark Bay world heritage property and national heritage place.

The Shark Bay Marine Park is significant because it contains habitats, species and ecological communities associated with the Central Western Shelf Province and Central Western Transition. The marine park provides connectivity between deeper Commonwealth waters and the inshore waters of the Shark Bay world heritage property (DNP, 2018a).

The Shark Bay Marine Park supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the marine park include breeding habitat for seabirds, internesting habitat for marine turtles, and a migratory pathway for humpback whales. The marine park and adjacent coastal areas are also important for shallow-water snapper. Ecosystems represented in the marine park are influenced by the Leeuwin, Ningaloo and Capes currents (DNP, 2018a).

The Gnulli and Malgana indigenous people have responsibilities for sea country in the marine park.Tourism, commercial fishing, mining and recreation (including fishing), are important activities in this AMP (DNP, 2018a).

7.12 Abrolhos Marine Park

The Abrolhos Marine Park covers an area of 88,060 km² and a water depth range between less than 15 m and 6,000 m. It is located adjacent to the WA Houtman Abrolhos Islands, and covers a large offshore area extending from the WA state water boundary to the edge of Australia's EEZ (DNP, 2018b).

The Abrolhos Marine Park is significant because it contains habitats, species and ecological communities associated with four bioregions: Central Western Province; Central Western Shelf Province; Central Western Transition; and Southwest Shelf Transition. It includes six KEFs:

- Commonwealth marine environment surrounding the Houtman Abrolhos Islands;
- Demersal slope and associated fish communities of the Central Western Province;
- 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.

The Abrolhos Marine Park supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the marine park include foraging and breeding habitat for seabirds, foraging habitat for Australian sea lions and white sharks, and a migratory pathway for humpback and pygmy blue whales. The marine park is adjacent to the northernmost Australian sea lion breeding colony in Australia on the Houtman Abrolhos Islands (DNP, 2018b).

The Abrolhos Marine Park does not overlap with any Commonwealth or National Heritage listings but is located adjacent to the Shark Bay World Heritage Property. It contains 11 known shipwrecks listed under the Underwater Cultural Heritage Act 2018 (DNP, 2018b).

The Nanda and Naaguja indigenous people have responsibilities for sea country in the Abrolhos Marine Park. Tourism, commercial fishing, mining, recreation including fishing, are important activities in this AMP (DNP, 2018b).

7.13 Jurien Marine Park

The Jurien Marine Park covers an area of 1,851 km² of continental shelf and a water depth range between less than 15 m and 220 m. It is located adjacent to the WA Jurien Bay Marine Park (DNP, 2018b).

The Jurien Marine Park is significant because it contains habitats, species and ecological communities associated with two bioregions: Southwest Shelf Transition and Central Western Province. It includes three KEFs (DNP, 2018b):

- Ancient coastline between 90 and 120 m depth;
- Demersal slope and associated fish communities of the Central Western Province; and
- Western rock lobster.

The marine park supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the marine park include foraging habitat for seabirds, Australian sea lions and white sharks, and a migratory pathway for humpback and pygmy blue whales (DNP, 2018b).

The marine park does not overlap with any known international, Commonwealth or national heritage listings. It contains two known shipwrecks listed under the Underwater Cultural Heritage Act 2018 (DNP, 2018b).

The Noongar indigenous people have responsibilities for sea country in the Jurien Marine Park. Tourism, commercial fishing, mining and recreation (including fishing), are important activities in this AMP (DNP, 2018b).

7.14 Perth Canyon Marine Park

The Perth Canyon Marine Park covers an area of 7,409 km² and water depth range between 120 m and 5,000 m (DNP, 2018b). It is significant because it contains habitats, species and ecological communities associated with four bioregions: Central Western Province, South-west Shelf Province, Southwest Transition and Southwest Shelf Transition. It includes three KEFs (DNP, 2018b):

- Perth Canyon and adjacent shelf break, and other west-coast canyons;
- Demersal slope and associated fish communities of the Central Western Province; and
- Western rock lobster.

The marine park includes the majority of the Perth Canyon, which is Australia's largest submarine canyon and home to the largest feeding aggregations of blue whales in Australia (DNP, 2018b).

The marine park supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the marine park include foraging habitat for seabirds, Antarctic blue, pygmy blue and sperm whales, a migratory pathway for humpback, Antarctic blue and pygmy blue whales, and calving buffer area for southern right whales (DNP, 2018b).

The marine park does not overlap with any known international, Commonwealth or national heritage listings (DNP, 2018b).

The Swan River traditional owners have responsibilities for sea country in the Perth Canyon marine park. Tourism, commercial shipping, commercial fishing, recreation (including fishing) and defence training are important activities in this AMP (DNP, 2018b).

7.15 South-west Corner Marine Park

The South-west Corner Marine Park covers an area of 271,833 km² and a water depth range between less than 15 m and 6,400 m. It is located adjacent to the WA Ngari Capes Marine Park and covers a large offshore area extending from the WA state water boundary to the edge of Australia's EEZ (DNP, 2018b).

The South-west Corner Marine Park is significant because it contains habitats, species and ecological communities associated with three bioregions: Southern Province, Southwest Transition and Southwest Shelf Province. It includes six KEFs (DNP, 2018b):

- Albany Canyon group and adjacent shelf break;
- Cape Mentelle upwelling;
- Diamantina Fracture Zone;
- Naturaliste Plateau;
- Western rock lobster; and
- Ancient coastline between 90 and 120 m depth.

The marine park supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the marine park include foraging habitat for seabirds, Australian sea lions, white sharks, and sperm whales, a migratory pathway for Antarctic blue, and pygmy blue and humpback whales, and a calving buffer area for southern right whales (DNP, 2018b).

The marine park does not overlap with any known international, Commonwealth or national heritage listings. It contains ten known shipwrecks listed under the Underwater Cultural Heritage Act 2018 (DNP, 2018b).

The Nyungar/ Noongar indigenous people have responsibilities for sea country in the South-west Corner Marine Park. Tourism, commercial shipping, commercial fishing and recreation (including fishing) are important activities in this AMP (DNP, 2018b).

7.16 Two Rocks Marine Park

The Two Rocks Marine Park covers an area of 882 km², extending from the WA state water boundary, and a water depth range from 15 m to 120 m (DNP, 2018b). The Two Rocks Marine Park is significant because it contains habitats, species and ecological communities associated with the Southwest Shelf Transition. It includes three KEFs (DNP, 2018b):

- The Commonwealth marine environment within and adjacent to the west-coast inshore lagoons;
- Western rock lobster; and
- Ancient coastline between 90 and 120 m depth.

The marine park supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the marine park include foraging habitat for seabirds and Australian sea lions, a migratory pathway for humpback and pygmy blue whales, and a calving buffer area for southern right whales (DNP, 2018b).

The marine park does not overlap with any known international, Commonwealth or national heritage listings (DNP, 2018b).

The Swan River traditional owners have responsibilities for sea country in the Two Rocks Marine Park. Tourism, commercial fishing, recreation (including fishing) and scientific research are important activities in this AMP (DNP, 2018b).

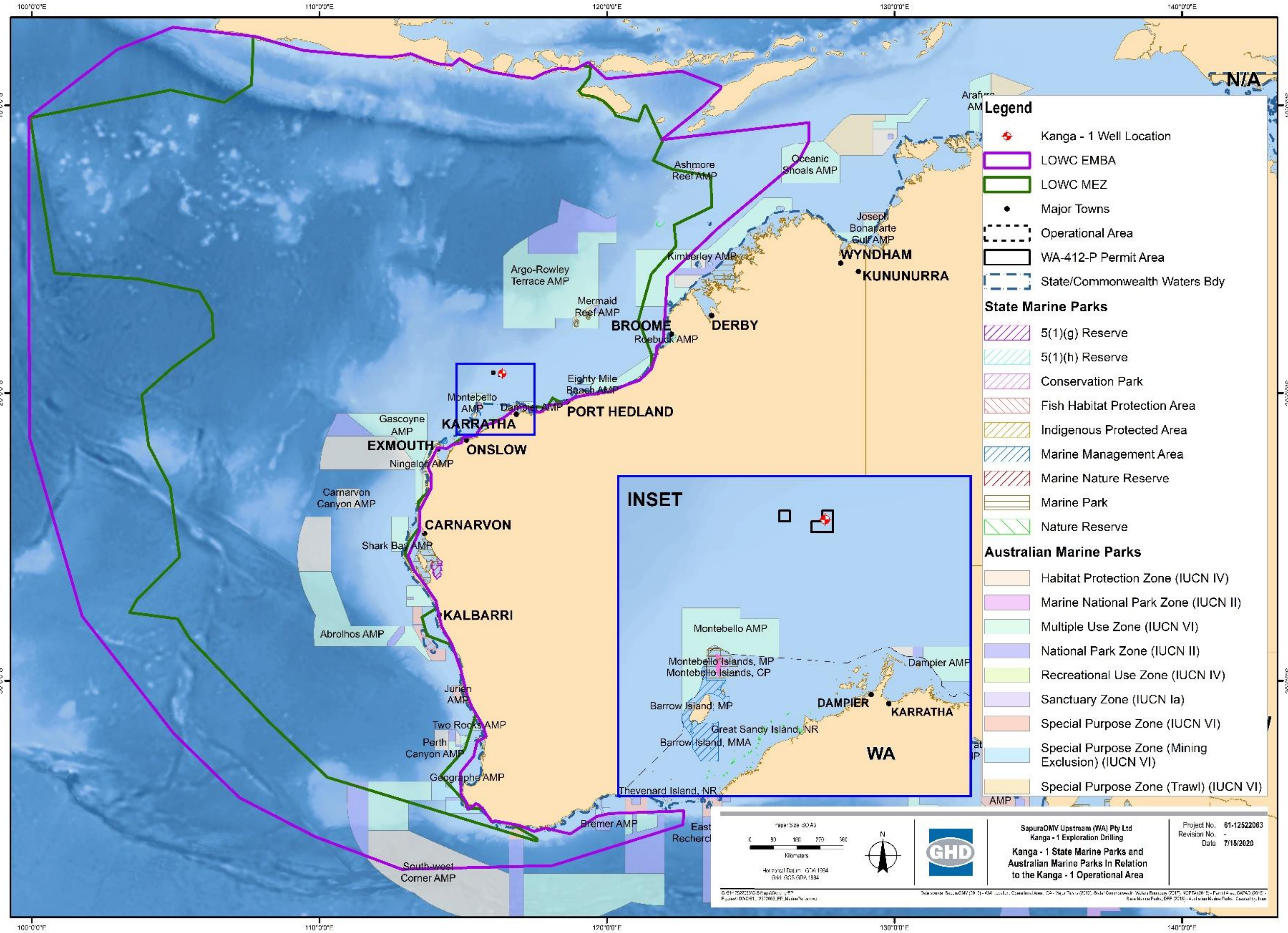


Figure 7-1 Australian and state marine parks, reserves and management areas in the vicinity of the MEZ and EMBA

8. State Marine Parks, Reserves and Management Areas

State marine parks and reserves have been progressively established in WA since 1987. Marine parks and reserves managed by the Department of Biodiversity, Conservation and Attractions (DBCA) help to conserve marine biodiversity and provide special places for people to enjoy and appreciate. Zoning and related rules for managing activities in marine parks ensure protection of marine habitats and species, while enabling use. Zones established for State marine parks are summarised in **Table 8-1**. Marine nature reserves are classified as marine park sanctuary zones, ‘look but don't take' areas where recreational and commercial fishing and collecting are not permitted.

Table 8-1 Summary of management zones in State marine parks

Management Zone	Objective
Sanctuary zone	The primary purpose of sanctuary zones is for the protection and conservation of marine biodiversity. Sanctuary zones are ‘look but don’t take’ areas managed solely for nature conservation and low-impact recreation and tourism. Recreational and commercial fishing and collecting are not permitted.
Recreation zone	Recreation zones have the primary purpose of providing opportunities for recreational activities, including fishing (subject to Department of Primary Industries and Regional Development regulations), for visitors and for commercial tourism operators, where these activities are compatible with the maintenance of the values of the zone. Commercial fishing, aquaculture and pearling are not permitted.
Special purpose zones	*Benthic protection zone*: This zone has the priority purpose of conservation of benthic habitat.
	Shore-based activities: Special purpose zones in marine parks are managed for a priority purpose or use, such as a seasonal event (e.g. wildlife breeding, whale watching) or a commercial activity (e.g. pearling).
General use zone	Conservation of natural values is still the priority of general use zones, but activities such as sustainable commercial and recreational fishing, aquaculture, pearling, and petroleum exploration and production may be permitted provided they do not compromise the ecological values of the marine park.

There are currently 31 WA state marine parks, reserves or management areas identified within the EMBA, of which 29 occur in the MEZ (see **Table 8-2** and **Figure 7-1**). The conservation values of those areas identified in the MEZ are described in **Sections 8.1** to **8.19**.

Table 8-2 State Marine Parks, Reserves and Management Areas overlapping the MEZ and EMBA

Name	Zone and IUCN Classification	Presence	
		MEZ	EMBA
Abrolhos Islands Fish Habitat Protection Area	Unassigned (IUCN IV)	✓	✓
Barrow Island Marine Park	Unassigned (IUCN IA)	✓	✓
Barrow Island Marine Management Area	Unassigned (IUCN VI)	✓	✓
Beagle Islands Nature Reserve	Unassigned (IUCN IA)	✓	✓
Buller, Whittell And Green Islands Nature Reserve	Unassigned (IUCN IA)	✓	✓
Cervantes Islands Nature Reserve	Unassigned (IUCN IA)	✓	✓
Eighty Mile Beach Marine Park	Unassigned (IUCN VI)	✓	✓
Essex Rocks Nature Reserve	Unassigned (IUCN IA)	✓	✓
Fisherman Islands Nature Reserve	Unassigned (IUCN IA)	✓	✓
Great Sandy Island Nature Reserve	Unassigned (IUCN IA)	✓	✓
Jurien Bay Marine Park	Special Purpose Zone (IUCN II and VI)	✓	✓
	Sancturay Zone (IUCN IA)	✓	✓
	Gerneral Use (IUCN II)	✓	✓
Kalbarri Blue Holes Fish Habitat Protection Area	Unassigned (IUCN IV)		✓
Lancelin Island Lagoon Fish Habitat Protection Area	Unassigned (IUCN IV)	✓	✓
Lipfert, Milligan, Etc Islands Nature Reserve	Unassigned (IUCN IA)	✓	✓
Marmion Marine Park	Sancturay Zone (IUCN IA)		✓
	Unassigned (IUCN IV)		✓
	General Use (IUCN II)		✓
	Recreation Zone (IUCN II)		✓
Montebello Islands Marine Park	Recreation Zone (IUCN II)	✓	✓
	Special Purpose Zone (IUCN VI)	✓	✓
	Sanctuary Zone (IUCN IA)	✓	✓
Montebello Islands Conservation Park	Unassigned (IUCN II)	✓	✓
Muiron Islands Marine Management Area	Conservation Area (IUCN IA)	✓	✓
	Unassigned (IUCN VI)	✓	✓
Ngari Capes Marine Park	Unassigned (IUCN VI)	✓	✓
Ningaloo Marine Park	Special Purpose Zone (IUCN II and IV)	✓	✓
	Recreation Area (IUCN II)	✓	✓
	Sanctuary Zone (IUCN IA)	✓	✓

Name	Zone and IUCN Classification	Presence	
		MEZ	EMBA
	Unassigned (IUCN II)	✓	✓
Nyangumarta Warrarn Indigenous Protected Area	Unassigned (IUCN VI)	✓	✓
Outer Rocks Nature Reserve	Unassigned (IUCN IA)	✓	✓
Point Quobba Fish Habitat Protection Area	Unassigned (IUCN IV)	✓	✓
Ronsard Rocks Nature Reserve	Unassigned (IUCN IA)	✓	✓
Rowley Shoals Marine Park	Recreation Zone (IUCN II)	✓	✓
	General Use (IUCN II)	✓	✓
	Sanctury Zone (IUCN IA)	✓	✓
	Unassigned (IUCN IV)	✓	✓
Sandland Islands Nature Reserve	Unassigned (IUCN IA)	✓	✓
Scott Reef Nature Reserve	Unassigned (IUCN IA)	✓	✓
Shark Bay Marine Park	General Use (IUCN II)	✓	✓
	Sanctury Zone (IUCN IA)	✓	✓
	Special Purpose Zone (IUCN IV)	✓	✓
Thevenard Island Nature Reserve	Unassigned (IUCN IA)	✓	✓
Unnamed WA48858 Nature Reserve	Unassigned (IUCN IA)	✓	✓
Walpole And Nornalup Inlets Marine Park	Unassigned (IUCN II)	✓	✓

8.1 Barrow Island Marine Park and Management Area

The Barrow Island Marine Park covers 4,169 hectares, all of which are zoned as sanctuary zone (the Western Barrow Island Sanctuary Zone). The Marine Park includes Biggada Reef, an ecologically significant fringing reef, and Turtle Bay, a significant breeding, nesting and aggregation site for turtles (DEC, 2007). The Marine Park protects a wide variety of habitats including subtidal coral reefs, macroalgal and seagrass communities, subtidal soft-bottom communities, rocky shores, intertidal reef platforms, mangrove communities. Passive recreational activities such as snorkelling, diving and boating are permitted, but fishing activities are prohibited.

The Barrow Island Marine Management Area is the largest reserve within the Montebello/Barrow Islands marine conservation reserves, covering 114,693 hectares (DEC, 2007). The Marine Management Area includes most of the waters around Barrow Island, the Lowendal Islands and the Barrow Island Marine Park, but excludes the port areas on Barrow and Varanus islands.

The management area is not zoned; however, the Bandicoot Bay Conservation Area, on the southern coast of Barrow Island was been created to protect benthic fauna and seabirds. It includes large intertidal sand/mudflats rich in invertebrate diversity and which are an important feeding area for migratory birds visiting the island (DEC, 2007).

Barrow Island itself has significant breeding and nesting areas for marine turtles including green, hawksbill and flatback turtles. Loggerhead turtles are also occasionally sighted. The surrounding waters support a diversity of marine fauna, important coral reefs and unique mangrove communities (DEC, 2007).

8.2 Montebello Islands Marine Park and Conservation Park

Montebello/Barrow/Lowendal Islands are part of a shallow submarine ridge, which extends north from the mainland near Onslow. The ridge contains extensive areas of intertidal and shallow subtidal limestone pavement surrounding the numerous, mostly small islands which are found in the region. The seabed is generally less than 5 m deep and consists of sand veneered limestone pavement with patches of fringing coral reef (DEC, 2007). The Montebello Islands comprise over 100 islands, the majority of which are rocky outcrops and rocky shore accounts for 81% of shoreline habitat (DEC, 2007).

The island chain lies entirely within WA State waters, with the State-Commonwealth boundary extending out to encompass the islands and waters 3 nm west of Barrow Island and north of the Montebello Islands. These islands are protected within as marine conservation reserves: Montebello Islands Marine Park (58,331 ha), Barrow Islands Marine Park and Barrow Island Marine Management Area.

The ecological and conservation values of the Montebello and Barrow Islands Marine Conservation Reserve (MCR) include important habitats including corals reefs and bommies, mangroves, seagrass and macroalgae meadows, rocky shorelines and hard substrate, intertidal sand and mudflat communities. These habitats provide protection, food and habitat for a large diversity of species, including dugongs, turtles, whales, other protected cetaceans and birds as well as sea snakes and fish. The area is considered to have a high biodiversity. The islands also provide feeding and resting areas for migrating shorebirds and seabird nesting areas.

Socio-economic values of the Montebello and Barrow Islands MCR include hydrocarbon exploration and production, pearling, nature-based tourism, commercial and recreational fishing, water sports, European history and maritime heritage and scientific research (DEC, 2007).

8.3 Great Sandy Island Nature Reserve

Great Sandy Island Nature Reserve protects more than 30 islands off the Pilbara coast within an area extending generally from about 15 km east of Cape Preston to the mouth of the Robe River, and ranging from approximately 10 to 35 km offshore. It does not, however, include the surrounding marine waters (Maunsell, 2005).

No formal management for the reserve has been prepared but the reserve provides valuable nesting sites for migratory birds which, because of their island location, are generally free from disturbance by introduced predators (Maunsell, 2005).

8.4 Muiron Islands Marine Management Area

Muiron Islands Marine Management Area (MMA) is located off the North West Cape of WA, and covers and area of approximately 28,616 ha, entirely within state waters. It was WA's first marine management 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 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. Eastern shores comprise sandy beaches backed by low dunes. They have gently sloping sand with patch reefs and coral bommies, eventually levelling out to muddy soft substrates (CALM, 2005a).

The marine fauna and flora of the Muiron Islands is in some cases similar to the Ningaloo Reef. However, the intertidal rock platforms on the western shores are of particular interest as this habitat type is a feature of a different biogeographic zone (west coast south of Cape Cuvier) which is uncommon in the tropics. The Muiron Islands MMA is important as it contains a very diverse marine environment, with coral reefs, filter-feeding communities and macroalgal beds. In addition, the Islands are important seabird and green turtle nesting areas (CALM, 2005a).

8.5 Ningaloo Marine Park

The Ningaloo Marine Park is located off the North West Cape of WA, and covers an area of approximately 263,343 ha. It straddles two bioregions, these being the Ningaloo Bioregion and the Pilbara Nearshore Bioregion. The Ningaloo Bioregion is characterised by interrupted fringing reefs in the south and continuous offshore reefs in the north. The Pilbara Nearshore Bioregion covers the nearshore area to 10 m depth, with habitats characterised by intertidal mudflat, sandflat and fringing coral reef environments. There is a progression in the gradient of representation of species with tropical species predominating in the north to increasing representation of temperate species in the south (CALM, 2005a).

Ningaloo Reef is the largest fringing coral reef in Australia. Temperate and tropical currents converge in the Ningaloo region resulting in highly diverse marine life including spectacular coral reefs, abundant fishes and species with special conservation significance such as turtles, whale sharks, dugongs, whales and dolphins. The region has diverse marine communities including mangroves, algae and filter-feeding communities and has high water quality (CALM, 2005a).

The Ningaloo area has very high social significance. As well as a wealth of Aboriginal history in the area associated with extended occupation, the area is very important for a variety of recreational pursuits and for nature-based tourism that centres on the reserve's natural attractions.

8.6 Thevenard Island Marine Reserve

Thevenard Island is classified as a class C nature reserve, and covers an area of approximately 550 ha (EPA, 2003). It is surrounded by limestone reefs and platforms, with diverse coral assemblages on the northern side. The benthic marine environment within the Thevenard Island area is broadly characterised by five intertidal and subtidal habitats (sandy beaches, intertidal limestone pavement, subtidal limestone pavement, coral communities, and subtidal sand).

Four species of marine turtle (green, loggerhead, hawksbill and flatback) have major nesting sites on Thevenard Island, and use the surrounding waters for foraging (DSEWPaC, 2012a).

8.7 Rowley Shoals Marine Park

Rowley Shoals Marine Park is at the edge of the continental shelf, approximately 260 km west northwest of Broome. The marine park protects two reefs (Clerke Reef and Imperieuse Reef) that make up a chain of three coral atolls at the edge of the continental shelf. The nearby Mermaid Reef lies within a Commonwealth marine reserve and is managed under Commonwealth legislation (DPIRD, 2020a). Each reef covers around 80 to 90 km^2 and rises with near-vertical sides from very deep water. At high tide, the reefs disappear beneath the sea, with only the sandy islands of Clerke and Imperieuse visible (DPaW, 2020a).

8.8 Abrolhos Islands Fish Habitat Protection Area

The Abrolhos Islands include 122 islands that lie 60 km west of Geraldton on WA's mid-west coast. The waters surrounding the islands have special status as a Fish Habitat Protection Area for the conservation of fish, fish breeding areas and associated aquatic ecosystem, and are popular for aquatic tourism and recreational activities (DoF, 2015).

The Abrolhos lie in the southward-flowing Leeuwin Current, which funnels warm, low-nutrient, tropical water along the edge of the continental shelf, from the north of WA down the coast. The current carries larvae, eggs and juveniles of many species of corals and other marine life far south of their usual range. Water temperatures in the current are maintained throughout the winter at around 20 to 22 ºC, enabling corals and tropical species of fish and invertebrates to thrive in latitudes where they normally would not survive (DoF, 2015).

8.9 Turquoise Coast Island Nature Reserves

This includes:

- Beagle Islands Nature Reserve;
- Buller, Whittell And Green Islands Nature Reserve;
- Cervantes Islands Nature Reserve;
- Ronsard Rocks Nature Reserve;
- Essex Rocks Nature Reserve;
- Fisherman Islands Nature Reserve;
- Lipfert, Milligan, etc Islands Nature Reserve;
- Outer Rocks Nature Reserve;
- Sandland Islands Nature Reserve; and
- Unnamed WA48858 Nature Reserve.

The Turquoise Coast island nature reserves are a chain of approximately 40 islands, islets and rocks lying between Lancelin and Dongara and extending from Lancelin Island and Edwards Island (~ 110 km north of Perth) to the Beagle Islands group (260 km north of Perth) in WA (CALM, 2004).

The islands range in size from less than 0.1 ha to approximately 31.5 ha and extend to low water mark, which includes the surrounding intertidal areas. The islands are grouped into 13 nature reserves, the majority of which were originally gazetted between 1958 and 1968, and are vested in the Conservation Commission of WA (Conservation Commission) and managed by the DBCA.

A key factor in the islands' conservation value is their location in the Central West Coast marine bioregion, a zone of overlap between temperate and tropical marine biogeographic areas. The islands are influenced by the Leeuwin Current, resulting in the presence of corals and many other tropical species around and on the islands. The geomorphology of the islands is diverse and includes significant intertidal reef platforms (CALM, 2004).

The islands provide educational, interpretive and recreational opportunities due to their diversity, conservation value and proximity to the coast. Commercial and recreational fishing occurs in the intertidal reef platforms surrounding the islands.

Key conservation values include (CALM, 2004):

- Rich and diverse terrestrial and marine communities and habitats, significant for the protection of priority and threatened fauna;
- Important examples of fauna and flora speciation on islands;
- Significant breeding and resting habitat for Australian sea-lions;
- Substantial habitat and breeding grounds for numerous seabird species;
- Diverse assemblages of native vegetation and flora;
- Sites of relatively undisturbed native vegetation and geomorphology; and
- Varied natural landscapes, seascapes and associated aesthetic values.

8.10 Eighty Mile Beach Marine Park

The Eighty Mile Beach Marine Park, located between Port Hedland and Broome, was gazetted on 29 January 2013. It covers an area of approximately 200,000 ha stretching for some 220 km from Cape Missiessy to Cape Keraudren, and includes sanctuary, recreation, general use and special purpose zones. The park is managed under the Eighty Mile Beach Marine Park Management Plan 2014-2024 (DPaW, 2014).

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

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

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

In addition to these natural values, the marine park contains land and sea important to traditional Indigenous owners through identity and place, family networks, spiritual practice and resource gathering. The marine park also has a history of European activity including exploration, pastoralism and commercial fishing (e.g. the pearl oyster fishery).

The park contains a historical WWII plane wreck (Dornier Do-24 X-36) and shipwrecks (two pearl luggers). The marine park provides tourism opportunity and recreational value through its remoteness, diversity and abundance of habitats and marine fauna and the pristine nature of the marine and coastal environment.

8.11 Jurien Bay Marine Park

The Jurien Bay Marine Park is a Class A marine park located on the central west coast of WA about 200 km north of Perth and covers an area of 82,375 ha (CALM, 2005b). Its western boundary is the seaward limit of WA coastal waters. Its northern boundary is the northern point of Dynamite Bay at Green Head (30° 4' 7.9" South), and its southern boundary is located just south of Wedge (30° 50' 20" South) and is contiguous with the southern boundary of the Wanagarren Nature Reserve.

Jurien Bay Marine Park is considered to be broadly representative of the Central West Coast limestone reef system, which is a major marine ecosystem within this bioregion. The marine biota of the area consists of an unusual mix of tropical and temperate species as well as many endemic species (Larkum and Hartog, 1989). The marine park is dominated by five major marine habitat types: seagrass meadows; bare or sparsely vegetated mobile sand; shoreline and offshore intertidal reef platforms; subtidal limestone reefs; and reef pavement (CALM, 2005b).

Marine wildlife includes 14 species of cetaceans, a variety of sea and shorebirds which nest on the islands and the Australian sea lion (North Fisherman Island to the north of Jurien Bay is one of the main breeding sites for sea lions in the Central West Coast region and it is believed this breeding population is genetically distinct from the southern coast population – Gales et al. 1992).

Commercial fishing for western rock lobster as well commercial wetlining, abalone, shark netting, beach seining for mullet and collecting of specimen shells and aquarium fish are carried out within the marine park.

8.12 Kalbarri Blue Holes Fish Habitat Protection Area

The Kalbarri Blue Holes Fish Habitat Protection Area (FHPA) is located immediately to the west of the town of Kalbarri and includes part of a near-shore limestone reef system, which stretches intermittently from Red Bluff in the South to the Murchison River Mouth in the North (DoF, 2004a).

The reef is accessible to the general public, and intensively used by locals and visitors to the Kalbarri area. The reef system is a popular recreational fishing site, particularly during summer months. Western Rock Lobster (Panuluris Cygnus) and Roe's Abalone (Haliotis roei) are also removed in season in the vicinity by both recreational and commercial fishing licence holders. Other marine organisms, such as oysters are also opportunistically harvested (DoF, 2004a).

8.13 Lancelin Island Lagoon Fish Habitat Protection Area

Lancelin Island is an emergent limestone feature of the coastal marine environment of the mid-west coast of WA. The island is located at 31°00' 30" S and 115°18' 55" E, approximately 110 km north of Perth and 800 m offshore from the Lancelin town site. It is linked by intertidal and sub-tidal reef platforms to Edward Island to its south (DoF, 2001).

The Lancelin Island Lagoon is a small area of reef habitat on the western side of Lancelin Island and a popular snorkelling and diving destination. Water depth ranges from less than 0.3 m on the intertidal reefs to less than 3 m on the sand or seagrass-covered bottom. The area has a diverse array of benthic marine habitat (DoF, 2001). The Lancelin Island Lagoon FHPA encompasses the waters of the Indian Ocean to the west of the northern and southernmost points of Lancelin Island and extending to the seaward edge of the intertidal/sub-tidal reef platforms.

During a marine survey of the area, over 200 flora and fauna species were positively identified, with many more remaining unidentified due to the diversity of species supported in this marine environment.

The purposes of the Lancelin Island Lagoon FHPA are:

- The conservation and protection of fish, fish breeding areas, fish fossils or the aquatic ecosystem; and
- The management of fish and activities relating to the appreciation or observation of fish.

8.14 Ngari Capes Marine Park

The Ngari Capes Marine Park is gazetted as a Class A Marine Park. The park is located off the southwest coast of WA, approximately 250 km south of Perth, covering approximately 123,790 ha. The seaward boundary of the marine park is congruent with the seaward limit of WA waters (3 nm from the territorial baseline).

The marine park consists of four areas that are representative of the Leeuwin–Naturaliste marine bioregion: Geographe Bay; Cape Naturaliste to Cape Mentelle coast; the Cape Mentelle to Cape Leeuwin coast; and Flinders Bay. These areas show distinct differences in geomorphology, oceanography, habitats and flora and fauna.

The Ngari Capes Marine Park was identified as one of the most diverse temperate marine environments in Australia. Warm, tropical waters of the Leeuwin Current mix with the cool waters of the Capes Current, resulting in high finfish diversity, including tropical and temperate species and internationally significant seagrass diversity with seagrasses occurring at depths greater than 40 m.

The marine park also surrounds a number of islands that are important seabird nesting habitat and pinniped haul-outs, including Hamelin Island, Sugarloaf Rock and the Saint Alouarn Islands which include Flinders Island, Seal Island and Square Rock (DEC, 2013). The marine park is also adjacent to the Leeuwin Naturaliste National Park which extends to the high water mark (DEC, 2013).

The Ngari Capes Marine Park was also created for its high social values. The unique geographical location of this region exposes it to large, uninterrupted ocean swells and results in the South West capes area being recognised as one of the world's premier surfing regions. Many activities occurring in the region are marine based, including commercial and recreational fishing, swimming, surfing, diving, snorkelling, boating, and marine nature-based tourism.

8.15 Nyangumarta Warrarn Indigenous Protected Area

In 2015 a dedication ceremony was held to signifying the establishment of the Indigenous Protected Area (IPA) for the Nyangumarta People. The Nyangumarta IPA covers about 28,420 km² and is managed by the Nyangumarta Rangers according to IUCN standards. The IPA is situated in the southern part of the Canning Basin and encompasses a range of diverse habitats. It extends some 310 km inland to the east through the Great Sandy Desert from the coastline of the Indian Ocean at Eighty Mile Beach.

See Eighty Mile Beach Marine Park (**Section 8.10**) for further conservation values.

8.16 Point Quobba Fish Habitat Protection Area

The Point Quobba FHPA adjoins the well-known 'Blowholes' tourist attraction at Quobba Station, 75 kilometres north-west of Carnarvon WA, at the northernmost point of Shark Bay (DoF, 2004b). The marine habitat at Point Quobba is located in a transition zone between tropical and temperate climatic zones, and is therefore highly diverse. It contains a mix of endemic temperate south-west Australian species and tropical and temperate Indo-Pacific species.

The Point Quobba coral reef and lagoon provides a good example of a sheltered near-shore reef. It is considered to have a high conservation value by virtue of the protection of the reef platform area within the existing Section 43 fisheries closure proclaimed in 1987, which prohibits the taking of all fish and aquatic organisms except for oysters (by hand) (Dof, 2004b).

8.17 Scott Reef Nature Reserve

Scott Reef is a large, emergent shelf atoll located on the edge of the broad continental shelf, about 300 km from mainland north-western Australia. The listing comprises the areas of Scott Reef that are within Commonwealth waters to the 50 m bathymetric contour. This includes North Reef, an annular reef, 16.3 km long and 14.4 km wide; and parts of the lagoon of South Reef, a crescent shaped reef 17 km across (DSEWPaC, 2012a).

This place is regionally significant both because of its high representation of species not found in coastal waters off WA and for the unusual nature of its fauna which has affinities with the oceanic reef habitats of the Indo-west Pacific as well as the reefs of the Indonesian region (DSEWPaC, 2012a).

8.18 Shark Bay Marine Park

The Shark Bay Marine Park was gazetted on 30 November 1990 as A Class Marine Park Reserve No. 7 and vested in the National Park and Nature Conservation Authority (NPNCA) under the CALM Act. The marine park encompasses an area of 748,725 ha (CALM, 1996).

The Bay 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 species with 11% warm temperate and 6% cool temperate species. Similarly, of the 218 species of bivalves 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 features of Shark Bay Marine Park include (CALM, 1996; DSEWPaC, 2013e):

- 12 species of seagrass making it one of the most diverse seagrass assemblages in the world;
- Seagrass that covers over 4,000 km^2 of the bay. The 1,030 km2 Wooramel Seagrass Bank is the largest structure of its type in the world;
- An estimated population of about 11,000 dugongs, one of the largest populations in the world;
- Humpback and southern right whales use the bay as a migratory staging post;
- Bottlenose dolphins occur in the bay, and green turtle and loggerhead turtle nest on the beaches;
- Large numbers of sharks including whaler, tiger shark and hammerhead are present as well as an abundant population of rays, including the manta ray;
- 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; and
- Shark Bay Marine Park does not cover Bernier and Dorre Islands and only coastal waters inshore of Dirk Hartog Island (east of eastern shoreline).

Shark Bay was included on the World Heritage List in 1991 primarily on the basis of three natural features: vast seagrass beds; dugong population; and stromatolites (microbial colonies that form hard, dome-shaped deposits and are among the oldest forms of life on Earth) (DSEWPaC 2013e; see **Section 5.1.6**).

8.19 Walpole and Nornalup Inlets Marine Park

The Walpole and Nornalup Inlets Marine Park was gazetted on 8 May 2009 as a Class A reserve. The marine park is located approximately 450 km south of Perth on the south coast of Western Australia. It is a discrete estuarine system, comprising both the Walpole and Nornalup inlets and the tidal reaches of the Frankland, Deep and Walpole rivers, covering an area of approximately 1442 ha (DEC, 2009).

The waters of the marine park support seagrasses and algae, a diverse benthic fauna, at least 40 marine and estuarine fish species and a variety of waterbirds, seabirds and shorebirds. The marine park is geologically complex, forming an estuary consisting of two connected inlets that are permanently open to the sea (DEC, 2009).

Shorelines of the Walpole and Nornalup inlet system comprise rocky shores, sandy beaches and a variety of vegetation assemblages.

The inlet system is biologically diverse compared to most estuaries in south-west WA because it is permanently open to the ocean and maintains marine-like conditions for most of the year. The inlet basins, which are dominated by mud and sand flats with some rocky shallows support ephemeral seagrasses and numerous species of algae. Polychaetes, crustaceans and molluscs dominate the relatively rich benthic invertebrate fauna.

9. Socio-economic Environment

9.1 Commercial Fisheries

9.1.1 Commonwealth-Managed Fisheries

Commonwealth-managed fisheries are those within 200 nautical miles Australian Fishing Zone (AFZ), managed by the Australian Fisheries Management Authority (AFMA) and are, on the high seas, and, in some cases, agreement with the State and Territory to the low water mark. Information on Commonwealth-managed Fisheries have been derived from the Fishery Status Report 2019 (ABARES, 2019).

The management areas for eight Commonwealth-managed fisheries overlap the EMBA. Of these, seven also overlap the MEZ (see **Table 9-1 and Figure 9-1**).

Table 9-1 Commonwealth-managed fisheries that overlap with the MEZ and EMBA

Fishery	Description	Fishing Effort	
		MEZ	EMBA
Southern Bluefin Tuna Fishery	Most of the Australian fishing effort for southern bluefin tuna is by purse-seine vessels in the Great Australian Bight and waters off South Australia (SA). The number of vessels in the purse-seine fishery has been fairly stable, ranging from five to eight since the 1994–95 fishing season. Since 2011, most fishing has occurred in the east of the Bight, closer to Port Lincoln. The number of longline vessels fishing for southern bluefin tuna off the east coast of Australia has been more variable, ranging from 11 to 24 vessels during the past 10 years. Southern bluefin tuna have been documented to spawn on the NWS between September and March, and larvae are seasonally abundant in surface waters during these months. There is no current fishing effort on the NWS (Patterson et al. 2019). There has been no active fishing in WA in recent years as fishing efforts are concentrated off New South Wales and SA (Patterson et al. 2019).	No	No
Western Skipjack Tuna Fishery	The Western Skipjack Tuna Fishery targets skipjack tuna (*Katsuwonus pelamis*) and is licensed to fish throughout WA waters. The fishery employs the purse seine, pole and line, and longline methods as its techniques. Historically, effort in has been low, and fishing effort has been focussed on southeast Australia. Operating season is from November to June. There has been no effort in this fishery since the 2008-09 fishing season, and in that season activity was concentrated off SA (Patterson et al. 2019).	No	No
Western Tuna and Billfish Fishery	The Western Tuna and Billfish Fishery boundary extends westward from Cape York Peninsula in Queensland, around WA, to the border between Victoria and SA. The fishery is primarily a longline fishery targeting bigeye tuna (*Thunnus obesus*), yellowfin tuna (*Thunnus albacares*), striped marlin (*Kajikia audax*) and swordfish (*Xiphias gladius*). The main fishing gear is pelagic longline with low levels of minor-line fishing. Since 2005, fewer than five vessels have been active in the fishery each year, with only 3 active in 2018 (Patterson et al. 2019).	Yes	Yes
Northwest Slope Trawl Fishery	Extends from 114° E to approximately 125° E off the WA coast between the 200 m isobath and the outer limit of the AFZ. This has predominantly been a scampi fishery using demersal trawl gear. In the 2017-18 fishing season, there were six fishing permits, four active vessels and effort occurred over 219 days (Patterson et al. 2019).	Yes	Yes
Small Pelagic Fishery	Four active vessels (three purse seine, one mid-water trawl) in the 2018-2019 season. Effort included 208 search-hours (purse-seine) and 216 shots (mid-water trawl) (Patterson et al. 2019).	Yes	Yes
Southern and Eastern Scalefish	This fishery is is a multisector, multigear and multispecies fishery, targeting a variety of fish and shark stocks. The management area covers almost half the area of the AFZ. The sector that overlaps the MEZ is the Great Australian Bight Trawl Sector,	Yes	Yes

Fishery	Description	Fishing Effort	
		MEZ	EMBA
and Shark Fishery	which had four active trawl vessels and one active seine vessl in the 2018-19 season (Patterson et al. 2019). Effort included 12,421 trawl-hours and 451 shots (Patterson et al. 2019).		
Western Deepwater Trawl Fishery	Best defined as a mixed species fish trawl fishery due to the wide range of species taken at low volumes. Three vessels were active in the 2017-2018 season with ~1108 hrs trawl-hours (Patterson et al. 2019).	Yes	Yes
Northern Prawn Fishery	The Northern Prawn Fishery operates off Australia's northern coast from Cape York (Queensland) to Cape Londonderry (WA) (AFMA, 2018). The Northern Prawn Fishery is restricted to 52 vessels. The majority of fishing is conducted in coastal waters, and the main fishing area is the Gulf of Carpentaria, with low intensity within the Joseph Boneparte Gulf. Primary target species include Banana prawns, tiger prawns, endeavour prawns, others (squid, bugs and scampi). Operating season is 1 April to 15 June and 1 August to 1 December.	No	Yes

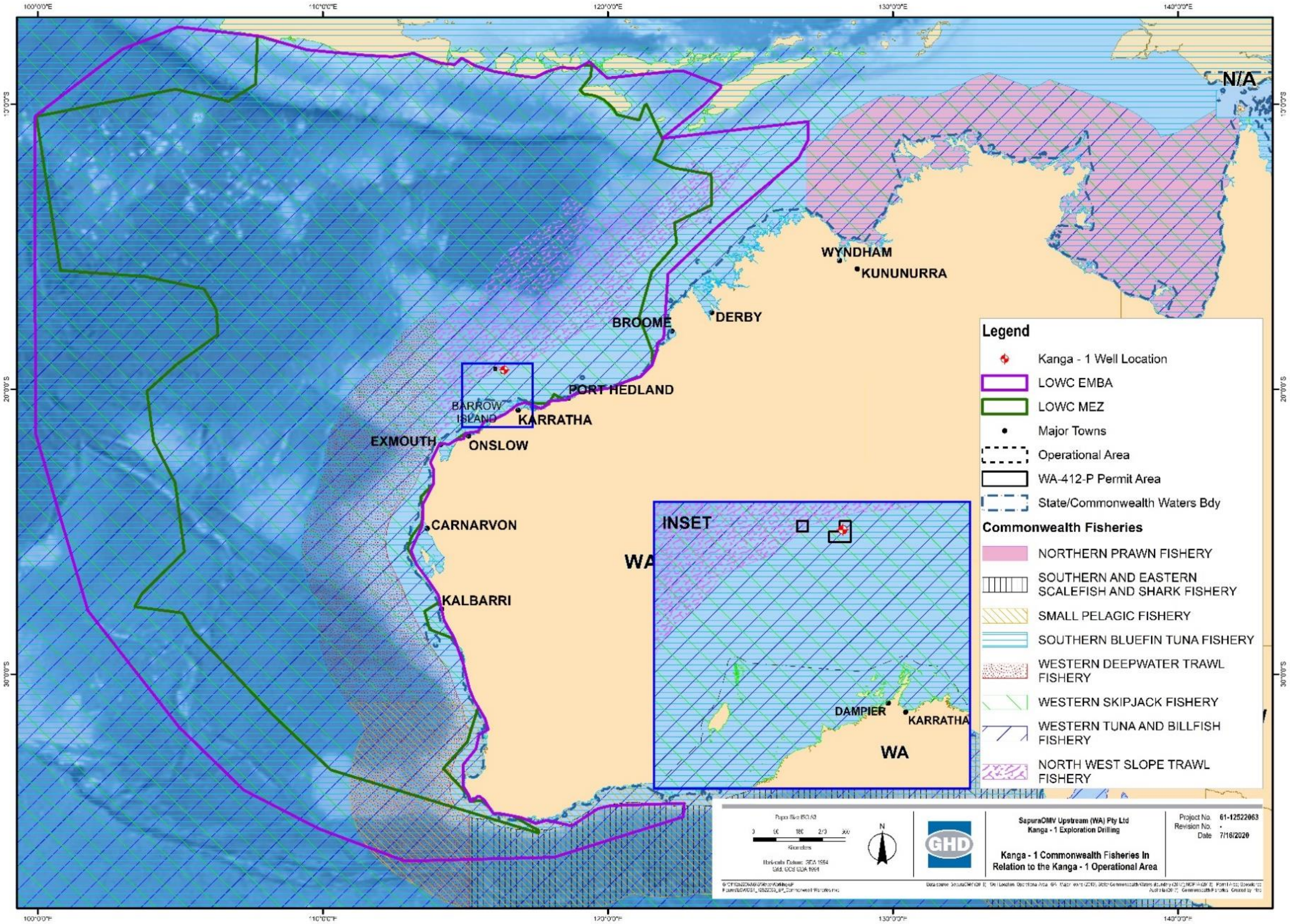


Figure 9-1 Commonwealth fisheries with management zones overlapping the MEZ and EMBA

9.1.2 Western Australian State Managed Fisheries

Western-Australia State-managed fisheries are managed by DPIRD with specific management plans, regulations a variety of subsidiary regulatory instruments under the *WA Fish Resources Management Act 1994*. The information on State managed fisheries has been derived from the 'Status Reports of the Fisheries and Aquatic Resources of Western Australia 2017/18: State of Fisheries' (Gaughan et al. 2019) unless otherwise specified in the table below.

The management areas for 37 WA State-managed fisheries overlap the EMBA. Of these, 36 also overlap the MEZ (see **Table 9-2** and **Figure 9-2**).

Table 9-2 WA State-managed fisheries that overlap with the MEZ and EMBA

Fishery	Description	Fishing Effort	
		MEZ	EMBA
Whole of State Fisheries			
Mackerel Managed Fishery	This fishery operates from Cape Leeuwin on the southwest coast to the WA-NT border, with most of the catch landed in the Kimberley and Pilbara regions. The fishery primarily targets Spanish mackerel (*Scomberomorus commerson*) by surface and mid-water trolling from vessels in coastal areas around reefs, shoals and headlands (WAFIC, 2020a). Jig fishing is also used to capture grey mackerel (*S. semifasciatus*).	Yes	Yes
Marine Aquarium Fish Managed Fishery	The fishery is licensed to operate on a state-wide basis throughout WA waters; however, licensees are not able to operate in any protected area. Operators are permited to take up to 950 species of marine aquarium fishes, coral, live rock, algae, seagrass and invertebrates. The fishery operates by collection of marine aquarium species by hand, by wading or diving (scuba or hookah). This is a limited entry managed fishery with 12 licences (11 active) currently permitted to operate in WA (Newman et al. 2019a).	Yes	Yes
Specimen Shell Managed Fishery	The fishery occurs throughout coastal waters of WA based on the collection of shells for display, collection, cataloguing, sale and classification. 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. ROVs are currently being trialled under exemption instruments; these are limited to one per licence (Hart et al. 2019a). The fishery encompasses the entire WA coastline, but fishing effort is generally concentrated in areas adjacent to populated centres such as Broome, Exmouth, Perth, Mandurah and Albany (Hart et al. 2019a). The 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. Of the 31 licences in the fishery, 23 fished in 2017, and 9 licences recorded consistent activity (Hart et al. 2019a).	Yes	Yes
North Coast Bioregion			
Broome Prawn Managed Fishery	Extremely low fishing effort occurred in 2017, with only one boat undertaking trial fishing to investigate whether catch rates were sufficient for commercial fishing. This resulted in negligible landings of western king prawns with no byproduct recorded (Kangas et al. 2019a).	Yes	Yes
Kimberley Crab Managed Fishery	This fishery includes all WA waters off the northern coast east of 120°00′ E longitude, and includes all waters seaward of the coastal waters of the State. The capacity of the Fishery is 600 crab traps. There were three commercial operators that fished for mud crab during 2017, with effort concentrated between May and September (Johnston et al. 2019a).	Yes	Yes
Kimberley Gillnet and Barramundi Managed Fishery	The Kimberley Gillnet and Barramundi Fishery operates in the nearshore and estuarine zones of the North Coast Bioregion and extends from the WA/Northen Territory (NT) border (129°E) to the top end of Eighty Mile Beach, south of Broome (19°S). It encompasses the taking of any fish by gillnet in inshore waters and the taking of barramundi (*Lates calcarifer*) by any means. Commercial fishing is now prohibited between the southern	Yes	Yes

Fishery	Description	Fishing Effort	
		MEZ	EMBA
	boundary of the fishery (19°00' S) to north of Willie Creek (17°44' S). Fishing is also restricted to within 3 nm of the high water mark for the remainder of the fishery (Newman et al. 2019b). During the 2017 season (February to November), four vessels fished, with at least 9 people directly employed (Newman et al. 2019b).		
Nickol Bay Prawn Managed Fishery	The boundaries of this fishery are all the waters of the Indian Ocean and Nickol Bay between 116°45' E longitude and 120° E longitude on the landward side of the 200 m isobath. Primarily targets banana prawns with otter trawl methods along the western part of the NWS in coastal shallow waters (Kangas et al. 2019a). Target species are usually found in shallow, nearshore waters.	Yes	Yes
North Coast Shark Fishery	This fishery includes all WA waters off the north coast east of 114° 06 E longitude. This fishery is currently closed to protect the breeding grounds of the resource that support the two southern shark fisheries. No fishing effort since 2008/09.	No	No
Northern Demersal Scalefish Managed Fishery	The permitted fishing methods in this fishery (Area 2 – offshore area) include handline, dropline and fish traps. The main species landed by this fishery in the Kimberley subregion are goldband snapper and red emperor (Newman et al. 2019c). Six vessels fished in the 2017 fishing season, and at least 20 people (3-4 crew per vessel) were directly employed (Newman et al. 2019c).	Yes	Yes
Onslow Prawn Managed Fishery	The Onslow Prawn Managed Fishery is one of four northern prawn managed fisheries (Kimberley, Broom, Nickol Bay and Onslow) that operate in the North Coast Bioregion. Low opening otter trawl systems target western king prawns (*Penaeus latisulcatus*), brown tiger prawns (*P. esculentus*), and endeavour prawns (*Metapenaeus endeavouri*). High opening, otter trawl systems are also used when targeting banana prawns (*P. merguiensis*). The total landings in 2017 were negligible. Only 5 days of fishing effort was undertaken (one boat) in 2017 (Kangas et al. 2019a).	Yes	Yes
Pearl Oyster Managed Fishery	The Pearl Oyster Fishery licence area extends from 114° 10' E near Exmouth to the WA/NT border, and out to the edge of the Australian Fishing Zone (200 nm). The licence area is subdivided into four zones. Zone 1 extends from 114° 10' E to 119° 30' E. The principal fishing grounds, holding sites and pearl farms are in waters off Eighty Mile Beach and Broome. A single approved pearl farm lease is located near North Turtle Island and pearl diving activities have previously occurred in coastal waters near Port Hedland and the De Grey river mouth (Hart et al. 2019). Pearl oyster shell fishing has not been reported in Zone 1 since 2008 (Fletcher and Santoro, 2014).	Yes	Yes
Pilbara Crab Managed Fishery	The Pilbara Crab Managed Fishery targets blue swimmer crabs within inshore waters around Nickol Bay with hourglass traps. During 2017 five people were employed as skippers and crew on vessels fishing for blue swimmer crabs along the Pilbara coast (Johnston et al. 2019).	Yes	Yes
Pilbara Demersal Scalefish Fishery (trap, line and trawl)	This fishery collectively use a combination of vessels, effort allocations (time), gear limits, plus spatial zones (including extensive trawl closures) as management measures. The main species landed in the Pilbara subregion are bluespotted emperor, red emperor and rankin cod (Newman et al. 2019c). It is estimated that ~10 fishers on 2 vessels were directly employed during 2017 in the trawl sector, and 8 fishers on 3 vessels in the trap sector, and at least ~15 fishers on 5 vessels in the line sector. Overall, at least ~33 people (e.g. 3-4 crew per vessel) were directly employed in this fishery. There has been no fish trawl effort allocation in Area 6 since 1998 (Newman et al., 2019b). Fishing vessels may occur around the operational area, but no fishing activity within the operational area has been recorded in recent years. The Pilbara Line Fishery fishing boat licensees are permitted to operate anywhere within "Pilbara waters", bounded by a line commencing at the	Yes	Yes

Fishery	Description	Fishing Effort	
		MEZ	EMBA
	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 AFZ and north to longitude 120° E. In the 2018 season there were nine individual licences in the Pilbara Line Fishery, held by seven operators (Newman et al. 2019c).		
Aquaculture	For the 2016/2017 season, species produced in WA aquaculture include barramundi, marron, mussels, yabbies, silver perch, goldfish and koi carp, ornamental invertebrates, ornamental fish, rainbow trout, algae and pearls. In total, there were 238 productive licences (Gaughan et al. 2019).	Yes	Yes
Kimberley Prawn Managed Fishery	The Kimberley Prawn Managed Fishery uses low opening, otter prawn trawl systems to target western king prawns, brown tiger prawns and endeaver prawns (Kangas et al. 2019a). There are two fishing periods for the complete season (April to mid-June, then from August to the end of November) with around 70% of the total landings taken in the first fishing period. Due to a change associated with the fleet structure and economics of fishing, there has been a marked reduction in the number of fishers since 2005 with fishing effort (boat-days) below historical levels. An effort cap of 1500 vessel days is set for the two parts of the season (Kangas et al. 2019a).	No	Yes
Gascoyne Coast Bioregion			
Abrolhos Islands and Mid West Trawl Managed Fishery	The Abrolhos Islands and Mid West Trawl Managed Fishery is the second largest scallop fishery and catches vary widely depending on the strength of recruitment. This fishery was re-opened in April 2017 for the first time in five years (Kangas et al. 2019c).	Yes	Yes
Exmouth Gulf Prawn Managed Fishery	The Exmouth Gulf Prawn Managed Fishery uses low opening, otter prawn trawl systems within the sheltered waters of Exmouth Gulf. In 2017 the total area trawled was ~392 square nm (34.4%) of trawlable grounds in Exmouth Gulf (Kangas et al. 2019d). The estimated employment in the fishery in 2017 was 18 people including skippers and other crew.	Yes	Yes
Gascoyne Demersal Scalefish Fishery	The Gascoyne Demersal Scalefish resource includes 60+ demersal species inhabiting marine waters deeper than 20 m in the Gascoyne Coast Bioregion. Commercial vessels in the Gascoyne Demersal Scalefish Managed Fishery use mechanised handlines and target pink snapper (*Chrysophrys auratus*) and goldband snapper (*Pristipomoides multidens*). In 2017 16 vessels fished at some point during the season, 10 of which fished for more than 10 days during the peak (pink snapper) season (Jackson et al. 2019a).	Yes	Yes
Shark Bay Beach Seine and Mesh Net Fishery	Beach seine netting targets four species/groups: whiting (*Sillago schomburgkii* and *S. analis*), sea mullet (*Mugil cephalus*), tailor (*Pomatomus saltatrix*) and western yellowfin bream (*Acanthopagrus morrisoni*). In 2017, six vessels operated, employing around 12 fishers (Jackson et al. 2019b).	Yes	Yes
Shark Bay Crab Managed Fishery	The Shark Bay Crab Managed Fishery commercially harvests the blue swimmer crab, and employs ~12 people as skippers and crew on vessels (Chandrapavan et al. 2019).	Yes	Yes
Shark Bay Prawn Managed Fishery	The Shark Bay Prawn Managed Fishery uses low opening, otter prawn trawl systems within inner Shark Bay. Management is based on input controls such as limited entry, gear controls, seasonal and spatial openings and closures designed to keep fishing effort at levels that will maintain a sufficient spawning biomass of prawns. During 2017 ~100 skippers and crew were employed in the fishery (Kangas et al. 2019b).	Yes	Yes
Shark Bay Scallop Managed Fishery	The Shark Bay Scallop Managed Fishery is s valuable WA scallop fishery with boats licensed to take only scallops, and boats that also fish for prawns. A catch limit of 1,650 tonnes (whole weight) was set for 2017 and 1,632 tonnes was achieved (Kangas et al. 2019c).	Yes	Yes

Fishery	Description	Fishing Effort	
		MEZ	EMBA
South West Trawl Managed Fishery	The South West Trawl Managed Fishery is a multi-species trawl fishery that primarily targets scallops. Management is generally based on limited entry, gear controls and seasonal closures. Only one boat fished in 2017 for a total of 41 boat days (Kangas et al. 2019c).	Yes	Yes
West Coast Deep Sea Crustacean Managed Fishery	The West Coast Deep Sea Crustacean resource consists primarily of Crystal (snow) (*Chaceon albus*), Champagne (spiny) (*Hypothalassia acerba*) and Giant (king) (*Pseudocarcinus gigas*) crabs. The fishery extends northward from Augusta throughout WA waters on the seaward side of the 150 m isobath out to the extent of the EEZ. It is a 'pot' fishery that uses baited pots in a long-line formation in the shelf edge waters (>150 m) of the West Coast and Gascoyne Bioregions (How and Orme, 2019a). In 2017, catches were dominated by crystal crabs. This fishery is considered to have low social amenity, and there is no recreational fishery. There were six vessels operating in 2017 (How and Orme, 2019a). Catch effort is concentrated in areas south of Exmouth.	Yes	Yes
South Coast Bioregion			
Abalone Managed Fishery	The Abalone Managed Fishery includes the West Coast Roe's Abalone resource and the South Coast Greenlip / Brownlip Abalone resource. The fishery operates state-wide between the NT border and SA border. Abalone is a dive fishery and operates in shallow coastal waters (<20 m) along southern and western coasts of WA (Hart et al. 2017).	Yes	Yes
South Coast Crustacean Managed Fishery	The South Coast Crustacean Managed Fishery is a multi-species, effort-controlled pot based fishery with catches of southern rock lobster (*Jasus edwardsii*) and western rock lobster (*Panulirus cygnus*) as well as deep-sea crab species namely, giant crab (*Pseudocarcinus gigas*), crystal crab (*Chaceon albus*) and champagne crab (*Hypothalassia acerba*). The fishery is based on mobile vessels that employ a skipper and two or three crew and is managed through limited entry, input controls (including limiting the number of pots that can be used), size limits and seasonal closures (How and Orme, 2019b).	Yes	Yes
South Coast Estuarine Fishery South Coast Salmon Managed Fishery	Nearshore and estuarine finfish are targeted by beach-based fishers and boat-based fishers operating in shallow water. The main commercial methods are gill net, haul net and beach seine. Thirteen estuaries in the South Coast Bioregion are open to commercial fishing (Smith at al. 2019). In 2017, there were approximately 36 commercial fishers employed in the South Coast Estuarine Fishery and 12 commercial fishers in the South Coast Salmon Managed Fishery (Smith at al. 2019).	Yes	Yes
South Coast Purse Seine Fishery	The five species comprising the south coast small pelagic scalefish resource are pilchards (*Sardinops sagax*), yellowtail scad (*Trachurus novaezelandiae*), Australian anchovy (*Engraulis australis*), scaly mackerel (*Sardinella lemuru*) and maray (*Etrumeus teres*). These fishers use purse seine gear in waters between Cape Leeuwin and the SA border (Norriss and Webster, 2019a). In the 2016/17 season there were 11 active vessels.	Yes	Yes
South-West Coast Salmon Fishery	Commercial fishers in WA traditionally target salmon during the annual autumn 'salmon run' in March/April when large schools form nearshore and move around the coast to their spawning area on the lower west coast. Salmon fishers use a beach seine net to catch fish, however they may also be caught by rod and line from the beach. Fishers typically 'spot' large salmon schools and then use small boats to deploy nets around the schools before pulling them ashore (DPIRD, 2020b). There are currently six licences. Licensees are not restricted to specific beaches, but in practice only a few beaches are fished (DEH, 2004). In 2018 there were three active vessels in this fishery (Stewart et al. 2018).	Yes	Yes
West Coast and Southern Demersal Gillnet and Demersal	The West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery operates between 26° and 33° S and the Southern Demersal Gillnet and Demersal Longline Managed Fishery operates from 33° S to the WA/SA border. Most fishers employ demersal gillnets to target mainly sharks with scalefish a byproduct. Demersal longline is also	Yes	Yes

Fishery	Description	Fishing Effort	
		MEZ	EMBA
Longline Managed Fisheries	permitted. but is not widely used. Between 18 and 21 skippers and crew were employed during 2016-17 (Braccini and Blay, 2019). The level of effort is such that the gear is deployed infrequently over approximately 40% of the fisheries' areas.		
West Coast Bioregion			
Octopus Interim Managed Fishery	This fishery in WA targets the octopus (*Octopus* aff. *tetricus*). The primary harvest method in the Octopus Interim Managed Fishery is a 'trigger trap'. In 2017, ~221 vessels caught octopus, although the vast majority of these landings were small (<100 kg) (Hart et al. 2019b).	Yes	Yes
West Coast Demersal Scalefish Interm Managed Fishery	The West Coast Demersal Scalefish Resource comprises over 100 species in inshore (20-250 m) and offshore (>250 m) demersal habitats of the West Coast Bioregion. Access to the fishery is restricted to 59 Interim Managed Fishery Permit holders. Each of the five management areas is allocated a maximum number of fishing hours that can be used on an annual basis. Units are allocated to permits and provide entitlement in 'hours' of fishing time (WAFIC, 2020b). Forty-one vessels operated in 2017 (Fairclough and Walters, 2019).	Yes	Yes
West Coast Estuarine Managed Fishery	Nearshore and estuarine finfish are targeted by beach-based fishers and boat-based fishers operating in shallow water. The main commercial methods are gill net, haul net and beach seine. Four estuaries in the West Coast Bioregion are open to commercial fishing (Smith and Grounds, 2019).	Yes	Yes
West Coast (Beach Bait Fish Net) Fishery			
West Coast Purse Seine Fishery	A total of six species can be taken by this fishery: the tropical sardine (scaly mackerel, *Sardinella lemuru*), pilchard (*Sardinops sagax*), Australian anchovy (*Engraulis australis*), yellowtail scad (*Trachurus novaezelandiae*), maray (*Etrumeus teres*) and Perth herring (*Nematalosa vlaminghi*). A small proportion of the catch is sold for human consumption while the vast majority is sold for bait, aquaculture feed or pet food (Norriss and Webster, 2019). In 2017 there were seven active vessels.	Yes	Yes
West Coast Rock Lobster Managed Fishery	The West Coast Rock Lobster Managed Fishery targets the western rock lobster (*Panulirus cygnus*), on the west coast of WA between Shark Bay and Cape Leeuwin. Commercial and recreational catch rates have been maintained near their record-high levels.There were 234 commercial vessels operating in 2017 (de Lestang et al. 2019).	Yes	Yes

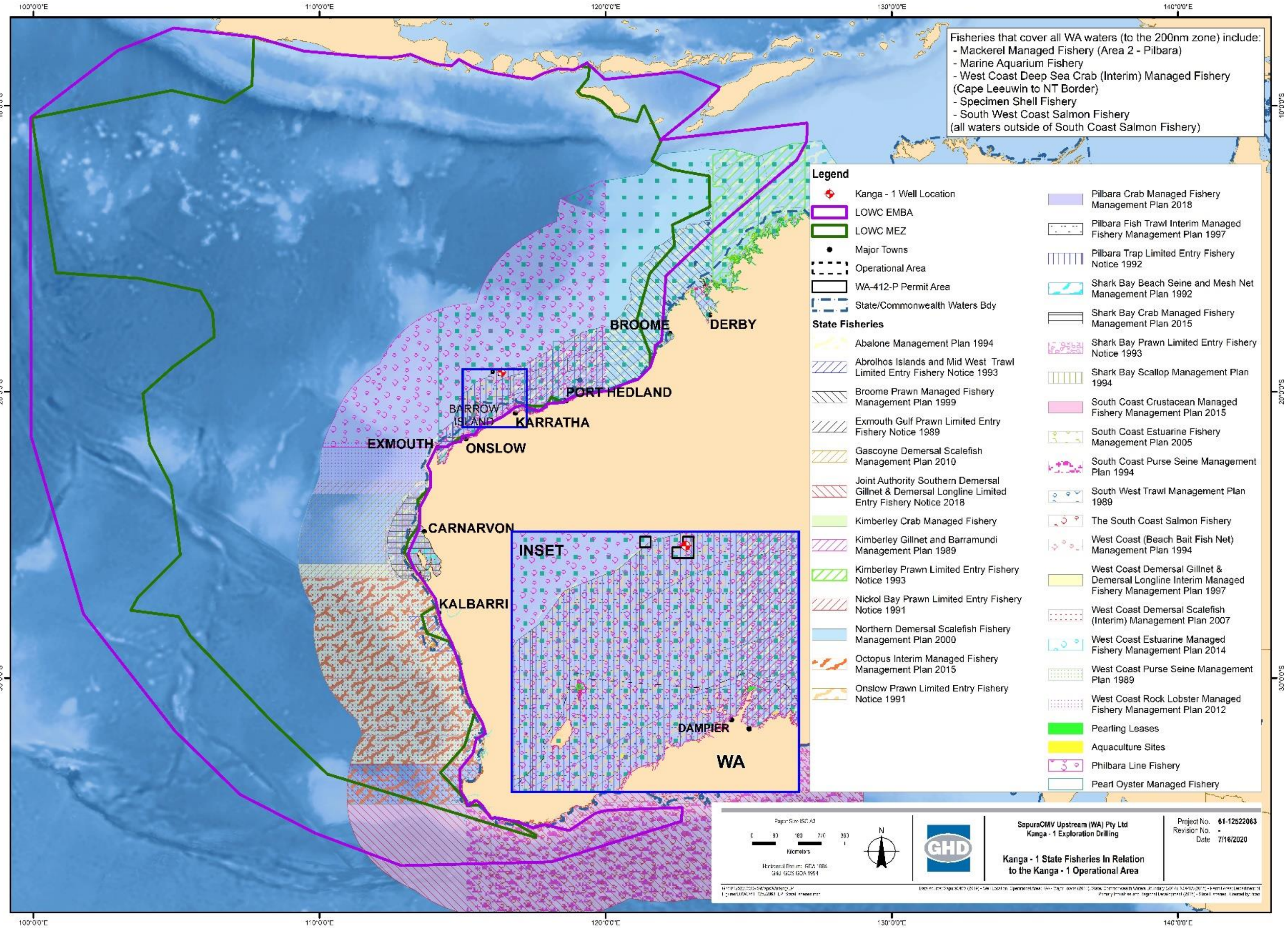


Figure 9-2 State fisheries with management zones overlapping the MEZ and EMBA

9.1.3 Indonesian Commercial and Subsistence Fishing

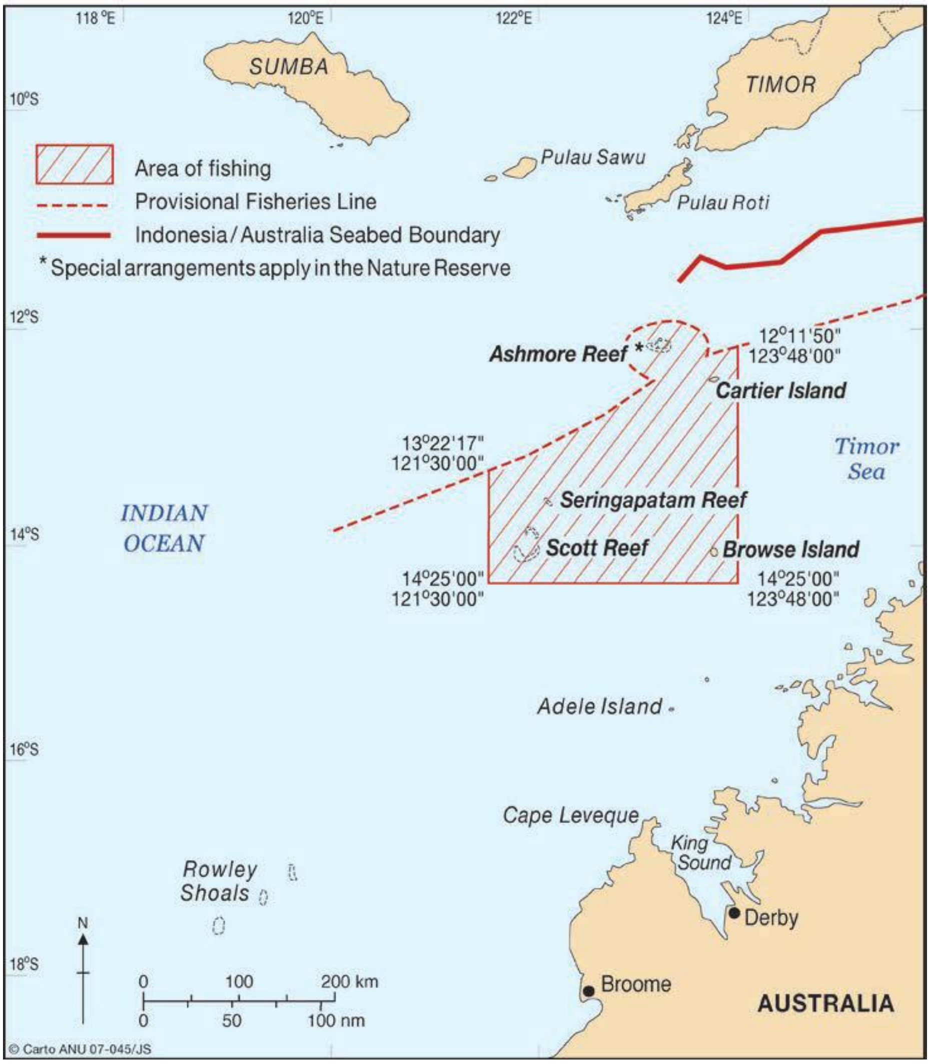
Within the northern and north-western extent of the MEZ/EMBA is a defined area where a Memorandum of Understanding (MoU) exists between the Australian and Indonesian Governments. The Agreement between the Government of Australia and the Government of the Republic of Indonesia Relating to Cooperation in Fisheries (1992 Fisheries Cooperation Agreement) provides the framework for fisheries and marine cooperation between Australia and Indonesia, and facilitates information exchange on research, management and technological developments, complementary management of shared stocks, training and technical exchanges, aquaculture development, trade promotion and cooperation to deter illegal fishing.

Cooperation under the Agreement today takes place under the auspices of the Working Group on Marine Affairs and Fisheries. Established in 2001, the Working Group on Marine Affairs and Fisheries is the primary bilateral forum to enhance collaboration across the spectrum of marine and fisheries issues relevant to the areas of the Arafura and Timor seas. The Working Group brings together the fisheries, environment and scientific research portfolios and agencies from both countries (DAWE, 2020h).

The MoU Box (shown on **Figure 9-3**) is an area of Australian water in the Timor Sea where Indonesian traditional fishers, using traditional fishing methods only, are permitted to operate. Officially it is known as the Australia-Indonesia Memorandum of Understanding regarding the Operations of Indonesian Traditional Fishermen in Areas of the Australian Fishing Zone and Continental Shelf – 1974 (DAWE, 2020h).

As part of negotiations to delineate seabed boundaries, Australia and Indonesia entered into the MoU which recognises the rights of access for traditional Indonesian fishers in shared waters to the north of Australia. This access was granted in recognition of the long history of traditional Indonesian fishing in the area. The MoU provides Australia with a tool to manage access to its waters while for Indonesia, it enables Indonesian traditional fishers to continue their customary practices and target species such as trepang, trochus, abalone and sponges. Guidelines under the MoU were agreed in 1989 in order to clarify access boundaries for traditional fishers and take into account the declaration of the 200 nautical mile fishing zones. Because of its approximate shape the MoU area became known as the MoU Box (DAWE, 2020h).

The fishers focus their activities in and around the shallow water lagoons of Scott Reef primarily targeting trepang; and opportunistically gather trochus shells. They also catch fish largely for subsistence purposes although the average fish catch per lete-lete (traditional Indonesian fishing vessel) in 2008 increased to commercial volumes. Although deeper waters are more plentiful in trepang, deep diving is generally not undertaken by the fishers due to the MoU stipulation on the exclusive use of traditional equipment only (Woodside, 2011).



Source: ResearchGate

Figure 9-3 Australia/Indonesia MoU Box

9.2 Tourism and Recreation

Marine tourism and recreational activities tend to be concentrated in the vicinity of population centres along the WA coastline, including Broome, Dampier, Exmouth, Coral Bay, Shark Bay, Perth, Bunbury, Geraldton, Margaret River, Jurien Bay, Augusta and Albany, all of which are in the vicinity of the MEZ/EMBA.

Tourism contributes to State and local economies in terms of both income and employment. Popular water-based activities include fishing, swimming, snorkelling/diving, surfing/windsurfing/kiting, wildlife watching and boating.

9.3 Cultural Heritage

9.3.1 Aboriginal Heritage Places

Aboriginal sites are of immense cultural, scientific, educational and historic interest and provides an important connection between Aboriginal people and their present and future culture (DPLH, 2020). There is a close relationship between Aboriginal people and the coastal and marine environments. Aboriginal people rely on the coastal and marine environments and resources for their cultural identity, health and wellbeing as well as domestic and commercial economies. Barrow Island, Montebello Isands, Exmouth, Ningaloo Reef, the Kimberley Coast, Eighty Mile Beach as well as the South West and the adjacent foreshores that are within the MEZ/EMBA, have a long history of occupancy by Indigenous communities. A search through the Aboriginal Heritage Inquiry System (AHIS) determined that the coastal areas of the MEZ/EMBA overlap with multiple registered Aboriginal Heritage Sites (DPLH, 2020). Aboriginal heritage sites in WA are protected under the *Aboriginal Heritage Act 1972*, whether or not they are registered with the Department of Planning, Lands and Heritage. While sea country is a recognised value, the registered site list contains only land-based sites. Areas that are covered by registered native title claims are likely to practice indigenous fishing techniques at various sections of the WA coastline.

Indigenous Protected Areas (IPA) are a component of the National Reserve System, which is the formally recognised parks, reserves and protected areas across Australia. IPAs are areas of land and sea country owned or managed by Indigenous groups, which are voluntarily managed as a protected area for biodiversity conservation through an agreement with the Australian Government. The following IPAs intersect the MEZ/EMBA:

- The Karajarri IPA covers nearly 25,000 km^2 of land in the southern Kimberley. The IPA lies south of Broome and comprises extensive coastlines, tidal creeks and wetlands as well as arid country that stretches into the Great Sandy Desert (NIAA, 2020).
- The Nyangumarta Warrarn IPA extends across four areas, totalling 28,675 km^2: Proposed Walyarta Conservation Reserve, Proposed Kujungurru Warrarn Conservation Reserve Area, the Great Sandy Desert and Eighty Mile Beach Marine Park (NIAA, 2020).

9.3.2 Underwater Cultural Heritage

The *Underwater Cultural Heritage Act 2018* protects Australia's underwater cultural heritage including shipwrecks, sunken aircraft and other types of underwater heritage. Under this Act, all shipwrecks older than 75 years are protected. Shipwrecks dating pre-1900 are protected under the Maritime Archaeology Act 1973. There are numerous (>1,500) known shipwreck and historic (>75 years old) shipwreck sites listed to occur within Commonwealth waters offshore WA, as listed in the Australasian National Shipwreck Database. Of these, 63 of the listed shipwrecks occur within the MEZ (DAWE, 2020c; **Table 9-3**; **Figure 5-1**). An additional 51 shipwrecks are listed as present in the EMBA.

Table 9-3 Shipwrecks within the MEZ

Name	Description	Location
Escort	Single screw steamer, wrecked 1903	Walpole, Nornalup Inlet
Mandalay	Sailing vessel, wrecked 1911	Mandalay Beach west of Nornalup Inlet near Walpole 9 miles from Brookes Inlet between Cliffy Head and Long Point
Pericles	Single screw steamer, wrecked 1910	Off Cape Leeuwin
Cumberland	Sailing vessel, wrecked 1830	Augusta Cape Hamelin Minnâ€™s Ledge
Toba	Sailing vessel, wrecked 1933	Peak Islet, Hamelin Bay
Chaudiere	Sailing vessel, wrecked 1883	At anchor, Hamelin Bay
Agincourt	Sailing vessel, wrecked 1882	Hamelin Bay
Katinka	Sailing vessel, wrecked 1900	Hamelin Bay 150 metres offshore in vicinity of the Hamelin Bay boat ramp
Hamelin Bay Unidentified 2	-	Hamelin Bay
Vergulde Draeck (Gilt Dragon)	Sailing vessel, wrecked 1656	Off Ledge Point

Name	Description	Location
Venus	Single screw steamer, wrecked 1923	50 miles north of Fremantle, Cape Leschenault
Key Biscayne	Wrecked 1983	19 km NW Ledge Point
J.P. Webb	Barge, wrecked 1951	Ledge Point
Grace Darling	Sailing vessel, wrecked 1914	Off Edward Island, Lancelin
Cervantes	Sailing vessel, wrecked 1844	Jurien Bay
Europa	Sailing vessel, wrecked 1897	12 miles south of Jurien Bay/Sand Reef
Lubra	Twin screw steamer, wrecked 1898	Jurien Bay
Cambewarra	Twin screw steamer, wrecked 1914	Near Fisherman's Island, 50 miles south of Dongara
Windsor	Twin screw steamer, wrecked 1908	Abrolhos, West of Pelsaert Island
Jon Jim	Trawler, wrecked 1961	Pelsaert Island, Wreck Pt
Ocean Queen	Sailing vessel, wrecked 1842	Abrolhos
Stanford	Wrecked 1983	African Reef south of Geraldton, 12 mile South of Moore Point
Ben Ledi	Sailing vessel, wrecked 1879	Abrolhos Islands, Pelsaert Islands
Marten	Sailing vessel, wrecked 1878	Pelsaert Island
Zeewijk	Sailing vessel, wrecked 1727	Houtman Abrolhos, Gun Island
Mayhill	Sailing vessel, wrecked 1895	Point Moore
Batavia	Sailing vessel, wrecked 1629	Morning reef, Houtman Abrolhos
Hadda	Sailing vessel, wrecked 1877	Off Beacon Island
Zuytdorp	Sailing vessel, wrecked 1712	North of Kalbarri
Sydney HMAS	Cruiser, wrecked 1941	113 n miles W of Steep Point
Kormoran HSK	Wrecked 1941	150 miles of Carvarvon
Santa Magdelenia	Wrecked 1992	Off Cape Inscription
Raconteur ex-Nanango	Wrecked 1976	Bernier Island
Korean Star	Wrecked 1988	Cape Cuvier
Emma	Sailing vessel, wrecked 1867	Coral Bay
Correio da Azia	Sailing vessel, wrecked 1816	Point Cloates
Point Cloates Unidentified/ Ningaloo Reef Unidentified	-	North of Correio da Azia site
Stefano	Sailing vessel, wrecked 1875	Point Cloates
Benan	Sailing vessel, wrecked 1888	Point Cloates
Rapid	Sailing vessel, wrecked 1811	Ningaloo Reef
Jane Bay Two Unidentified	-	Jane Bay, Point Cloates
Jane Bay One Unidentified	-	Jane Bay
Perth	Twin screw steamer, wrecked 1887	Point Cloates

Name	Description	Location
Fin	Single scrw steamer, wrecked 1923	Point Cloates, Fraser Island
Zvir	Twin screw steamer, wrecked 1902	Point Cloates
Norwegian Bay Whaling Station boat	Wrecked 1990	10 m N of whaling station jetty
Norwegian Bay Unidentified Barge	Barge	Off Norwegian Bay Whaling Station
Chofuku Maru	Twin screw steamer, wrecked 1931	Point Cloates
Fairy Queen	Sailing vessel, wrecked 1875	Exmouth N W Cape
Mildura	Twin screw steamer, wrecked 1907	North-West Cape
Bandicoot Bay UNID	-	Bandicoot Bay, Barrow Island
Parks Lugger	Sailing vessel	Hermite Island. Montebello Islands
Plym HMS	Frigate, wrecked 1952	Trimouille Island Island
Trial	Sailing vessel, wrecked 1622	Trial Rocks
McCormack	Wrecked 1989	N.E. tip of Eaglehawk Island West of Dampier, Dampier Archipelago
McDermott Derrick Barge No 20	Barge, wrecked 1989	N.E. tip of Eaglehawk Island, Dampier Archipelago
Edith	Barge, wrecked 1907	Condon
Pearl	Sailing vessel, wrecked 1920	Off North Turtle Island
Dornier Do-24 X-36 80 Mile Beach	-	80 mile Beach Anna Plains Station
19 mile unidentified	-	-
Lively	Sailing vessel, wrecked 1810	Mermaid Reef, Rowley Shoals
Yarra	Sailing vessel, wrecked 1884	Scott Reef
Ann Millicent	Sailing vessel, wrecked 1888	NT Waters Cartier Reef near Cartier Island

9.4 Marine and Coastal Industry

There are a number of minor marine/coastal industrial facilities within the MEZ/EMBA, but the most significant are associated with the petroleum industry. WA's petroleum industry was worth $38.4 billion per annum in 2018/2019. The petroleum sector accounted for 26% of the total value of WA's mineral and petroleum sales in 2018/19. Offshore oil and gas development in WA is focussed in the Carnarvon Basin, Browse Basin and on the NWS (DMP, 2014). There are also coastal domestic gas plants on Varanus Island in the NWS, Devil Creek Onshore Gas Plant and Macedon Gas Plant in the Pilbara region and an oil facility at Cliff Head near Dongara. The Carnarvon Basin itself supports >95% of WA's oil and gas production, and accounts for ~63% of Australia's total production of crude oil, condensate and natural gas (DEWHA, 2008d). Numerous oil and gas facilities occur within the MEZ and EMBA as do permits operated by other titleholders.

9.5 Shipping

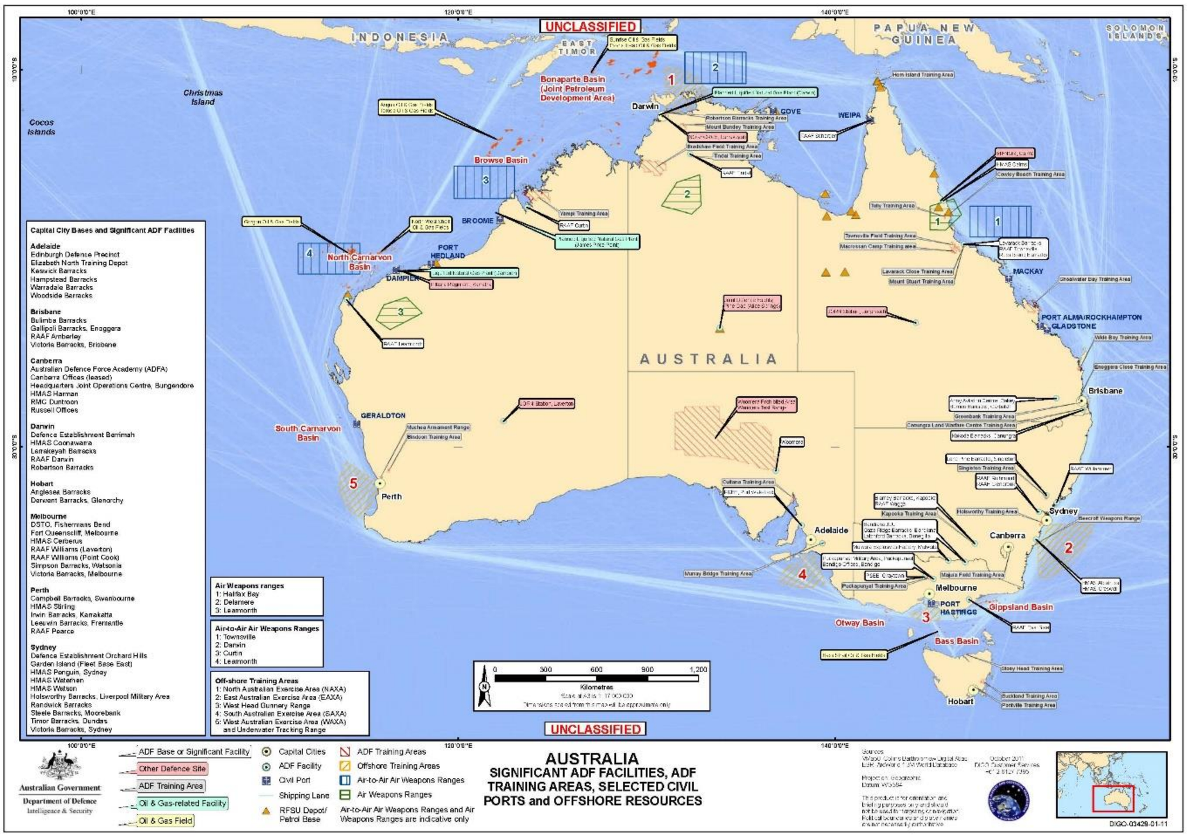
AMSA has established a network of shipping fairways off the northwest coast of Australia as a means of managing shipping traffic (AMSA, 2013). The aim of the shipping fairways are to keep shipping traffic away from offshore infrastructure and therefore reduce the risk of collision (AMSA, 2013). Vessels are strongly advised to use these shipping fairways although use is not mandatory.

Vessels do not have special right of way when using the shipping fairways (AMSA, 2012). The International Regulations for Preventing Collisions at Sea 1972 apply to all vessels navigating within or outside the shipping fairways.

The WA coastline supports twelve ports including the major ports of Fremantle, Dampier, Port Hedland and Broome which are operated by their respective port authorities. Large cargo vessels moving to and from Fremantle transit along the coastline. Commercial shipping also moves to and from marine terminals associated with the oil and gas industry. Other large ports in WA include Geraldton, Busselton, Albany and Esperance. Vessels that access these ports includes construction vessels/barges/dredges, domestic support vessels, and offshore survey vessels.

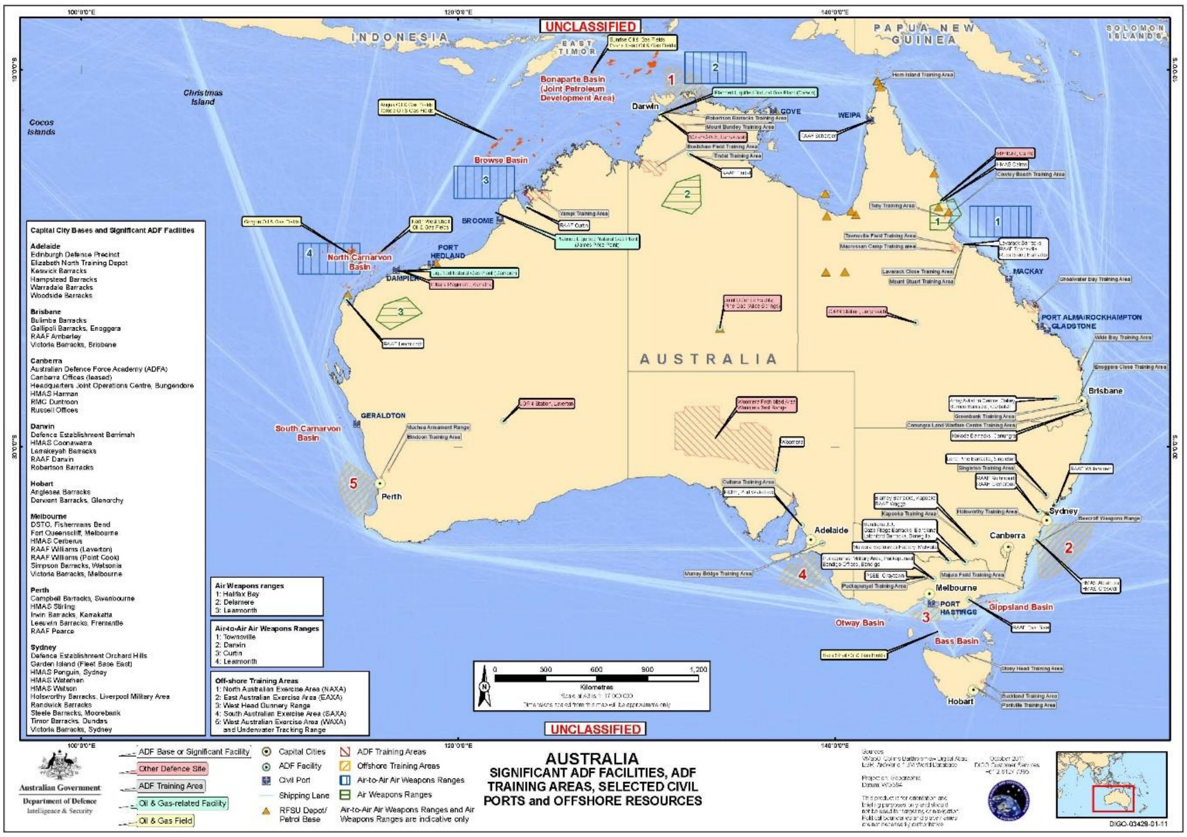
9.6 Defence

Key defence bases, facilities and training areas that occur in the MEZ/EMBA and that may be contacted in the unlikely event of an unplanned hydrocarbon release from a LOWC are illustrated in



Source: Department of Defence, 2020

Figure 9-4 **Figure 9-4**.



Source: Department of Defence, 2020

Figure 9-4 Defence activities relevant to the MEZ and EMBA

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Appendix E – Environment Plan Consultation

Introduction to SapuraOMV Upstream (Western Australia) Pty Ltd and Drilling of Kanga-1

SapuraOMV Australia Kanga <kanga.australia@sapura-omv.com>
Tue 28/01/2020 5:26 PM
To: SapuraOMV Australia Kanga <kanga.australia@sapura-omv.com>

1 attachments (1 MB)
SapuraOMV Intro Letter and Kanga-1 Project Fact Sheet - January 2020.pdf;

Dear Sir/ Madam,

SapuraOMV is planning to drill a single exploration well (Kanga-1) in the WA-412-P permit area, located in the Carnarvon Basin, off north-western Australia. You have been identified as one whose interest or activities may be affected by the drilling activity. Please see attached for a letter and fact sheet introducing SapuraOMV and describing the Kanga-1 Project.

We value your comments and feedback, and would welcome your input at your earliest opportunity and preferably prior to 28 February 2020 should you have any comments/ feedback on the proposed activity. Comments/ feedback can be made via email, letter or phone. Our contact details can be found in the attached letter and fact sheet.

Thank you.

Regards,

SapuraOMV Upstream (WA) Pty Ltd
Level 2, 251 St Georges Terrace,
Perth, Western Australia, 6000.
T: 1800 959 553
E: kanga.australia@sapura-omv.com
www.sapura-omv.com

Dear Sir/Madam

RE: Introduction to SapuraOMV Upstream (Western Australia) Pty Ltd and Drilling of Kanga-1

SapuraOMV Upstream (Western Australia) Pty Ltd (SapuraOMV), is a wholly owned subsidiary of SapuraOMV Upstream Sdn Bhd, which is a strategic partnership between Sapura Energy Berhad and OMV AG. SapuraOMV is a leading independent oil and gas company with operating assets in Malaysia and exploration interests in Australia, New Zealand and Mexico.

SapuraOMV recognises that the implementation of good Health, Safety and Environment (HSE) practices are not only essential but critical to the achievement of operational excellence. We are committed to implementing our HSE management system in accordance with international standards to minimise HSE risk to people, stakeholders and the environment.

SapuraOMV plans to drill a single exploration well (Kanga-1) in the WA-412-P permit area located in the Carnarvon Basin, off north-western Australia.

You have been identified as one whose interest or activities may be affected by the drilling activity. A Project Fact Sheet is attached, which provides background information on the proposed activity, including a summary of potential key risk and associated management measures.

Your feedback on the proposed activity and our response will be included in the Environment Plan for the activity, which will be submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for approval. Under the new public transparency arrangements by NOPSEMA, the Environment Plan will be published in full on the NOPSEMA website. Therefore, please advice SapuraOMV if you do not wish for any part of your feedback to be published. This will allow for us to utilise the information received in our assessment while maintaining confidentiality.

The SapuraOMV office is based in Perth, Western Australia. Our contact details can be found below. Enquiries related to the Kanga-1 Project must be addressed to the email kanga.australia@sapura-omv.com or by telephone on 1800 959 553. These contact details are included in the attached Kanga-1 Project Fact Sheet – January 2020.

Yours faithfully

Zamin Zawawi
Country Manager, Australia

Att: Kanga-1 Project Fact Sheet – January 2020

SapuraOMV Upstream (WA) Pty Ltd
(Formerly known as Sapura Exploration and Production (WA) Pty Ltd)
Level 2, 251 St Georges Terrace, Perth, 6000, Australia
T +618 6118 4990 | **Email** enquiries.australia@sapura-omv.com | **www.sapura-omv.com**

Kanga-1 Project Fact Sheet – January 2020

Background

SapuraOMV Upstream (Western Australia) Pty Ltd (SapuraOMV) proposes to drill the Kanga-1 exploration well within petroleum exploration permit area WA-412-P, in the Carnarvon Basin offshore north-western Australia. A pre-drilling seabed survey around the proposed well site will be undertaken prior to drilling activities.

As part of the development of the Environment Plan for the drilling campaign, we are assessing the environmental and socioeconomic values of the area of our proposed activities and how they may be affected by the proposed activities. Ongoing consultation with stakeholders is an important part of our management of impacts, and we welcome your input and feedback.

Activity Location

The proposed Kanga-1 well is located approximately 160 km north-northwest of Karratha (Figure 1; Table 1), in water depths of approximately 147 m.

The petroleum activities will be conducted in the Operational Area, measuring approximately 4 km by 4 km around the well location (Table 2). The Operational Area is not located within any Marine Protected Areas and is outside of established shipping fairways.

The Operational Area includes a 500 m exclusion zone around the Mobile Offshore Drilling Unit (MODU). This is will only be in place for the duration of the activity, while the MODU is in the Operational Area.

Table 1: Approximate Coordinates for Kanga-1 Well[1]

Latitude	Longitude
19° 19' 02.30" S	116° 21' 26.80" E

Table 2: Operational Area Approximate Coordinates

Latitude	Longitude
19° 20' 07.27" S	116° 20' 18.28" E
19° 17' 57.06" S	116° 20' 18.28" E
19° 17' 57.06" S	116° 22' 35.31" E
19° 20' 07.27" S	116° 22' 35.31" E

[1] The final well location is subject to site survey results and may move up to 1 km in the event of unforeseen drilling difficulties (i.e. respud)

Activity Duration

The drilling campaign (including seabed survey) is expected to take 40-50 days (excluding weather and operational delays), and is planned to begin between October 2020 and October 2021. Stakeholders will be notified of the commencement date, once confirmed.

The MODU and vessels will operate on a 24-hour basis, 7 days a week.

Pre-Drilling Survey

The proposed pre-drilling seabed survey will be undertaken in the Operational Area. The survey will use standard seabed survey techniques to identify any hazards that affect the location of the MODU. Data acquired will also inform planning for drilling the well.

Drilling Campaign

One exploration well will be drilled using a semi-submersible MODU. The MODU will be towed to location and anchored over the well site.

Once positioned, the MODU will be supported by support vessels and helicopters. Support vessels will be stationary or operating at slow speeds while working in the Operational Area. Helicopter frequency is expected to be several times per week. The supply base is expected to be in the Port of Dampier.

Environmental Considerations

In accordance with the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009*, the Environment Plan for the petroleum activity will include a comprehensive risk assessment of all potential environmental impacts and risks from the activity, including those associated with emergency conditions. The sensitivities considered in the EP will include (but not be limited to):

- Presence of listed threatened or migratory species or threatened ecological communities identified in EPBC Protected Matter searches.
- Presence of Biologically Important Areas (BIAs) and habitats critical to the survival of marine fauna.
- Presence of important fauna behaviours (e.g. foraging, roosting or breeding) by fauna, including those identified in EPBC Protected Matter searches.

- Habitat values to other receptors (e.g. nursery habitat, food source, commercial species).
- Importance to human activities (e.g. recreation and tourism, aesthetics, economy).

The Environment Plan will be available on NOPSEMA's website for public comment prior to NOPSEMA's assessment.

The proposed pre-drilling seabed survey and drilling activities are standard industry practices involving established techniques and managed according to recognised standards and guidelines.

A summary of the potential hazards and risks relevant to offshore drilling campaign and associated management measures for planned activities and unplanned events is provided in Table 3.

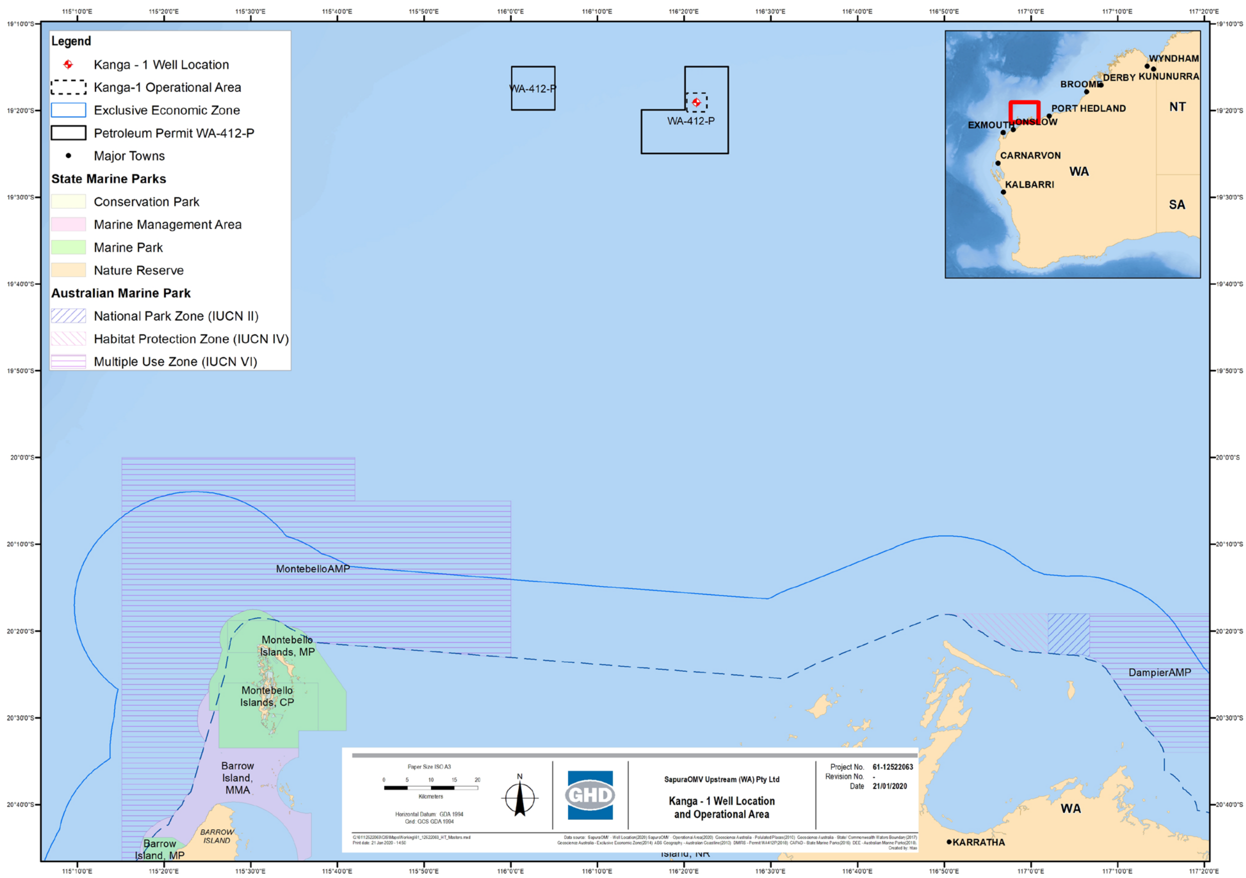

Figure 1: Location of Kanga-1 Well and Operational Area

Table 3: Summary of key risks/ hazards and standard management measures (assessed impacts/risks and associated management measures will be provided in Fact Sheet 2)

Potential Risks / Hazards	Standard Management and/or Mitigation Measures
Planned Events/ Hazards	
Physical presence: interaction with other marine users	• Relevant stakeholders will be notified prior to commencement of activities. • Notice to Mariners issued in advance of the pre-drilling survey and drilling program. • A 500 m radius exclusion zone will be in place around the MODU for the duration of the activity. • MODU and vessel bridge-watch will be maintained 24 hours/ day to assist with early detection of approaching vessels. • Recreational fishing by MODU/vessel crew will be prohibited during the activity.
Physical presence: seabed disturbance	• MODU positioning according to MODU move procedure and based on pre-drilling survey (to identify and address well-specific hazards). • Objects dropped overboard are recovered (where possible).
Emissions: noise	• Noise emitting equipment will be maintained in accordance with planned maintenance systems to reduce risk of excessive noise due to poor maintenance. • Compliance with EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with Cetaceans: ○ To minimise risks of interference from vessels and helicopters, unless an action is reasonably necessary to prevent a risk to human health or to deal with an emergency.
Emissions: light	• Lighting will be kept to minimum while still meeting navigation and workplace safety requirements.
Emissions: atmospheric emissions	• MODU/vessels marine diesel (fuel oil) sulphur content compliant with MARPOL/AMSA Marine Order.
Marine discharges: routine/ operational and domestic	• All routine marine discharges and waste treatment systems will be meet MARPOL requirements and are routinely managed. • Chemical use will be managed in accordance with SapuraOMV's Chemical Selection Procedure.
Marine discharges: drilling related	• Only water-based drill fluids will be used (i.e. no synthetic based drill fluids). • Drilling fluids program and drill cuttings management system will be in place.
Waste generation	• Wastes generated onboard the vessels and MODU will be managed in accordance with legislative requirements and a Waste Management Plan.
Unplanned Events/ Risks	
Introduction of invasive marine species (IMS)	• MODU and vessels will be assessed and managed as appropriate to prevent the introduction of IMS. • Compliance with Australian biosecurity requirements and guidance.
Marine fauna interactions	• Implementation of EPBC Regulations (Part 8) for interacting with cetaceans to minimise disturbance to marine fauna caused by vessels and helicopter operations. • Environmental awareness inductions will be provided to crew prior to the activities, including marine fauna interaction requirements and reporting arrangements.
Unplanned releases including hydrocarbons	• MODU and vessels have appropriate spill response plans; spill response equipment and materials will be maintained and available on-board. • Appropriate refuelling procedures and equipment will be used to prevent spills to the marine environment. • All personnel undertaking activities will undergo relevant inductions and training. • Procedures will be in place for equipment maintenance, inspections and bunding. • All offshore activities will be managed in accordance with lifting and transfer procedures. • The MODU will have an accepted Safety Case and Well Operations Management Plan (WOMP). • An accepted Environment Plan and Oil Pollution Emergency Plan (OPEP) will be in place and the OPEP will be implemented in the event of a loss of well control. • An assistance Memorandum of Understanding (MoU) will be in place with major operators via the Australian Marine Oil Spill Centre (AMOSC).

Contact Details and Further Information

We welcome your response to understand how SapuraOMV's proposed activities may impact on your interests, together with any feedback on potential risks and impacts associated with the proposed activities.

We appreciate your input and any comments you may have for our consideration in the development of the Environment Plan. Should you wish to provide us with comments, please do so at your earliest convenience. Alternatively, if you would like to opt out of future communications, please let us know.

Email: kanga.australia@sapura-omv.com

Phone: 1800 959 553

Mail: SapuraOMV Upstream (WA) Pty Ltd
PO Box 7990
Cloisters, Western Australia, 6000

Kanga-1 Pre-drilling Site Survey

SapuraOMV Australia Kanga <kanga.australia@sapura-omv.com>
Tue 21/04/2020 7:15 PM
To: SapuraOMV Australia Kanga <kanga.australia@sapura-omv.com>

1 attachments (427 KB)
SapuraOMV Kanga-1 Project Fact Sheet - April 2020.pdf;

Dear Sir/ Madam,

In January 2020, SapuraOMV advised of our proposal to drill the Kanga-1 exploration well and undertake an associated pre-drilling site survey in the WA-412-P permit area, located in the Carnarvon Basin, off north-western Australia. You were identified as one whose interest or activities may be affected by the Kanga-1 project. Please see attached for an updated fact sheet, with further details on the activities involved in the pre-drilling site survey.

We value your comments and feedback, and would welcome your input at your earliest opportunity should you have any comments/ feedback on the proposed activity. Comments/ feedback can be made via email, letter or phone. Our contact details can be found in the attached fact sheet.

Thank you.

Regards,

SapuraOMV Upstream (WA) Pty Ltd
Level 2, 251 St Georges Terrace,
Perth, Western Australia, 6000.
T: 1800 959 553
E: kanga.australia@sapura-omv.com
www.sapura-omv.com

Kanga-1 Project Fact Sheet – April 2020

Background

In January 2020, SapuraOMV Upstream (Western Australia) Pty Ltd (SapuraOMV) advised of its intent to drill the Kanga-1 exploration well and undertake an associated pre-drilling site survey in petroleum exploration permit area WA-412-P of the Carnarvon Basin of north-western Australia.

This Fact Sheet provides an update on the project, including further detail on the activities involved in the pre-drilling site survey, the potential impacts and risks that have been identified and the management that will be implemented to avoid or minimise those impacts/risks.

Details for the drilling of the Kanga-1 exploration well will be distributed in a separate Fact Sheet.

Ongoing consultation with stakeholders is an important part of our management of impacts, and we welcome your input and feedback.

Environmental Planning

As part of the preparatory work required to determine the optimal well location, a geophysical and geotechnical site survey is required to assess surface and shallow subsurface characteristics and potential geohazards in the area.

SapuraOMV is preparing separate Environment Plans (EPs) for the site survey and the exploration well to meet the requirements of the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009*. As part of the development of the EP for the site survey, a comprehensive risk assessment of all potential environmental impacts and risks from the activity, including those associated with emergency conditions, has been completed.

The EP will be published on NOPSEMA's website.

Activity Location

The proposed Kanga-1 site survey will be conducted in an area measuring approximately 4 km x 4 km centred around the proposed Kanga-1 well location (operational area) (Table 1). The operational area is not located within any Marine Protected Areas.

The operational area is located approximately 163 km north-northwest of Karratha (Figure 1), in water depths of approximately 147 m.

Table 1: Proposed Operational Area

Latitude	Longitude
19° 20' 07.27" S	116° 20' 18.28" E
19° 17' 57.06" S	116° 20' 18.28" E
19° 17' 57.06" S	116° 22' 35.31" E
19° 20' 07.27" S	116° 22' 35.31" E

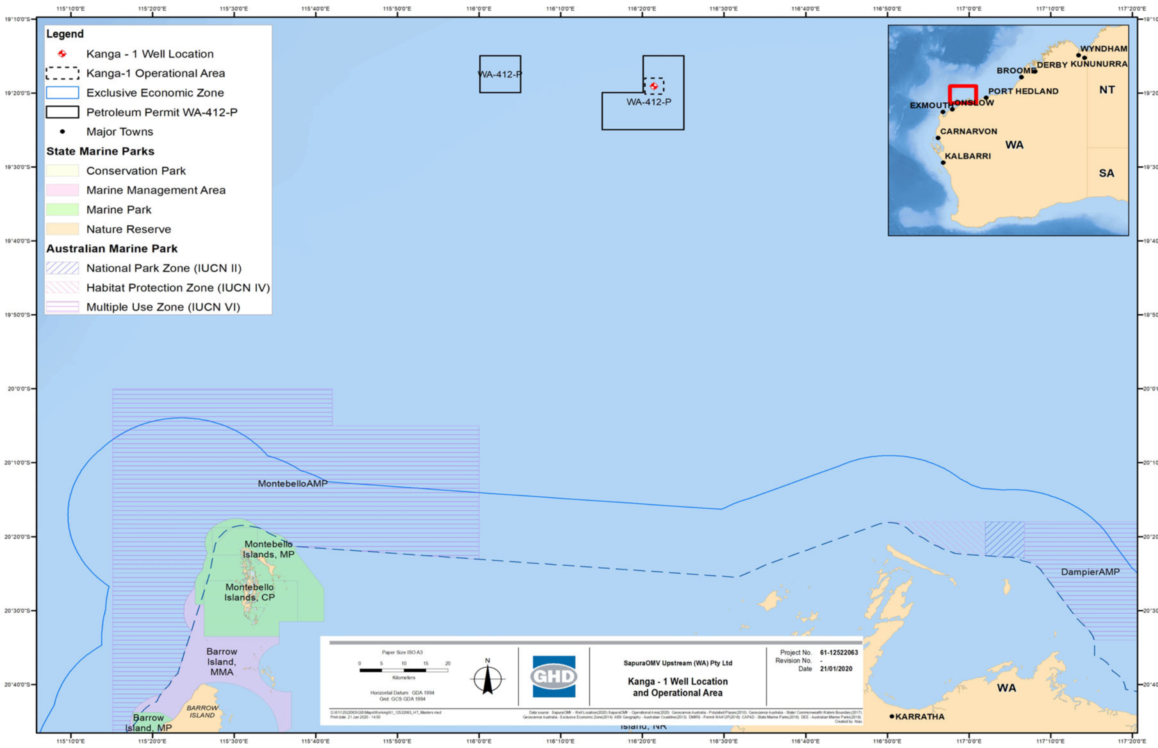

Figure 1: Location of Kanga-1 Site Survey Operational Area

SapuraOMV Upstream (WA) Pty Ltd

Level 2, 251 St Georges Terrace, Perth, 6000, Australia
T +618 6118 4990 | **Email** kanga.australia@sapura-omv.com | **www.sapura-omv.com**

Activity Duration

The site survey is expected to take up to 14 days (excluding weather and operational delays), and is planned to occur between October 2020 and November 2021.

Only one vessel is expected to be required onsite to complete the site survey studies, although a different vessel may undertake the different (e.g. geophysical vs geotechnical) activities. The vessel will operate on a 24-hour/day basis.

Survey Activity

Geophysical Study

The geophysical study will involve scanning the seabed to collect data (i.e. measurements of seabed characteristics, imaging and profiling) for assessment of water depths, seabed topography, seabed conditions and potential obstructions on the seabed. Proposed geophysical techniques include:

- Multi-beam echo sounder (MBES).
- Side scan sonar (SSS).
- Sub-bottom profiling (SBP).
- Magnetometer.

Geotechnical Study

The geotechnical study will collect seabed sediment samples and direct measurements of seabed conditions within the operational area. The purpose of the geotechnical survey is to assess seabed conditions within the operational area, including validating the geophysical survey measurements. Proposed techniques include:

- Piston or vibrocoring sampling.
- Cone Penetration Test (CPT).
- Box core sampling.

The site survey activities are standard industry practices involving established techniques and managed according to recognised standards and guidelines.

A summary of the potential impacts and risks identified for the site survey, and associated management measures for planned activities and unplanned events, are provided in Table 2.

Table 2: Summary of identified risks/ hazards and proposed management measures

Potential Risks / Hazards	Proposed Management and/or Mitigation Measures
Planned Events/ Hazards	
Physical presence: interaction with other marine users	• Relevant stakeholders will be notified prior to commencement of activities. • Maritime notices issued in advance of the site survey. • Vessel bridge-watch will be maintained 24 hours/ day to assist with early detection of approaching vessels.
Physical presence: seabed disturbance	• Deployment of submersible equipment will be carried out only under suitable weather/sea state conditions, as determined by the Vessel Master. • Recovery of anchors and equipment from the seabed upon completion of the activity. • Objects dropped overboard will be recovered (where possible).
Emissions: noise	• Noise emitting equipment will be maintained in accordance with Planned Maintenance System (PMS) to reduce risk of excessive noise due to poor maintenance. • Compliance with EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with Cetaceans • Adopt measures consistent with the DPaW Whale Shark Management Program (2013), to avoid approaching closer than 30 m of a whale shark and not exceeding 8 knots within 250 m. • Vessel bridge-watch will be maintained 24 hours/ day to assist with early detection of marine megafauna. • Selection of techniques with lowest intensity sources that meets survey objectives (no seismic).
Emissions: light	• Lighting will be kept to a minimum while still meeting navigation and workplace safety requirements. • External lighting will be directed onto deck/working areas.
Emissions: atmospheric emissions	• Use of 'low sulphur' marine diesel, compliant with MARPOL/AMSA Marine Order. • Vessels will be compliant with MARPOL and legislative requirements. • Vessel engines and machinery/ equipment on-board maintained according to PMS.
Marine discharges: routine/ operational and domestic	• All routine marine discharges and waste treatment systems will be routinely managed and meet MARPOL and legislative requirements. • Engines/ machinery/ equipment on-board are certified and maintained in accordance with PMS.
Waste generation	• Wastes generated on-board vessels will be managed in accordance with legislative requirements and a Waste Management Plan. • Crew inductions will include requirements for waste management.

Potential Risks / Hazards	Proposed Management and/or Mitigation Measures
Unplanned Events/ Risks	
Introduction of invasive marine species (IMS)	• Survey vessel will be assessed and managed as appropriate to prevent the introduction of IMS. • Compliance with Australian biosecurity requirements and guidance. • Compliance with Australian Ballast Water Management Requirements (if appropriate).
Marine fauna interactions	• Implementation of EPBC Regulations (Part 8) for interacting with cetaceans to minimise disturbance to marine fauna caused by vessels and helicopter operations. • Adopt measures consistent with the DPaW Whale Shark Management Program (2013), to avoid approaching closer than 30 m of a whale shark and not exceeding 8 knots within 250 m. • Environmental awareness inductions will be provided to crew prior to the activities, including marine fauna interaction requirements and reporting arrangements.
Unplanned releases including hydrocarbons	• Survey vessel will have an approved Ship Oil Pollution Emergency Plan (SOPEP); spill response equipment and materials will be maintained and available on-board. • All personnel undertaking activities will undergo relevant inductions and training. • Procedures will be in place for equipment maintenance, inspections and bunding. • Site survey activities will be managed in accordance with vessel lifting and transfer procedures. • Emergency response capability will be maintained in accordance with the EP, which includes an Oil Pollution Emergency Plan (OPEP) in the event of a spill from an unlikely vessel collision incident.

Contact Details and Further Information

We welcome your response to understand how SapuraOMV's proposed activities may impact on your interests, together with any feedback on potential risks and impacts associated with the proposed activities.

We appreciate your input and any comments you may have for our consideration in the development of the EP. Should you wish to provide us with comments, please do so at your earliest convenience. Alternatively, if you would like to opt out of future communications, please let us know.

Email: kanga.australia@sapura-omv.com

Phone: 1800 959 553

Mail: SapuraOMV Upstream (WA) Pty Ltd
PO Box 7990
Cloisters, Western Australia, 6000

Kanga-1 Exploration Drilling

SapuraOMV Australia Kanga <kanga.australia@sapura-omv.com>
Wed 3/06/2020 5:36 PM

To: SapuraOMV Australia Kanga <kanga.australia@sapura-omv.com>
Bcc: [redacted]

1 attachments (504 KB)
SapuraOMV Kanga-1 Project Fact Sheet - June 2020 Rev 0.pdf;

Dear Sir/ Madam,

In January 2020, SapuraOMV advised of its intent to drill the Kanga-1 exploration well and to undertake an associated pre-drilling site survey in petroleum exploration permit WA-412-P. The attached Kanga-1 Project Fact Sheet - June 2020 provides an up-date and additional details on the Kanga-1 exploration drilling activity.

Should you have any comments/ feedback on the proposed activity, please contact us at the earliest opportunity. Comments/ feedback can be made via email, letter or phone. Our contact details can be found in the attached fact sheet.

Regards,

SapuraOMV Upstream (WA) Pty Ltd
Level 2, 251 St Georges Terrace,
Perth, Western Australia, 6000.
T: 1800 959 553
E: kanga.australia@sapura-omv.com
www.sapura-omv.com

Kanga-1 Project Fact Sheet – June 2020

Background

In January 2020, SapuraOMV Upstream (Western Australia) Pty Ltd (SapuraOMV) advised of its intent to drill the Kanga-1 exploration well and undertake an associated pre-drilling site survey in petroleum exploration permit area WA-412-P of the Carnarvon Basin of north-western Australia.

This fact sheet provides further detail on the Kanga-1 exploration drilling activity (the Activity), including the potential impacts and risks that have been identified and the management measures that will be implemented to avoid or minimise those impacts/risks.

Ongoing consultation with stakeholders is an important part of our management of impacts, and we welcome your input and feedback.

Environmental Planning

To meet the requirements of the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* SapuraOMV is preparing an Environment Plan (EP) for the Activity. As part of the development of the EP, a comprehensive risk assessment of all potential environmental impacts and risks from the Activity, including those associated with emergency conditions, has been completed.

The EP will be available on NOPSEMA's website for public comment prior to NOPSEMA's assessment.

Activity Location

The Kanga-1 well is located approximately 163 km north-northwest of Karratha (Figure 1; Table 1), in water depths of approximately 147 m.

The Activity will be conducted in the Operational Area measuring 4 km x 4 km centred around the Kanga-1 well location (operational area) (Table2). The operational area is not located within any Marine Protected Areas and is outside of established shipping fairways.

Safety Zone and Precautionary Area

While the Mobile Offshore Drilling Unit (MODU) is on location, there will be a 500 m Petroleum Safety Zone (PSZ) and a 2.5 nm Cautionary Area centred around the MODU. Only authorised vessels will be permitted within the PSZ. Other marine users will be permitted within the Cautionary Area, but must approach and operate with caution. The PSZ and Cautionary Area are centred around the MODU and therefore may move within the Operational Area depending on the final well/MODU location (eg. requirement to respud).

Table 1: Proposed Kanga-1 Well[1]

Latitude	Longitude
19° 19' 02.30" S	116° 21' 26.80" E

Table 2: Proposed Operational Area

Latitude	Longitude
19° 20' 07.27" S	116° 20' 18.28" E
19° 17' 57.06" S	116° 20' 18.28" E
19° 17' 57.06" S	116° 22' 35.31" E
19° 20' 07.27" S	116° 22' 35.31" E

Activity Duration

The drilling activity is expected to take 40 days (excluding weather and operational delays), and will occur between Quarter 3 2021 and Quarter 2 2022. The MODU and support vessels will operate 24-hour/day, 7 days a week.

Exploration Drilling

One exploration well will be drilled using a semi-submersible MODU. The MODU will be towed to location and anchored over the well site. The well will be drilled using water-based muds to remove cuttings from the well, cool the drill bit, and maintain pressure control of the well. Downhole formation evaluation will be performed using vertical seismic profiling (VSP). The well will be plugged and abandoned at the end of the Activity and no equipment is planned to be left on the seabed upon completion of the Activity.

The MODU will be supported by support vessels and helicopters. Support vessels will be stationary or operating at slow speeds while working in the operational area, and depending on availability of vessels, likely to transit to shore between four to six times a week. Helicopter flight frequency may be several times per week. The supply base is expected to be in the Port of Dampier.

The exploration drilling activities are standard industry practices involving established techniques and managed according to recognised standards and guidelines.

A summary of the potential impacts and risks identified for the Activity, and associated management measures for planned activities and unplanned events, are provided in Table 3.

[1] The final well location is subject to site survey results and may move up to 1 km within the Operational Area in the event of unforeseen drilling difficulties (i.e. respud)

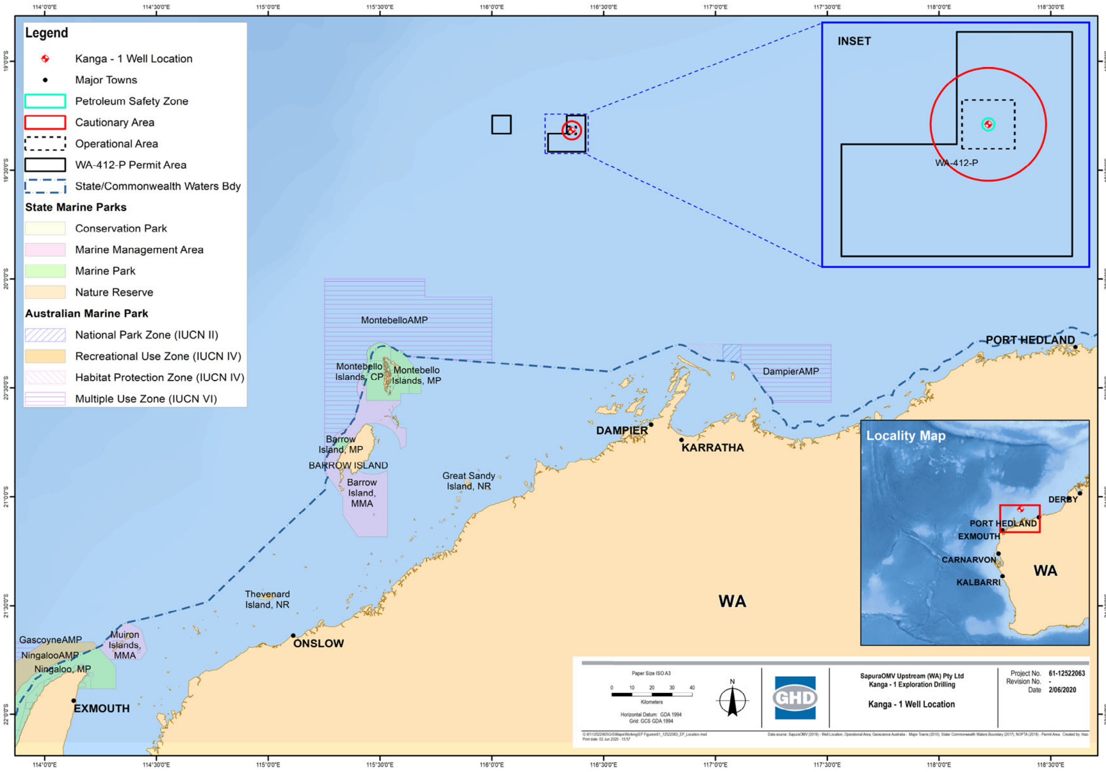

Figure 1: Location of Kanga-1 Exploration Drilling Operational Area, PSZ and Cautionary Area

Table 3: Summary of identified risks/ hazards and proposed management measures

Potential Risks / Hazards	Proposed Management and/or Mitigation Measures
Planned Events/ Hazards	
Physical presence: interaction with other marine users	• MODU and vessels will be fitted with lights, signals, AIS transponders and navigation and communications equipment, as required by the *Navigation Act 2012*. • Stakeholder consultation with relevant stakeholders. Ongoing consultation records maintained as required • The Australian Hydrographic Office (AHO) will be notified before the Activity for promulgation of 'Notice to Mariners'. • AMSA's JRCC will be notified prior to commencement of the Activity for promulgation of radio-navigation (AUSCOAST) warnings. • MODU and vessel bridge-watch will be maintained 24 hours/ day to assist with early detection of approaching vessels. • MODU will be attended by at least one support vessel, who will monitor the 500 m PSZ and the 2.5 nm radius Cautionary Area around the MODU and warn vessels approaching within the PSZ.
Physical presence: seabed disturbance	• Rig move and positioning plan, based on an approved mooring design. • Encounters with marine archaeological resources/wrecks will be recorded and reported in accordance with the *Underwater Cultural Heritage Act 2018*. • Recovery of all anchors and equipment from the seabed planned upon completion of the Activity.
Emissions: noise	• Noise emitting equipment will be maintained in accordance with Planned Maintenance System (PMS) to reduce risk of excessive noise due to poor maintenance. • Vessels and helicopters will operate in accordance with relevant Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Regulations to minimise risks to sensitive marine fauna. • Vessels to adopt measures consistent with the DPaW Whale Shark Management Program (2013), to avoid approaching closer than 30 m of a whale shark and not exceeding 8 knots within 250 m. • MODU and vessels bridge-watch will be maintained 24 hours/ day to assist with early detection of marine megafauna. • Vertical seismic profiling (VSP) will be undertaken with reference to the EPBC Act Policy Statement 2.1 - Interaction between offshore seismic exploration and whales. • Environmental awareness induction for MODU and vessel crew, including marine fauna interaction requirements.
Emissions: light	• Lighting will be kept to a minimum while still meeting navigation and workplace safety requirements.
Emissions: atmospheric emissions	• Use of 'low sulphur' marine diesel, compliant with MARPOL/AMSA Marine Order. • MODU and vessels will be compliant with MARPOL and legislative requirements. • MODU and vessel's engines and machinery/ equipment on-board maintained according to PMS.

Potential Risks / Hazards	Proposed Management and/or Mitigation Measures
	• Fuel consumption will be monitored and recorded.
Marine discharges: routine/ operational and domestic	• All routine marine discharges and wastewater treatment systems will be routinely managed and meet MARPOL and legislative requirements. • Engines/ machinery/ equipment on-board are certified and maintained in accordance with PMS. • Spill response bins/kits will be maintained and located near potential spill points.
Unplanned Events/ Risks	
Solid releases (loss overboard)	• MODU and vessels will be compliant with MARPOL requirements. • Wastes generated on-board vessels will be managed in accordance with legislative requirements and a Waste Management Plan. • Crew inductions will include requirements for waste management. • Lifting management procedures for MODU and support vessels. • Lifting equipment is regularly inspected and maintained according to PMS. • Equipment and materials dropped to the marine environment will be recovered where safe and practicable to do so.
Introduction of invasive marine species (IMS)	• MODU and vessels will be assessed and managed as appropriate to prevent the introduction of IMS. • Compliance with Australian biosecurity requirements and guidance. • Compliance with Australian Ballast Water Management Requirements (if appropriate).
Marine fauna collision/entanglement	• Implementation of EPBC Regulations (Part 8) for interacting with cetaceans to minimise disturbance to marine fauna caused by vessels and helicopter operations. • Vessels to adopt measures consistent with the DPaW Whale Shark Management Program (2013), to avoid approaching closer than 30 m of a whale shark and not exceeding 8 knots within 250 m. • Environmental awareness inductions will be provided to crew prior to the activities, including marine fauna interaction requirements and reporting arrangements. • MODU and vessels bridge-watch will be maintained 24 hours/ day to assist with early detection of marine megafauna.
Unplanned releases including hydrocarbons	• NOPSEMA accepted Well Operations Management Plan and Safety Case will be in place prior to start of the drilling activity. • Suitably trained and experienced personnel will be employed for drilling operations. • A blowout preventer (BOP) will be installed and function tested during drilling operations. • MODU and vessels will be fitted with lights, signals, AIS transponders and navigation and communications equipment, as required by the *Navigation Act 2012*, to ensure early detection of third party vessels. • 500 m PSZ around the MODU. • MODU and vessels will have an approved Ship Oil Pollution Emergency Plan (SOPEP); spill response equipment and materials will be maintained and available on-board. • All personnel undertaking activities will undergo relevant inductions and training. • Procedures will be in place for equipment maintenance, inspections and bunding. • Activities will be managed in accordance with vessel lifting and transfer procedures. • Detailed assessment and planning will be undertaken to ensure impacts are minimised in the unlikely event of a worst case spill event, including NOPSEMA accepted Oil Pollution Emergency Plan (OPEP) in place prior to start of the drilling activity. • Emergency response capability will be maintained in accordance with the OPEP in the event of a spill from an unlikely loss of well control (LOWC) or vessel collision incident. • The Australian Hydrographic Office (AHO) will be notified before the Activity for promulgation of appropriate 'Notice to Mariners'. • AMSA's JRCC will be notified prior to commencement of the Activity for promulgation of radio-navigation (AUSCOAST) warnings.

Contact Details and Further Information

We welcome your response to understand how SapuraOMV's proposed activities may impact on your interests, together with any feedback on potential risks and impacts associated with the proposed activities.

We appreciate your input and any comments you may have for our consideration in the development of the EP. Should you wish to provide us with comments, please do so at your earliest convenience. Alternatively, if you would like to opt out of future communications, please let us know.

Email: kanga.australia@sapura-omv.com

Phone: 1800 959 553

Mail: SapuraOMV Upstream (WA) Pty Ltd
PO Box 7990
Cloisters, Western Australia, 6000

Appendix F – OPEPs

Appendix F.1 Kanga-1 Exploration Well OPEP for a Crude Oil Spill

SapuraOMV Upstream (WA) Pty Ltd

Kanga-1 Exploration Well Oil Pollution Emergency Plan for a Crude Oil Spill

April 2021

SapuraOMV Upstream (WA) Pty Ltd
Level 2, 251 St Georges Terrace
Perth, WA 6000
T: +61 8 6118 4990 www.sapura-omv.com
ACN 629 043 518

Quick Access Guide

In the event of a loss of well control spill, initiate response in the following sequence:

Relevant Person or Group	Time post incident	Action	Refer to
OSC	Immediate	•Alert On-Duty Incident Commander	Section 2.4
IC	Immediate	•Activate Incident Management Team (IMT)	Section 2.7
IC	<1 hour	•Gain situational awareness	Section 3.1
IC/IMT	<1 hour	•Activate Notification Plan	Section 3.2
IMT	<3 hours	•Activate Well Containment Plan	Section 3.3
IMT	<3 hours	•Activate Monitor and Evaluate (Operational) and Scientific Monitoring Plans	Sections 3.4 and 3.5
IMT	Continuous	•Ongoing Response	

DOCUMENT INFORMATION

Document Title:	Kanga-1 Exploration Well Oil Pollution Emergency Plan for a Crude Oil Spill
Document Number:	AU-HSE-KG1-EX-PLN-037
Document Revision:	2
Document Owner:	HSE Department

CURRENT REVISION APPROVALS

Action	Name	Position	Initial	Date
Prepared by	GHD	-		23 April 2021
Reviewed by	Michael Chua	Senior HSE Specialist		23 Apr 2021
Endorsed by	Richard Baillie	Drilling Manager		23 Apr 2021
Approved by	Zamin Zawawi	Country / Asset Manager		23/Apr/2021

REVISION / AMENDMENT RECORD

Rev	Date	Prepared	Reviewed	Endorsed	Approved	Description
A	8 June 2020	GHD Pty Ltd	MC, RB, ZZ	-	-	Issued for review
B	29 June 2020	GHD Pty Ltd	MC, RB, ZZ	-	-	Issued for review
0	1 July 2020	GHD Pty Ltd	MC	RB	ZZ	Issued for consultation with DoT and submission to NOPSEMA
0.1	20 August 2020	GHD Pty Ltd	MC	RB	ZZ	Update on basis of consultation with DoT
1	27 November 2020	GHD Pty Ltd	MC	RB	ZZ	Update following NOPSEMA RRFWI 20/09/2020
2	23 April 2021	GHD Pty Ltd	MC	RB	ZZ	Update following NOPSEMA OMR 22/12/2021

Table of Contents

Table Index

Figure Index

Appendices

LIST OF ACRONYMS

Abbreviation	Description
bbl	Barrel
ppb	Parts per billion
ppm	Parts per million
km	Kilometre
m	Metre
m^3	Cubic metre
MM scf	Million Standard Cubic Feet
AIMS	Australian Institute of Marine Science
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
AMOSC	Australian Marine Oil Spill Centre Pty Ltd
AMOSPlan	Australian Marine Oil Spill Plan
AMSA	Australian Maritime Safety Authority
APASA	Asia-Pacific Applied Science Associate
APPEA	Australian Petroleum Production and Exploration Association
ASAP	As Soon As Possible
BAOAC	Bonn Agreement Oil Appearance Code
CMT	Crisis Management Team
DAWE	Department of Agriculture, Water and the Environment
DBCA	Department of Biodiversity, Conservation and Attractions
DG	Dangerous Goods
DMIRS	Department of Mines, Industry Regulation and Safety
DoT	Western Australia Department of Transport
DPaW	Department of Parks and Wildlife
DPIRD	Department of Primary Industry and Regional Development
DWER	Department of Water and Environmental Regulation
ECC	Emergency Control Centre
EP	Environment Plan
EPA	Environmental Protection Authority (of Western Australia)
EPBC	Environment Protection and Biodiversity Conservation
EPO	Environmental Performance Outcome
EPS	Environmental Performance Standard
ERT	Emergency Response Team
ESC	Environmental Scientific Coordinator
G&G	Geophysical and Geotechnical
GPS	Global Positioning System
HMA	Hazard Management Agency
HSE	Health, Safety and Environment
HSEMS	Health, Safety and Environment Management System
IBC	Intermediate Bulk Container
IC	Incident Commander
ICC	DoT Marine House Incident Command Centre
ICR	Incident Control Room
IAP	Incident Action Plan
IMP	Incident Management Plan
IMT	Incident Management Team
IPIECA	International Petroleum Industry Environmental Conservation Authority
JRCC	Joint Rescue Coordination Centre - Australia
JSCC	Joint Strategic Coordination Committee
KEF	Key Ecological Features
LEL	Lower Exposure Limit
LOWC	Loss of Well Control
MDO	Marine Diesel Oil

Abbreviation	Description
MEE	Maritime Environmental Emergencies
MEECC	Maritime Environmental Emergency Coordination Centre
MEER	Maritime Environmental Emergency Response
MFO	Marine Fauna Observer
MoC	Management of Change
MODU	Mobile Offshore Drilling Unit
MoU	Memorandum of Understanding
MSDS	Material Safety Data Sheet
NatPlan	National Plan for Maritime Environmental Emergencies
NEBA	Net Environmental Benefit Analysis
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NRT	National Response Team
NWS	North West Shelf
OIM	Offshore Installation Manager
OIW	Oil-In-Water
OPEP	Oil Pollution Emergency Plan
OPGGS	Offshore Petroleum and Greenhouse Gas Storage Act 2006
OPGGS(E)R	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
OSMF	Operational and Scientific Monitoring Framework
OSMIP	Operational and Scientific Monitoring Implementation Plan
OSRA	Oil Spill Response Atlas
OSRL	Oil Spill Response Limited
OSTM	Oil Spill Trajectory Modelling
OWA	Oiled Wildlife Advisor
OWD	Oiled Wildlife Division
OWM	Oil Weathering Model
OWR	Oiled Wildlife Response
POLREP	Marine Pollution Report
PPE	Personal Protective Equipment
PROWRP	Pilbara Region Oiled Wildlife Response Plan
RCC	Rescue Coordination Centre
ROV	Remotely Operated Vehicle
SAG	Scientific Advisory Group
SapuraOMV	SapuraOMV Upstream (Western Australia) Pty Ltd
SAP	Sampling and Analysis Plan
SAT	Shoreline Assessment Team
SCT	Site Control Team
SDS	Safety Data Sheet
SFRT	Subsea First Response Toolkit
SITREP	Marine Pollution Situation Report
SMEEC	State Maritime Environmental Emergency Coordinator
SOP	Standard Operating Procedure
SOPEP	Shipboard Oil Pollution Emergency Plan
SRT	State Response Team
TEC	Threatened Ecological Community
WA	Western Australia
WAF	Water-accommodated Fraction
WAMSI	WA Marine Science Institution
WAOWRP	Western Australian Oiled Wildlife Response Plan
WCP	Well Containment Plan
WDC	Wildlife Division Coordinator
WWC	Wild Well Control

1. Introduction

1.1 Purpose

This Oil Pollution Emergency Plan (OPEP) accompanies the *Kanga-1 Exploration Well Environment Plan (AU-HSE-KG1-EX-PLN-036)*, as required by Regulation 14(8) of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS(E)R).

This OPEP describes the offshore oil spill response arrangements to be undertaken for the Kanga-1 exploration well drilling (the Activity) (see **Section 1.2**) in the event of a crude oil spill from a loss of well control incident. A separate OPEP (*Kanga-1 Exploration Well OPEP for a MDO Spill (AU-HSE-KG1-EX-PLN-039)*) describes the oil spill response arrangements to be undertaken for a MDO spill incident during the activity (i.e. vessel collision, refuelling incident during MODU bunkering operations). Separate OPEPs for crude oil and MDO oil spills have been prepared for this Activity to reflect differences in the spill response arrangements for these two hydrocarbon types, facilitating operational implementation in the event of an incident.

This OPEP is to be read in conjunction with the Kanga-1 Exploration Well Environment Plan (EP) when considering the existing environment, environmental impacts, risk management, performance standards, reporting compliance, and the decision processes that will apply in the event that a crude oil spill occurs.It contains the necessary information and guidance to carry out the initial response during an emergency marine oil pollution incident arising from a loss of well control during the Activity.

1.2 Summary of Proposed Activity

SapuraOMV Upstream (Western Australia) Pty Ltd (SapuraOMV) is the registered titleholder and operator for petroleum exploration permit WA-412-P in offshore Commonwealth waters on the North West Shelf (NWS) of Western Australia (WA). SapuraOMV propose to drill the Kanga-1 exploration well in the permit area between Quarter 1 (Q1) 2022 and Q4 2022 (**Figure 1-1**). The activity will be carried out with a semi-submersible mobile offshore drilling unit (MODU) and is expected to take approximately 40 days. To account for potential weather delays, technical difficulties and rig/vessel availability constraints; the EP allows for the activity to take up to 80 days.

The operational area is approximately 163 km north-northwest of Karratha (nearest town) and approximately 125 km north-northwest of Legendre Island (nearest land) in water depths of approximately 147 m.

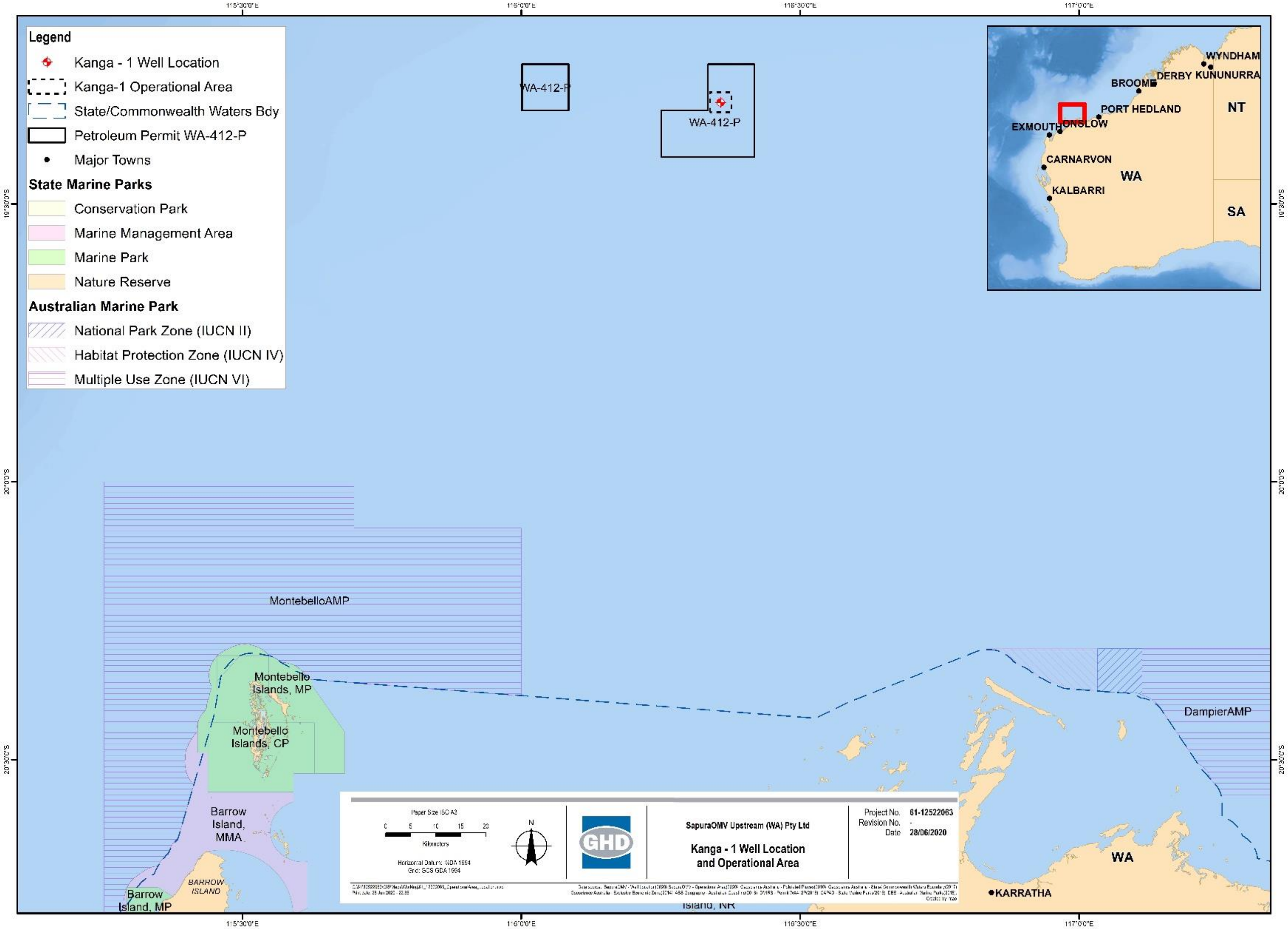

Figure 1-1 Location of Kanga-1 well and operational area

1.3 Overview of Potential Spill Impacts

The EP identified four unplanned events that may occur during the Activity and lead to a hydrocarbon spill into the marine environment (**EP Sections 8.1** to **8.4**). This OPEP focuses on a crude oil spill from a loss of well control scenario (**EP Section 8.1**). The two MDO scenarios (**EP Sections 8.2** and **8.3**) are covered in a separate OPEP for improved response, operability and implementation (*Kanga-1 Exploration Well OPEP for a MDO Spill (AU-HSE-KG1-EX-PLN-039)*). Minor hydrocarbon spills (**EP Section 8.4**) are managed via the SOPEP.

1.4 Selected Spill Response Strategies for this OPEP

Appendix A describes the preliminary net environmental benefit analysis (NEBA) that was used to select applicable spill response strategies, and their delineations as primary or secondary responses for a Level 3 spill. In the event of a Level 3 spill, operational NEBAs by the IMT will be regularly undertaken as part of the Incident Action Plan (IAP) development process (see **Section 4.1**), so that the combination of spill response strategies and their implementation may evolve over time. Following on from the preliminary NEBA, **Appendix A** applies the 'As Low As Reasonably Practicable' (ALARP) principle across potential control measures of the selected spill response strategies. The implementation of these ALARP justified responses as control measures are the basis of this OPEP, and are summarised in **Table 1-1.**

Table 1-1 Selected response strategies and control measures for a Level 3 loss of well control spill

Response Strategy	Level 3 Spill	Control Measure
Source Control – Emergency BOP Intervention	Primary	Manage by IAP and third party contractor requirements.
		Subsea emergency accumulator (or similar) available through contract.
		Mutual Aid MOU.
Source Control – Capping Stack	Primary	Manage by IAP and third party contractor requirements.
		Capping stack and subsea intervention tool system available through contract.
Source Control – Relief Well	Primary	Manage by IAP and third-party contractor requirements.
		Mutual aid MoU plus addition inventory available.
Source Control – Subsea Dispersant Application	Secondary	Manage by IAP and third party contractor requirements.
		Subsea dispersant system available through contract.
Monitor and Evaluate (Operational Monitoring)	Primary	Manage by IAP and OSMP.
		Oil Spill Trajectory Modelling.
		Surveillance (Oil Spill Tracking Buoys, Aerial and Vessel Observations, Shoreline Assessment, Satellite Imagery).
Surface Dispersant Application – Vessel	Secondary	AMOSC and OSRL memberships.
		AMSA MoU.
Surface Dispersant Application – Aerial	Secondary	AMOSC and OSRL memberships.
		AMSA MoU.
Mechanical Dispersion	Secondary	Primary vessel contractor.
		Ad hoc vessel hire.

Response Strategy	Level 3 Spill	Control Measure
Containment & Recovery	Secondary	AMOSC and OSRL memberships.
Shoreline Protection & Deflection	Secondary	AMOSC and OSRL memberships.
Shoreline Clean-up	Secondary	Shoreline clean-up services via call-off contracts.
		Waste management services provider on contract.
Oiled Wildlife Response	Secondary	AMOSC and OSRL agreements.
		AMOSC and OSRL equipment availability.
Scientific Monitoring	Primary	Managed by IMT during response, Scientific Monitoring Contractor thereafter.
		Call-off arrangements with service providers.

1.5 Prioritisation of Sensitive Locations

For spill response planning purposes, based on the oil spill modelling results (GHD (2020b) and the environmental impact and risk assessment for a worst case (Level 3) loss of well control (**EP Section 8.1**), protection priority sites were identified in **Appendix A** (**Section A-4**). These protection priorities may change based on the nature and scale of the spill and through informed discussions with relevant Hazard Management Agencies / Jurisdictional Authorities. A summary of oil spill response strategies to be initiated in the event of a spill, outlined by sensitive receptor type, is provided in **Table 1-2** (also **Table A-5** in **Appendix A**).

Table 1-2 Summary of sensitive receptors, their location and assessment of oil spill response strategies

Sensitive Receptors	Priority Locations					Oil Spill Response Strategy								
	Barrow Island	Montebello Islands	Imperieuse Reef	Ningaloo Region	Muiron Islands	Source Control	Mechanical Dispersion	Operational & Scientific Monitoring	Surface Dispersant Application	Subsea Dispersant Application	Offshore Containment & Recovery	Shoreline Protection & Deflection	Shoreline Clean-up	Oiled Wildlife Response
Cetaceans	✓	✓	✓	✓	✓	R	C	R	C	C	C	N/A	N/A	C
Marine reptiles	✓	✓	✓	✓	✓	R	C	R	C	C	C	C	C	C
Dugongs	✓	✓	-	✓	✓	R	C	R	C	N/A	C	N/A	N/A	C
Seabirds/ shorebirds	✓	✓	✓	✓	✓	R	C	R	C	N/A	C	C	C	R
Fish, sharks, rays	✓	✓	✓	✓	✓	R	NR	R	N/A	C	C	N/A	N/A	NR
Marine invertebrates	✓	✓	✓	✓	✓	R	NR	R	N/A	N/A	N/A	N/A	N/A	NR
Sandy beaches	✓	✓	✓	✓	✓	R	C	R	N/A	N/A	N/A	C	R	N/A
Submerged reefs	✓	✓	✓	✓	✓	R	NR	R	N/A	N/A	N/A	N/A	N/A	N/A

Sensitive Receptors	Priority Locations					Oil Spill Response Strategy								
	Barrow Island	Montebello Islands	Imperieuse Reef	Ningaloo Region	Muiron Islands	Source Control	Mechanical Dispersion	Operational & Scientific Monitoring	Surface Dispersant Application	Subsea Dispersant Application	Offshore Containment & Recovery	Shoreline Protection & Deflection	Shoreline Clean-up	Oiled Wildlife Response
Seagrass beds	✓	✓	✓	✓	✓	R	NR	R	NR	NR	N/A	N/A	N/A	N/A
Mangroves	✓	✓	-	✓	-	R	C	R	NR	NR	C	C	C	N/A
Australian & State Marine Parks	✓	✓	✓	✓	✓	R	C	R	NR	NR	C	C	C	N/A
National & World Heritage	-	-	-	✓	✓	R	C	R	C	NA	C	C	C	N/A
Key Ecological Features	-	-	-	✓	-	R	C	R	C	C	C	N/A	N/A	N/A
Tourism/ recreation	-	✓	✓	✓	✓	R	C	R	C	C	C	C	R	N/A
Fisheries	✓	✓	-	✓	✓	R	NR	R	C	C	C	N/A	N/A	N/A
Shipping	✓	-	-	-	-	R	C	R	N/A	N/A	N/A	N/A	N/A	N/A
Indigenous heritage	✓	✓	-	✓		R	C	R	N/A	N/A	C	C	C	N/A

Key:
✓ = receptor present
- = receptor not present
R = Recommended

NR = Not recommended
N/A = Not applicable
C = Considered

1.6 Integration with Other SapuraOMV and Contractor Plans

This OPEP interfaces with other relevant SapuraOMV and contractor crisis and emergency plans as detailed in **Table 1-3**.

Table 1-3 Relevant SapuraOMV and contractor management plans that interface with this OPEP

Title	Document Number	Scope and Function
SapuraOMV Health, Safety and Environment Management System (HSEMS)	HSE-MM-MAN-0001	Details SapuraOMV HSEMS expectations with regards to achieving Operating Excellence, with respect to health, safety and environmental management.
SapuraOMV Incident Management Plan (IMP)	AU-HS-PLN-002-1.0	Details Incident Management Team (IMT) response procedures for the safe, rapid, effective and efficient management of incidents in Australia.
SapuraOMV Kanga-1 Exploration Drilling Environment Plan (EP)	AU-HSE-KG1-EX-PLN-036	Sets out environmental management requirements for the Activity.
MODU Shipboard Oil Pollution Emergency Plan (SOPEP)	As per contractor document control.	SOPEP as per MARPOL requirements.

1.7 Organisational Roles and Responsibilities

The roles and responsibilities of organisations referred to in this OPEP are provided in the following sub-sections.

1.7.1 Jurisdictional Authority

The Jurisdictional Authority is the relevant Statutory Authority identified that has the jurisdictional or legislative responsibilities for oil pollution in the area to ensure there is adequate prevention of, preparedness for, response to and recovery from a specific incident.

1.7.2 Controlling Agency

The Controlling Agency is the agency or organisation assigned by legislation, administrative arrangement or within the Oil Pollution Emergency Plan (OPEP) to control the response activities of an actual or impending oil spill incident.

1.7.3 SapuraOMV Upstream (WA) Pty Ltd

As required by Regulation 14(8) of the OPGGS(E)R, SapuraOMV is required to include an OPEP to accompany the EP that describes preparedness for the possiblity of an oil spill, and emergency response arrangements to be implemented if an oil spill occurs. The EP includes control measures to ensure the implementation of SapuraOMV's oil spill response responsibilities. As per SapuraOMV's Incident Management Plan (AU-HS-PLN-002-1.0), SapuraOMV's Incident Commander (IC) would be notified in the event of a spill incident and SapuraOMV's Incident Management Team (IMT) would be activated if required by the IC.

1.7.4 MODU Contractor

In the event of a spill from/on the MODU, on behalf of the MODU Contractor the Offshore Installation Manager (OIM) will take on the role of On Scene Commander (OSC). The OSC will be responsible for the implementation of emergency response procedures as per the SOPEP and the onsite requirements of this OPEP.

1.8 Jurisdictional Authorities and Controlling Agencies

Table 1-4 shows the Jurisdictional Authority (or Hazard Management Agency [HMA] in WA state waters) and Controlling Agency for different spill levels in Commonwealth and WA state waters.

The Kanga-1 exploration drilling is situated in Commonwealth waters. For a crude oil spill from a loss of well control during the Activity, the Jurisdictional Authority is NOPSEMA. SapuraOMV will be the Controlling Agency and will implement intial response actions until such a time and if another organisation assumes Controlling Agency status.

Modelling indicates that in the event of a very large (e.g. Level 3) spill from a loss of well control incident, crude oil is likely to enter into WA state waters and contact shorelines (GHD, 2020b). In these instances, cross-jurisdictional arrangements between WA state and Commonwealth waters apply; the DoT is the Hazard Management Agency (HMA) (i.e. Jurisdictional Authority) and Controlling Agency for any petroleum spill that occurs within or enters State waters.

Table 1-4 Jurisdictional authority and controlling agency for crude oil spills in Commonwealth and state waters for this Activity

Location	Incident	Jurisdictional Authority	Controlling Agency		
			Level 1 Spill	Level 2 Spill	Level 3 Spill
Australian Commonwealth Waters	MODU Crude Oil Spill	NOPSEMA	SapuraOMV	SapuraOMV	SapuraOMV
Slick/spill enters WA state Waters		DoT	Not credible to enter State waters	DoT	DoT

1.8.1 Petroleum Activity Spill in Commonwealth Waters

NOPSEMA is the Statutory Agency responsible for the oversight of response actions to pollution events from offshore petroleum activities in areas of Commonwealth jurisdiction. *The Offshore Petroleum and Greenhouse Gas Storage (OPGGS) Act 2006* and its associated regulations provides power for NOPSEMA, or the responsible Commonwealth Minister, to direct titleholders to take actions, investigate accidents, occurrences and circumstances involving deficiencies in environmental management, in response to a spill incident.

SapuraOMV is the Controlling Agency for all non-vessel petroleum activity spills in Commonwealth waters and has the operational responsibility to respond in accordance with this OPEP. SapuraOMV will retain the Controlling Agency role until such a time as the relevant Jurisdictional Agency (ie. NOPSEMA) identifies the need to delegate control. In such instances, the Controlling Agency role may be delegated to the Australian Maritime Safety Authority (AMSA) to assume control of the incident and respond in accordance with the National Plan. SapuraOMV would then assume a Support Agency role providing resources (personnel, equipment or services), and/ or information to the incident management team during the response.

1.8.2 Cross-Jurisdictional Spills

Cross-jurisdiction relates to a marine oil pollution incident that originates in Commonwealth waters and moves into State waters, resulting in the DoT exercising their HMA (Jurisdictional Authority) obligations in respect to actual or impending response activities in State waters.

Oil spill trajectory and fate modelling of the worst-case spill scenario predicts that a Level 3 loss of well control spill in the Operational Area is likely to enter State waters. In these instances, cross-jurisdictional arrangements will apply.

Where State waters are impacted by a crude oil spill from an offshore petroleum activity in Commonwealth waters, DoT will only assume the role of Controlling Agency for that portion of the response activity that occurs within State waters while SapuraOMV assumes the role of Controlling Agency for the portion of response activity that occurs within Commonwealth waters. DoT and SapuraOMV will both establish IMTs for their respective response activities. SapuraOMV will be required to provide an appropriate number of appropriately qualified personel for the DoT IMT. In fullfilling its obligation as Controlling Agency, DoT will require SapuraOMV to work in partnership with DoT to ensure an adequate response is provided across the entire incident. A Joint Strategic Coordination Committee (JSCC) will be established to facilitate effective coordination between the two Controling Agencies.

2. Crisis and Incident Management Response

2.1 Overview of Crisis and Incident Management System

Crisis and incident response is managed by a hierarchy of teams within SapuraOMV supported by the resources of SapuraOMV's office in Kuala Lumpur. Response teams are progressively activated depending on the level of incident severity, resource needs, and incident complexity. Responsibility begins at the site level Contractor Emergency Response Team (ERT) or Site Control Team (SCT) and rises through the Incident Management Team (IMT) in Perth and the Crisis Management Team (CMT) in Kuala Lumpur (see **Figure 2-1**).

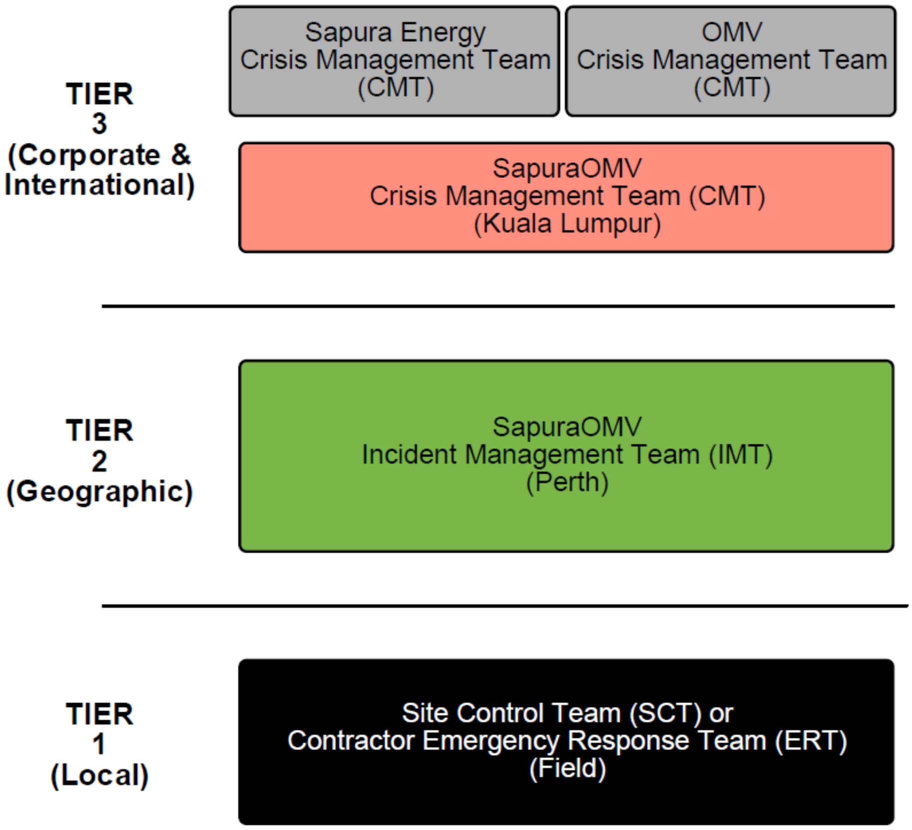

Figure 2-1 Crisis and incident management structure

2.2 Responsibilities of Emergency Response (Site Control), Incident Management and Crisis Management Teams

The primary responsibilities of the ERT/ SCT, IMT sections and CMT during an oil spill incident are outlined in **Table 2-3**.

Table 2-1 Primary responsibilities of ERT/ SCT, IMT sections and CMT

Team	Responsibilities
ERT/ SCT	The ERT (or SCT) manages and implements on-scene operational response activities, and is comprised of contractor and SapuraOMV personnel that have a role in site-level teams (e.g. fire response, medical response, evacuation) and is responsible for the following: • Manages all aspects of the incident at the site level. • Notifying, advising (assist in determining level of response) and updating the IMT. • Providing initial resources required by the facility operation or vessel in difficulty. The incident response within the ERT/ SCT is managed by the On Scene Commander (OSC) who maintains direct communication with the IMT, via the SapuraOMV Offshore Representative.
IMT	Incident Commander (IC) The IC leads the IMT and is responsible for the overall management and support to the response operations of the incident. Planning Section • Conduct short-term (e.g. preparation of Incident Action Plans [IAPs]) and long-term planning (e.g. preparation of a General Plan) to meet strategic objectives of the response as set by Command Section. • Manage information associated with emergency response operations by establishing and maintaining a situation status display (the Information Centre) and collecting and preserving documentation. • Environmental Unit provides advice, monitoring and technical support, and includes 3rd party specialists to assist with OSMP implementation and oil spil trajectory forecasting. Operations Section • Provide strategic direction to the ERT. • Incorporate any mobilised specialist technical capability to support the response. • Direct assessment and planning for spill response actions. • Development of spill response section of the IAP. • Management, supervision and monitoring of spill response operations. • Inform IMT on nature and status of spill response operations. Logistics Section • Support emergency response operations by sourcing personnel, equipment, materials, and supplies needed to carry out the operations. • Coordinate the services to sustain emergency response including food, water, housing, clothing, transportation, first aid, security, fuel, spare parts and anything else to keep people and equipment working in a safe and productive fashion. Finance and Administration Section • Manage all financial aspects of the response ensuring that the IMT has the necessary financial resources and processes in place. • Monitor expenditure and maintains records for insurance / cost recovery purposes.
CMT	The CMT is based in Kuala Lumpur and is responsible for providing corporate level support and guidance (if required) drawn from the Shareholders (namely Sapura Energy and OMV) of the following: • Provides strategic leadership and resource support to the IMT. • Sets and implements high-level strategic objectives for SapuraOMV including stakeholder relations, investor relations, reputation recovery, and media management. • Manages internal and external communication. • Worldwide leadership representation. • Provides updates to the Board of Directors.

2.3 IMT Functional Role and Structure

The IMT is accountable for managing the overall physical and tactical response. The IMT also manages all other issues arising from an emergency that have implications to personnel or operations. The functional role of the IMT is to:

- Establish and maintain contact and provide guidance and support to the On Scene Commander (Vessel Master), via SapuraOMV Offshore Representative, who is conducting the physical and immediate response to the incident at and near the incident scene.
- Develop objectives and associated plans for the overall management of the incident and its consequences, ensuring the response moves from a reactive to a proactive response as quickly as possible.
- Obtain and mobilise resources as appropriate to support the operations of the IMT and support staff.
- Ensure that initial notifications and interactions with Commonwealth, State and Local Government regulatory bodies are completed.
- Manage relationship with traditional and social media, including issuing media statements.
- Manage all immediate financial matters related to the incident including implementing procurement and cost tracking processes.
- Escalate the stakeholder impacts and broader emergency management concerns and requests for support to the CMT in Kuala Lumpur (if activated but not likely for a Level 2 incident).

SapuraOMV's IMT structure is illustrated in **Figure 2-2**. The IMT is organised in accordance with the principles of the International Petroleum Industry Environmental Conservation Authority (IPIECA) Good Practice Guidelines – Incident Management System and designed to be scaleable according to the particular nature and response demands of the incident. The expanded IMT structure that might be required in the event of a 'worst case' (maximum oil ashore) scenario is provided in Appendix B.

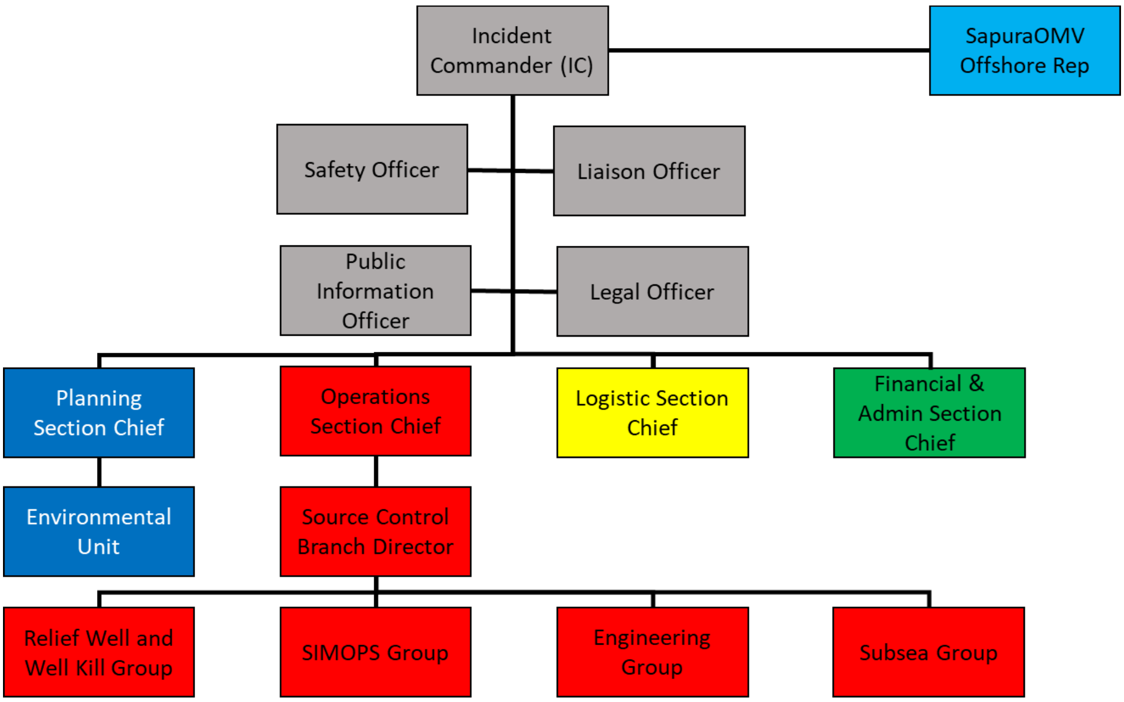

Figure 2-2 IMT structure

The responsibilities of key IMT personnel are summarised in **Table 2-3**.

Table 2-2 Key IMT personnel responsibilities

Section	Responsibilities
Command	Incident Commander (IC) The IC leads the IMT and is responsible for the overall management and support to the response operations of the incident including: • Establishing command and taking control of the incident. • Activate the IMT in accordance with Incident Management Plan. • Monitoring and reviewing safety and welfare. • Facilitating media management. • Developing, implementing and monitoring the IAP. • Notifying CMT. • Notifications as per Notification Plan (**Section 3.2**). • Approve involvement of additional third parties. • Conclude and review emergency activities. The IC may be assisted by a Deputy IC and may delegate some activities accordingly.
Planning	Planning Section Chief The Planning Section is lead by the Planning Section Chief who is responsible for: • Collecting, analysing and utilising incident information. • Engage other Section Chiefs to assist in response actions. • Organising incident response mobilisation/demobilisation. • Risk analysis of the incident and provision of specialist information (e.g. weather, spill behaviour, projections). • Ensure that NEBA assessments are carried out appropriately to support the development of IAPs. • Dissemination of incident information including to the media and public where required. • Coordination of surveillance flights. • Maintaining a record of communications and actions including resources requested/allocated/in use. • Liaises with the DBCA OWA (Oiled Wildlife Advisor) through the SapuraOMV OWA (provided by AMOSC). The Planning Section Chief may be assisted by a Deputy and may delegate some activities accordingly. Environmental Unit The Environmental Unit Leader will operate under the direction of the Planning Section Chief and will coordinate: • Environmental support. • Environment monitoring. • Technical advice.
Operations	Operations Section Chief The Operations Section is lead by the Operations Section Chief who is responsible for: • Development of spill response section of the IAP. • Notify most of the relevant organisations in the Notification Plan (**Section 3.2**). • Coordinating spill response operations. • Engaging with other Section Chiefs to assist in response actions. • Mobilisation of OSRL and AMOSC resources if required. Source Control Branch Director The Source Control / Well Containment Team will operate under the direction of the Operations Section Chief. The Source Control Branch Director's responsibilities include: • Direct assessment and planning for source control actions. • Notifying WWC of the incident as per Notification Plan (**Section 3.2**).

Section	Responsibilities
	• Development of source control section of the IAP. • Briefing and allocating operations personnel. • Management, supervision and monitoring of source control operations. • Assist in liaison with drilling and support contractors. The Source Control Branch Director may be assisted by a Deputy and delegate some activities accordingly. Relief Well and Well Kill Group Operating under the Source Control / Well Containment Branch Director this group will provide: • Relief well planning • Directional drilling planning. • Geophysical and geotechnical (G&G) data procurement and interpretation. • Well kill strategies. SIMOPS Group Operating under the Source Control / Well Containment Branch Director this group will provide: • Coordinate intervention vessels for source control activities. • Coordinate removal of debris for source control activities. Subsea Intervention Group Operating under the Source Control / Well Containment Branch Director this group will provide: • Debris clearance. • Capping stack deployment. • ROV operations (e.g. BOP hot stab, subsea dispersant application). Flow Engineering Group Operating under the Source Control / Well Containment Branch Director this group will provide: • Flow calculations for intervention planning. • Reservoir engineering information. • Flow assurance.
Logistics	Logistics Section Chief The Logistics Section is lead by the Logistics Section Chief who is responsible for: • Development of logistics section of the IAP. • Organise resources (e.g. helicopters, vessels). • Waste disposal planning / resources • Estimate future service and support requirements. • Provision of technical advice to the Planning Section Chief.
Finance and Administration	Finance and Administration Section Chief The Finance and Administration Section is lead by the Finance and Administration Section Chief who is responsible for ensuring that finances are available to all areas that require the purchasing or hire of goods (e.g. equipment) and services (e.g. personnel, transportation) and to keep financial records of all spill response expenditures. Procurement Group The Procurement Group will operate under the direction of the Finance and Administration Section Chief. This group will: • Handle administration for procurement and contracting. • Management of imports/exports and customs matters relating to procurement of resources.
IMT Command and Support	IMT Command Roles • *Liaison Officer* – communicate information to all relevant stakeholders, including ongoing consultation throughout a hydrocarbon spill emergency. • *Safety Officer* – provide HSE services in support of the oil spill response and source control team. Ensure the response operations are undertaken in a safe manner,

Section	Responsibilities
	consistent with work place safety legislation and also ensures the security of responders, the IMT and other SapuraOMV employees and contractors during a crisis. • *Public Information Officer* - responsible for managing the IMT related media issues for the response effort, in collaboration with the CMT. • *Legal Officer* - provide legal advice for all actions undertaken or considered by the IMT in response to the incident. Third Party Support Resources Third Party Resources that are a part of the IMT includes: • *Public Relations Support* - a public relations consultant will be in place for the duration of a major response to support the Public Information Officer and coordinate media releases and statements to ensure information flow is maintained and managed accurately and in a timely manner. SapuraOMV will engage a public relations consultant throughout the campaign planning phase. • *Legal Support* – a legal consultant may be appointed into the Legal Officer role to support the IMT. • *Environmental Specialist Support* - an environmental specialist consultant will be in place for the duration of a major response to support the Environment Unit under the Planning Section Chief. Responsibilities will include the recommendation and implementation of strategies outlined in the Operational and Scientific Monitoring Implementation Plan (OSMIP, Doc No AU-HSE-KG1-EX-PLN-038).

2.3.1 Emergency Control Centre

The SapuraOMV Board Room will be utilised as the Primary Emergency Control Centre (ECC) Room.

The IMT tools are stored in the IMT cupboard and appropriately equipped with communications equipment, meetings rooms and status boards.

If the Primary ECC is not useable for any reason, the IC will make alternative arrangements at the time, commensurate with the nature and scale of the emergency or crisis. Large venues exist within walking distance to the SapuraOMV office that have access to power, water, amenities, tables, chairs, communications and internet services.

2.4 Internal Emergency Response Activation Process

In the event of a Level 2 or Level 3 spill, the On Scene Commander is to contact On-Duty Incident Commander, via the SapuraOMV Offshore Representative.

The flow diagram in **Figure 2-3** shows SapuraOMV's internal emergency response activation process in the event of any hydrocarbon spill (Level 1, Level 2 or Level 3).

Contact numbers for personnel in **Figure 2-3** are listed in SapuraOMV's Emergency Contact List located in Annex 1 of the Incident Management Plan (AU-HS-PLN-002-1.0). This list is regularly updated, along with Annex 1 of the Incident Management Plan, and distributed to all relevant parties.

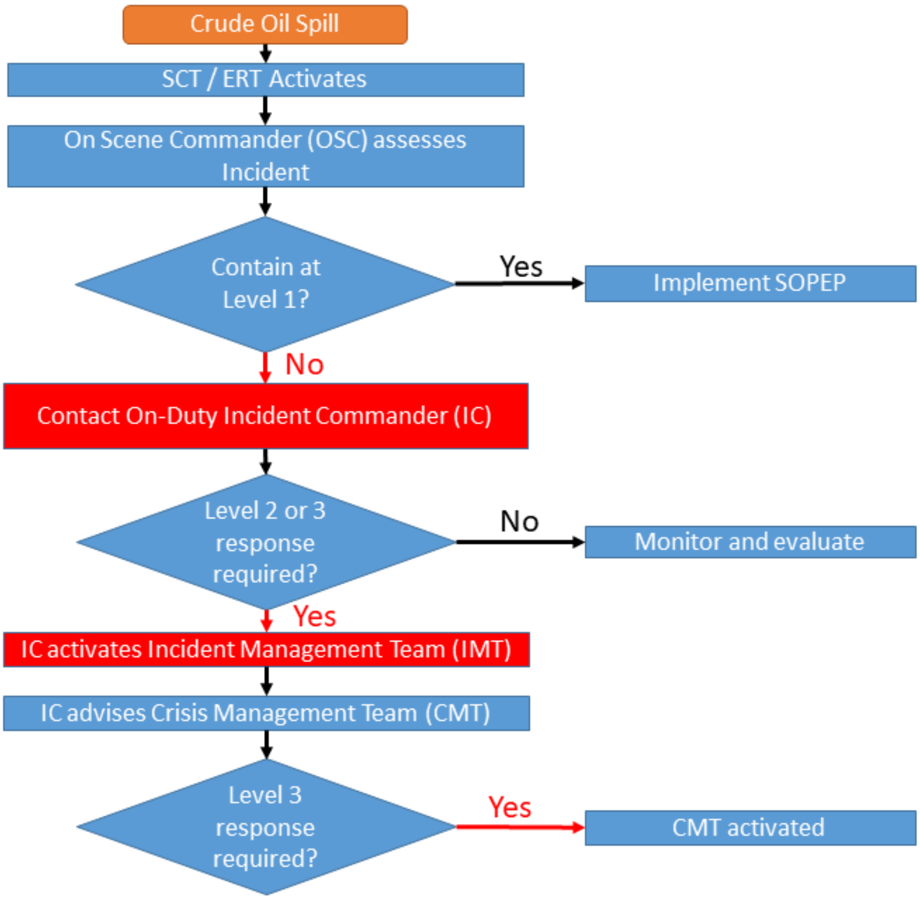

Figure 2-3 Internal emergency response activation process

The responsibilities of those involved in emergency response notification procedures are detailed in **Table 2-3.**

Table 2-3 Summary of contractor and SapuraOMV oil spill response roles and responsibilities during internal emergency response activation

Role	Position	Location	Responsibility
SapuraOMV Personnel			
SapuraOMV Offshore Representative(s)	SapuraOMV Offshore Representative(s)	MODU	• Responsible for emergency communications to the SapuraOMV IMT.
Incident Commander (IC)	On-Duty SapuraOMV Management of IMT	Perth	• Ensure adequate structure of the IMT for response escalation if required. • Liaison between Statutory Authorities, Controlling Agencies, Response Agencies and other stakeholders. • Inform SapuraOMV CMT.
CMT Lead	Nominated SapuraOMV Management on CMT	Kuala Lumpur	• Manage wider corporate implications of the incident and provide support in aspects such as media, government or community liaison. • Ensure that an effective response is mounted by the SapuraOMV IMT.

Role	Position	Location	Responsibility
			• Ensure adequate structure of the SapuraOMV CMT for the response escalation if required.
Contractor Personnel			
On Scene Commander (OSC)	OIM or delegate representative	MODU	• Responsible for emergency communications to SapuraOMV Offshore Representative and Rig Operator. • Responsible for implementation of emergency response procedures.
Third Party Contractors	Various	MODU/ Vessels / Helicopters	• Follow instruction from the IC and IMT.

2.5 Communication and Integration with Other Organisations and Plans

The IMT is responsible for both internal (i.e. CMT, ERT/SCT) and external communications (e.g. government, media). Dependent on the size of the spill and jurisdiction, SapuraOMV has support from a range of mutual support agencies and organisations, of which some of the key agencies and organisations are outlined in the following sub-sections.

2.5.1 Australian Maritime Safety Authority (AMSA) and National Plan for Maritime Environmental Emergencies (NatPlan)

NatPlan sets out the national arrangements, policies, and roles and responsibilities of states, territories and industry in managing maritime environmental emergencies. NatPlan integrates Commonwealth and State government oil spill response framework to facilitate effective response to marine pollution incidents. AMSA manages the National Plan and works with State governments (who manage the equivalent State plans that integrate into the NatPlan), shipping, petroleum, chemical industry and emergency services to optimise Australia's marine pollution response capability. This plan applies to all hydrocarbon spills in Commonwealth waters seaward of the State water limit while the WA State Hazard Plan – MEE applies in State waters within 3 nautical miles (nm) of the territorial sea baseline. The National Plan is Australia's key maritime emergency contingency and response plan.

2.5.2 Australian Marine Oil Spill Centre (AMOSC) and AMOSPlan

SapuraOMV will have access to AMOSC oil spill recovery and response equipment, dispersant and technical (human) capabilities along with those resources held by member companies as outlined in the AMOSPlan on a 24-hour, 7-days a week basis before and throughout drilling operations. The AMOSPlan details the Australian industry cooperative arrangements in a series of international agreements and relationships designed to support the petroleum industry during a Level 3 response. SapuraOMV's primary interface with the AMOSPlan during an oil spill response is via AMOSC's 24/7 Duty Officer, who will provide the initial point of contact for oil spill responses that require AMOSC assistance.

AMOSC is a member of the Global Response Network.

2.5.3 Oil Spill Response Limited (OSRL)

SapuraOMV has access to the 24 hour, 7-days a week OSRL response service. In addition to equipment and personnel resources, OSRL has a number of aircraft on standby to facilitate the movement of equipment from Singapore to Western Australia. AMOSC and OSRL have a MoU in place to facilitate working together in the event that both AMOSC and OSRL have been activated. ORSL is a member of the Global Response Network.

2.5.4 WA Department of Transport (DoT) and WA State Hazard Plan – Maritime Environmental Emergencies (MEE)

The WA State Hazard Plan - MEE sets out arrangements for managing marine oil pollution and marine transport emergencies in WA. The WA State Hazard Plan – MEE prescribes management arrangements for the prevention of, preparation for, response to and recovery from a marine oil pollution incident in order to minimise the impacts of oil spill incidents from vessels, offshore petroleum activities and other sources in State waters.

Where a spill enters or is predicted to enter from Commonwealth to State waters, the HMA (DoT Marine Safety General Manager, or their designated proxy) will assume the role as the State Maritime Enviornmental Emergency Coordinator (SMEEC), and the DoT will take on the role of Controlling Agency for response actions in State waters. The HMA has overall responsibility for ensuring there is an adequate response to spill incidents in State waters, including those resulting from a petroleum activity and from a vessel originating in Commonwealth waters. The SMEEC provides overall strategic management response and executive level support and guidance to the Incident Control.

For a spill that crosses from Commonwealth to State waters, it is an expectation that SapuraOMV will conduct initial response actions in State waters as necessary in accordance with this OPEP and continue to manage those operations until formal incident control can be established by DoT. SapuraOMV will notify the DoT Maritime Environmental Emergency Response (MEER) unit as soon as practicable as per the **Section 3.2** Notification Plan. On notification, the HMA will establish and operate the Maritime Environmental Emergency Coordination Centre (MEECC) and activate the DoT IMT.

SapuraOMV and DoT will establish separate IMTs to manage response activities in Commonwealth and State waters, respectively, with one of the IMTs adopting the role of ‘Lead IMT’ for some response functions. Unless otherwise agreed through the Joint Strategic Coordination Committee (JSCC), the allocation of IMT function and designation of ‘Lead IMT’ will be as detailed in Appendix 2 of the Offshore Petroleum Industry Guidance Note: Marine Oil Pollution - Response and Consultation Arrangements (DoT, 2020).

To facilitate effective coordination between DoT and SapuraOMV and their respective IMTs in the event of a cross-jurisdictional response (e.g. if SapuraOMV remains Controlling Agency for those responses in Commonwealth marine waters with DoT the Controlling Agency in State waters), the JSCC will be established. The JSCC is a committee, not a team operating from a specified location. The JSCC will be jointly chaired by the SMEEC and a nominated senior SapuraOMV representative, and will comprise individuals deemed necessary by the chairs to ensure an effective coordinated response across both jurisdictions and to provide a mechanism for de-conflicting competing priorities and requests for resources. The key functions of the JSCC are set out within Section 6.5.1 of DoT’s Offshore Petroleum Industry Guidance Note: Marine Oil Pollution Response and Consultation Arrangements (DoT, 2020).

In the event that DoT is required to establish an IMT, at the request of the SMEEC, SapuraOMV will comply with DoT’s Offshore Petroleum Industry Guidance Note: Marine Oil Pollution - Response and Consultation Arrangements (DoT, 2020) and provide the necessary resourcing including equipment and personnel, to assist the DoT’s IMT in performing duties as a Controlling Agency. SapuraOMV will make available appropriately qualified persons to work within the DoT IMT (as described in Appendix 3 and 4 of the Offshore Petroleum Industry Guidance Note: Marine Oil Pollution - Response and Consultation Arrangements (DoT, 2020).

In addition to the IMT roles, SapuraOMV will also provide appropriately qualified personnel (e.g. AMOSC core group, OSRL staff, specialist consultants) to assist with field operational activities, such as shoreline clean-up and oiled wildlife response. DoT may also opt to deploy field response personnel through the State Response Team and request National Response Team support.

Figure 2-4 show the integration and coordination arrangements, respectively, between WA DoT and SapuraOMV for a spill entering State waters.

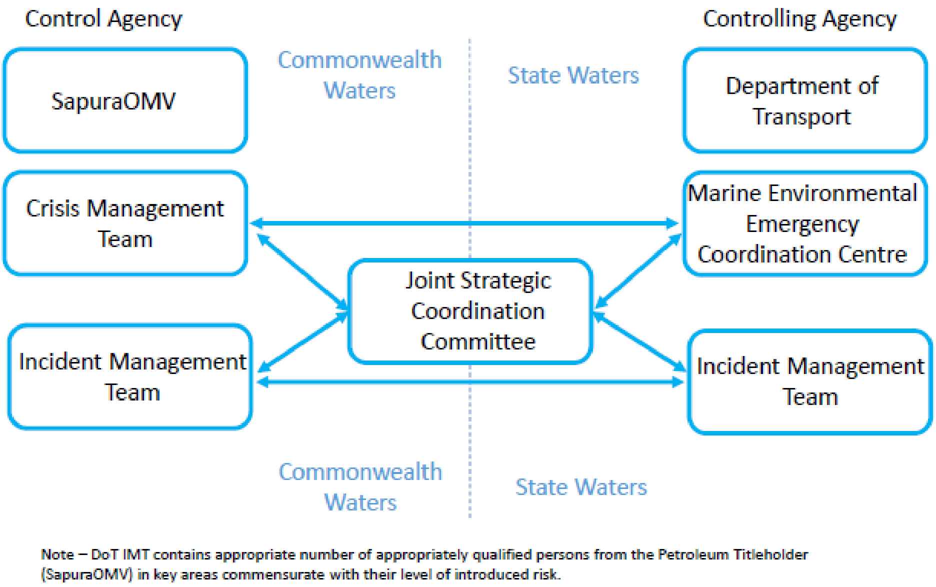

Figure 2-4 Coordination structure for cross-jurisdiction spills

2.5.5 WA Department of Biodiversity, Conservation and Attractions (DBCA) and WA Oiled Wildlife Response Plan (WAOWRP)

The DBCA has responsibility and statutory authority to protect wildllife as outlined in the WA *Biodiversity Conservation Act 2016*. It also has leglislative requirement to ensure the humane treatment, housing and release or euthanising of fauna under the *Animal Welfare Act 2002*.

For spills in State waters, DoT is the Controlling Agency and DBCA is the Jurisidictional Authority for OWR and lead agency for OWR. The role of DBCA (formerly DPaW) in an OWR is outlined in the WA Oiled Wildlife Reponse Plan (WAOWRP) and regional sub-plans. The WAOWRP (DPaW, 2014a) sets out the minimum standard required for an OWR in WA in both State and Commonwealth waters. The Pilbara Region Oiled Wildlife Response Plan (PROWRP) (DPaW, 2014b) outlines specific ‘on ground’ information required to carry out OWR specific to this region (e.g. environmental values, high risk environmental areas, designated oiled wildlife facilities, equipment lists and resource lists, contact lists).

For a spill originating from petroleum activities in Commonwealth waters that moves into State waters, SapuraOMV retains command until formal incident control is etablished by DoT. In the event that wildlife has been impacted or there is imminent threat of impact requiring OWR, the WAOWRP and PROWRP will be activated. A Wildlife Division Coordinator (WDC) will be established and will liaise with the DoT to identify and coordinate the necessary OWR functional units of the Oiled Wildlife Division (OWD), as per the WAOWRP. In the event of oiled wildlife, DBCA will provide an Oiled Wildlife Advisor (OWA) to advise. The OWA and WDC will provide advice to the DoT on the level of OWR required and will ensure provision of resources to support OWR operations.

Once DoT becomes the Controlling Agency, they will be responsible for overall command of an OWR. SapuraOMV will provide necessary resources (equipment and personnel, primarily through SapuraOMV's AMOSC membership), as directed by DoT to support their functions.

During a Level 3 spill from petroleum activities and that impacts only Commonwealth waters, DBCA will similarly provide advice on OWR to SapuraOMV IMT through a nominated OWA.

2.5.6 Australian Petroleum Production and Exploration Association (APPEA)

APPEA is the peak national body representing Australia's oil and gas exploration and production industry. It has about 60 full member companies, of which SapuraOMV is a full member. These are oil and gas explorers and producers active in Australia. APPEA also represents about 140 associate member companies that provide a wide range of goods and services to the upstream oil and gas industry. SapuraOMV will engage with other APPEA members to facilitate the Mutual Aid Memorandum of Understanding (MoU) and source assistance from nearby operators.

2.6 Additional Support for IMT (Surge Capacity)

In the event of a large spill requiring resources exceeding those of the SapuraOMV organisation, additional personnel and resources will be obtained from:

- Third party contract services and spot hire.
- Industry organisations (e.g. AMOSC, OSRL).
- APPEA Mutual Aid MoU.

Additional resources will be under the control of the relevant IMT Section Chiefs. An indication of the potential positions and delegation of responsibilities that may occur in a large spill scenario are described in **Appendix B**.

2.7 IMT Activation

The activation of the SapuraOMV incident management response is on the basis of the Level of a spill. The IMT is activated for any spill that cannot be controlled using onsite resources (i.e. Levels 2 and 3). For a Level 3 spill the IMT and CMT are activated and the IMT will typically continue to control the response with the CMT managing its defined responsibilities (see **Section 2.2** SapuraOMV Response Model).

As described previously in **Section 2.4** (Internal Emergency Response Activation Procedure), contact numbers of IMT personnel are listed in SapuraOMV's Emergency Contact List per Annex 1 of the Incident Management Plan (AU-HS-PLN-002-1.0), which is updated and distributed to all relevant parties. Also refer to the Notification Plan in **Section 3.2**.

A range of mutual support agencies will be invited to the IMT at the start of an incident. The DoT will attend to the spill in State waters as described in **Sections 1.8.2** and **2.5.4**. Refer to the Notification Plan in **Section 3.2** for the internal and external notification procedure in the event of a Level 2 or Level 3 spill incident.

3. Immediate Actions

Immediate actions for a Level 3 loss of well control spill have been planned in this section to expedite spill response by the IMT. These actions are to be undertaken while the Incident Action Plan (IAP) is updated during the subsequent 'Ongoing Response' (**Section 4**). Immediate actions to be executed by the IMT include:

- Gain situational awareness of the incident (**Section 3.1**).
- Execute the Notification Plan (**Section 3.2**).
- Initiate Source Control Plan (**Section 3.3**).
- Initiate the Monitor and Evaluate Plan (**Section 3.4**).
- Initiate the Scientific Monitoring Plan (**Section 3.5**).

3.1 Incident Situational Awareness

3.1.1 Information Acquisition

To review the applicability of response strategies within this OPEP to an actual Level 3 spill incident's characteristics, and to conduct a NEBA to ensure impacts of selected response strategies are ALARP, the IMT must initially gain situational awareness by obtaining information from the field immediately after activation. Responsibility for collection of site information at the location of the spill will reside with the On Scene Commander for a Level 3 spill. This information needs to address the following questions:

- Is the crude oil similar to the oil spill modelling analogue?
- What is the expected behaviour of the crude oil that has been spilled?
- How much crude oil has been spilled?
- What is the spill source and is it under control?
- Where is the spill and its trajectory?
- Is there anything in the path of the predicted spill trajectory?
- Can the spill be approached or are there safety concerns?
- Can the spill be contained?
- Can the spill be dispersed?
- Will shoreline impacts occur and clean-up be required?
- Will wildlife be affected and require response?
- What are the wind and sea state conditions?

3.1.2 Classification of Spill Level

Following information acquisition (**Section 3.1.1**), the spill level will be classified via **Table 3-1** to gauge a proportionate response. Where doubt exists over the severity or appropriate response to spill event, the On Scene Commander (Vessel Master) is to discuss the situation with the IC. **The principle of prudent over-reaction and rapid de-escalation applies when considering the level of activation as it is easier and usually more effective to scale down an over-reaction than to ramp up an under-reaction.**

Table 3-1 Guideline to determine crude oil spill level and response

<table>
<tr><th colspan="2">Level 1 Spills</th></tr>
<tr><th colspan="2">Small spills up to 10 tonnes (>0 - ~70 bbl, >0 - ~10 m^3)</th></tr>
<tr><td>Possible Scenario</td><td>Recovery of reservoir fluid samples to surface, and spillage of these coincides with leak in surface containment allowing crude oil to be spilt to the sea.</td></tr>
<tr><td>Worst Case Credible Volume</td><td>0.25 bbl</td></tr>
<tr><td>Resourcing Requirements</td><td>As described in MODU SOPEP</td></tr>
<tr><td>Description</td><td>• Incident can be controlled with onsite resources (immediate response and containment).
• Any spill into marine waters rapidly dissipates.
• Low danger of explosive vapours.
• No potential impact to environmental sensitive areas and/or local communities.
• Unlikely any media interest.</td></tr>
<tr><th colspan="2">Level 2 Spills</th></tr>
<tr><th colspan="2">Spills between 10 and 1,000 tonnes (>~70-~7,000 bbl, >~10 - ~1,000 m^3)</th></tr>
<tr><td>Possible Scenario</td><td>Unobserved well kick leads to a loss of primary well control and subsequent flow of hydrocarbons to surface. Hydrocarbons observed at the rotary table are diverted overboard. Activation of secondary well control at this point is successful in controlling the flow of hydrocarbons, and the well is circulated with increased mud weight to regain primary well control.</td></tr>
<tr><td>Worst Case Credible Volume</td><td>200 bbl</td></tr>
<tr><td>Resourcing Requirements</td><td>As described in MODU SOPEP, AMOSPlan and NatPlan, possibly WAOWRP and PROWRP, and if the spill enters State waters WA State Hazard Plan-MEE and external services contracting strategy (Section 6.2).</td></tr>
<tr><td>Description</td><td>• Incident cannot be controlled solely by use of onsite resources and requires additional support and resources to manage the spill.
• Risk of fire or explosion.
• Potential for additional release.
• Potential impact to environmentally sensitive areas and/ or local communities.
• Spill extends beyond spill source site.
• Local / national media attention.</td></tr>
<tr><th colspan="2">Level 3 Spills</th></tr>
<tr><th colspan="2">Spills >1,000 tonnes (>~7,000 bbl, >~1,000 m^3)</th></tr>
<tr><td>Possible Scenario</td><td>Unobserved well kick leads to a loss of primary well control and subsequent flow of hydrocarbons to surface. Activation of secondary well control at this point fails, resulting in uncontrolled flow of hydrocarbons to surface.</td></tr>
<tr><td>Worst Case Credible Volume</td><td>345,014 m^3</td></tr>
<tr><td>Resourcing Requirements</td><td>As described in MODU SOPEP, AMOSPlan and NatPlan, possibly WAOWRP and PROWRP, and if the spill enters State waters, WA State Hazard Plan-MEE, and external services contracting strategy (Section 6.2).</td></tr>
<tr><td>Description</td><td>• Incident cannot be controlled solely by use of onsite resources and requires additional support and resources to manage the spill, including internation resources (e.g. OSRL, Wild Well Controll).
• Risk of fire or explosion.
• Potential for additional release.
• Potential impact to environmentally sensitive areas and/ or local communities.
• Spill extends beyond spill source site.
• Local / national / international media attention.</td></tr>
</table>

3.2 Notification Plan

Figure 3-1 shows the SapuraOMV notification procedure in the event of a Level 2 or Level 3 crude oil spill. The On Scene Commander (OSC) is responsible for activating the available on-site initial response for all spills. The IC (or delegate) is responsible for subsequent activations and notifications on the basis of the spill circumstances. Notifications will include:

- All known material information and circumstances regarding the incident.
- Details of any action(s) taken to avoid or mitigate any adverse environmental impacts from the incident.
- Details of any corrective action(s) that has been taken (or proposed) to prevent a similar reportable incident.

The environmental performance outcome, performance standard and measurement criteria for the Notification Plan are provided in **Table 3-2**. Key SapuraOMV roles, and regulator and spill response organisations contact details are provided in **Table 3-3**.

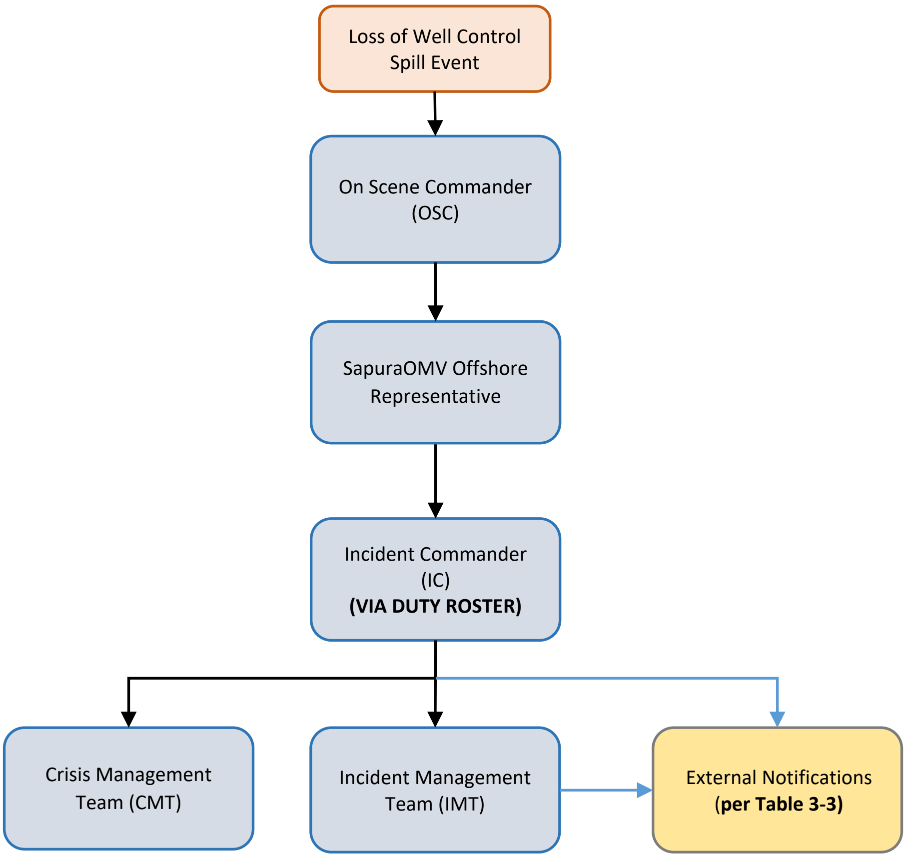

Figure 3-1 Summary of internal and external spill notification procedure

Table 3-2 Performance criteria for spill notifications

Environmental Performance Outcome	Performance Standard	Measurement Criteria
Organisations are informed of the incident and the response arrangements within regulatory and this OPEP's stipulated timeframes.	Undertake communications in accordance with the Notification Plan.	• Communications records. • Incident log. • Applicable notifications within nominated timeframes.

Table 3-3 Notification plan contact details

From	To	Description	Type	Timing
Internal SapuraOMV Notifications				
SapuraOMV Offshore Representative	On-duty Incident Commander (IC)	Notify IC of incident and provide preliminary situational awareness info.	Verbal. Written – Initial Incident Notification Form	ASAP
IC (or delegate)	IMT (via SapuraOMV Duty Roster)	Activate IMT.	Verbal.	ASAP
IC (or delegate)	CMT (via SapuraOMV Duty Roster) KL Duty Manager +60 12 204 3229	Activate (Level 3) or inform (Level 2) CMT.	Verbal.	ASAP or within 1 hour of IMT activation.
External Notifications (*in order of required timing*)				
IC (or delegate)	AMOSC 24 hr number: +61 438 379 328	Industry resource for OPEP implementation (personnel, equipment, plant). Additional resources and personnel will be requested as required via AMOSC through the AMOSPlan arrangements for access to personnel and equipment.	Verbal and written activation via the Service Contract.	ASAP after incident identification.
IC (or delegate)	WWC +1 281 784 4700	Industry service provider for source control of well blowout.	Verbal.	ASAP after incident identification.
IC (or delegate)	OSRL +65 6266 1566 (Singapore Duty Manager) +65 6266 2312 (Singapore Emergency Fax) dutymanagers@oilspillresponse.com	Industry resource for OPEP implementation.	Verbal. OSRL Mobilisation Authorisation Form.	ASAP after incident identification.
IC (or delegate)	NOPSEMA (if reportable incident) +1 300 674 472 submissions@nopsema.gov.au	Jurisdictional Authority for all non-vessel spills in Commonwealth waters (i.e. LOWC spills). Requirement to submit regulatory report. notify NOPSEMA for spills >80L (cc WA Department of Mines, Industry Regulation and Safey (DMIRS) at: petroleum.environment@dmirs.wa.gov.au).	Verbal.	As soon as practicable and no later than 2 hrs after incident identification.
			Written notification.	As soon as practicable after oral notification.
			Written report (FM0831- http://www.nopsema.gov.au/environmental-management/notification-and-reporting/).	As soon as practicable, but within 3 days of incident identification.

From	To	Description	Type	Timing
IC (or delegate)	AMSA (Rescue Coordination Centre) +1 800 641 792 (24 hrs, in Australia) + 61 2 6230 6811 (24 hrs, outside of Australia) *Do not use this number when testing notification plan.*	Legal requirement to notify in the event of any spill of oil to sea. Notification and request for mobilisation of NatPlan resources. Jurisdictional Authority and Controlling Agency for all spills from ships in Commonwealth waters.	Verbal.	As soon as practicable and no later than 2 hrs after incident identification.
			POLREP (i.e. pollution report) (https://amsa-forms.nogginoca.com/public/polrep.html) .	
IC (or delegate)	APPEA Australian Petroleum Production and Exploration Association (APPEA) Level 4, 190 St George's Terrace Perth WA 6000 Phone: 08 9426 7200 Fax: 08 9321 9778 perth@appea.com.au	SapuraOMV will request APPEA to engage with other APPEA members to facilitate the Mutual Aid MoU and source assistance from nearby MODUs.	Verbal.	ASAP and within 3 hours of incident identification.
Operations Section Chief (or delegate)	WA DoT Maritime Environmental Emergency Response (MEER) Duty Officer 08 9480 9924 (24 hrs) marine.pollution@transport.wa.gov.au	HMA for responses in WA State waters to spills originating in Commonwealth waters. Requirement to submit POLREP for any spill so WA State response agencies can be alerted if required.	Verbal.	As soon as practicable and no later than 2 hrs of becoming aware that spill is predicted to enter State waters.
			Written WA POLREP form (Marine Pollution Report (https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-PollutionReport.pdf).	As soon as practicable after verbal notification if spill enters or is predicted to enter State waters.
			Written WA SITREP form (Marine Pollution Situation Report (https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-SituationReport.pdf).	If requested, within 24 hours of spill entering or predicted to enter State waters.

From	To	Description	Type	Timing
Operations Section Chief (or delegate)	Commonwealth Director of National Parks 0419 293 465 (24 hour Marine Compliance Duty Officer)	Responsible for Australian (Commonwealth) Marine Parks. The notification should include: • Titleholder details • Time and location of the incident (including name of marine park likely to be affected) • Proposed response arrangements as per this OPEP (e.g. dispersant application, containment and recovery) • Contact details for the response coordinator	Verbal.	As soon as practicable and within 3 hours of spill entering or predicted to enter a Commonwealth Marine Park.
Operations Section Chief(or delegate)	WA Department of Primary Industry and Regional Development (DPIRD) - Fisheries Senior Management Officer Fisheries Certification/ Biodiversity (08) 9203 0281 (Primary Contact) 0447 453 677 (Primary Contact) (08) 9203 0281 (Secondary Contact) 0427 234 449 (Secondary Contact) DPIRD Spill Response Officer on 0433 151 567 environment@fish.wa.gov.au	State fisheries department – primary contact for all fishermen.	Verbal and written.	Within 24 hours of spill reaching State waters.
Operations Section Chief (or delegate)	WA Department of Biodiversity, Conservation and Attractions (DBCA) 08 9219 9108 State Duty Officer (Oiled Wildlife Response)	Provision of advice and support for Oiled Wildlife Response and/ or oiling of shorelines/ waters managed by DBCA.	Verbal.	As soon as practicable if potential for oiled wildlife and/ or oiling of DBCA managed water/ shorelines.
IC (or delegate)	National Offshore Petroleum Titles Administrator (NOPTA)	Requirement to notify as per Guidance Note (N-03000-GN0926) Notification and Reporting of Environmental Incidents.	Written report.	Within 7 days of the initial report being submitted to NOPSEMA.
IC (or delegate)	Department of Mines, Industry Regulation and Safety (DMIRS)	Requirement to notify as per Guidance Note (N-03000-GN0926) Notification and Reporting of Environmental Incidents.	Written report.	Within 7 days of the initial report being submitted to NOPSEMA.

From	To	Description	Type	Timing
IC (or delegate)	Department of Agriculture, Water and the Environment (DAWE) Phone: +61 2 6274 1111 epbcmonitoring@environment.gov.au	Responsible for administration of EPBC Act in Commonwealth waters and to be notified if spill threatening wildlife in Commonwealth waters. This allows for timely response and for DAWE to provide an informed response to enquiries from media and stakeholders.	Written.	ASAP and within 7 days if spill incident injures of kills one or more of the following: • EPBC list threatened, migratory and/or marine species. • Member of EPBC listed Threatened Ecological Community (TEC) • Cetacean.
IC (or delegate)	Department of Industry, Science, Energy and Resources (DISER) +61 2 6213 6000 opicc@industry.gov.au	Lead agency in the event of an incident requiring coordinated strategic response from Government under the Offshore Petroleum Incident Coordination Framework; responsible for activating the OPICC (if required) and for liaison with other agencies, including DFAT in the event a MODU spill is likely to impact another country.	Verbal or written	As soon as practicable if spill exceeds SapuraOMV first strike capability and/or response requires State or Commonwealth government support.
Operations Section Chief (or delegate)	Department of Foreign Affairs and Trade (DFAT) WA State Office Level 25, Exchange Tower Sherwood Court (off St Georges Terrace) Perth WA 6000 (08) 9231 4499 Dfat.wa@dfat.gov.au	Responsible for Australia's international notification obligations and coordinating official communication between the Government of Australia and any foreign government affected by a spill in Australian waters.	Verbal and written.	As soon as practicable if spill predicted to enter foreign waters, including the waters within the Timor-Leste and Indonesian agreement/treaty zones.
Operations Section Chief (or delegate)	Port Authority(ies) Port authorities details available at: https://www.transport.wa.gov.au/Freight-Ports/port-authorities.asp	Responsible for maintaining water quality and the movement of vessels in Port waters	Verbal	As soon as practicable if spill predicted to enter any Port waters

3.3 Source Control Plan

The initial and highest priority response to a spill incident is to prevent or limit further loss of hydrocarbons into the marine environment. This will only be attempted if the safety of personnel is not compromised and the source control activity does not cause any further risk or impact to the environment. In most circumstances, the net benefit of source control outweighs the risks and impacts from further hydrocarbons being released.

Figure 3-2 illustrates an overview of the Source Control Plan for a Level 3 spill (**Table 3-4**) and **Figure 3-3** provides the timeline for its implementation. The Source Control Plan will be supported by a Well Containment Plan (WCP) (see **Appendix F** for outline of contents) and contains additional high level IMT guidance (Source Control Emergency Response Plan). For a Level 3 spill due to a loss of well containment, SapuraOMV will be the controlling agency for the source control response.

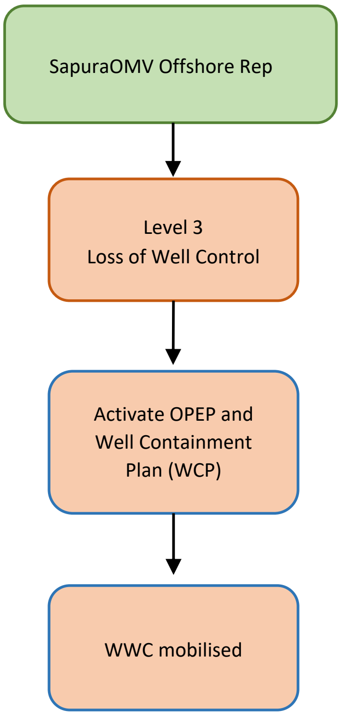

Figure 3-2 Overview of source control plan

Table 3-4 Source control plan for Level 3 crude oil spill

Source Control Plan: Loss of Well Control			
Initiation Trigger	Notification of a spill incident from a loss of well control.		
Aim	Safely re-establish primary well control to minimise hydrocarbon releases to the marine environment.		
Procedure	**Required Timeframe and Action (if safe)**	**Responsible**	**Tick When Complete**
	Day 0 – Activate APPEA Mutual Aid MoU to source assistance from nearby MODU or MODU Mobilisation Plan if no MOU-MODU in Australia. Activate AMOSC, OSRL and Wild Well Control (WWC).	IC	◻
	Day 0 – Request Subsea Dispersant System, Debris Clearance Tools and Capping Stack Equipment along with suitable vessels for installation/operations.	Source Control Section Chief (or delegate)	◻

	By day 5 – Carry out rapid dispersant efficacy assessment via surface application trial: Determine if released oil amenable to dispersant (control measure for subsea dispersant system response) with assessment evaluated on basis of operational study OS1 (Hydrocarbon Surveillance and Tracking) and scientific study SM02 (Dispersant Effect on Subsurface Concentrations). Forecasting of environmental benefit and safety hazard reduction of subsea dispersant application at wellhead to be carried out via operational study OS2 (OSTM).	Operations Section Chief (or delegate)	□
	By day 16 – If oil amenable to dispersant and ROV observations confirm suitable release (moderate to high energy exit velocities) then establish subsea dispersant system as a response strategy (if safe to do so, and material environmental benefit forecasted): Refer to **Section 4.4** for response arrangements associated with this secondary response strategy to: • Mitigate the potential safety risks over the well for debris removal and capping stack operations. • Reduce environmental and socioeconomic risks/impacts associated with surface oil and shoreline loading.	Source Control / Well Containment Team Leader (or delegate)	□
	By day 7 –Attempt emergency BOP intervention primary response strategy (if safe to do so): Attempt actuation of BOP with ROV (or subsea accumulator package, if relevant) via the manual intervention circuit.	Source Control / Well Containment Team Leader (or delegate)	□
	By day 21 – Debris removal for capping stack deployment: Debris clearing equipment from Wild Well Control (WWC) on shared standby.	Source Control / Well Containment Team Leader (or delegate)	□
	By day 28 –Capping stack available to be deployed: A 28 day deployment period for the well capping equipment considered a conservative estimate.[1] Capping stack to be sourced from WWC from Singapore and/or Aberdeen stockpiles (maintained in "ready deploy" status).	Source Control / Well Containment Team Leader (or delegate)	□
	By day 77 – Relief well drilled – Casing and wellhead equipment available for a relief well with dedicated standby casing supplies via MITO, additional wellhead equipment via Dril-Quip. In addition, casing required is widely used by Australian Titleholders, with stockpiles maintained in Australia accessible via APPEA MoU provisions.	Source Control / Well Containment Team Leader (or delegate)	□

	Resource	Available From: (Refer to Section 6.2)
Resources Required	Support vessel(s) with ROV(s)	Two to four support vessels available immediately. Additional vessels via Mutual Aid MoU or vessel brokers / direct. Available unit listing maintained by vessel brokers.
	Secondary MODU	A MODU may be sourced under direct contract or via the Mutual Aid MoU to facilitate the transfer of drilling units and well site services between operators in Australian administered waters to overcome emergency conditions.
	Relief well casing and wellhead	Relief well casing and wellhead pre-arranged.
	ROV(s)	Pre-drill survey of relief well. Supplier(s) as per the external services contracting strategy (if necessary given existing information on hand) (**Section 6.2**).
	Subsea intervention tool system	WWC
	Dispersant	AMOSC stockpiles AMSA stockpiles OSRL stockpiles

[1] A capping stack may be feasible to stop (or reduce) the spill. Less than 21 days is estimated for the capping stack to be tested and to be mobilised to the release site from Singapore (per WWC Logistics Plan, incorporated into Source Control Emergency Response Plan).

<table>
<tr><td rowspan="3"></td><td>Debris clearing equipment and ROV(s)</td><td colspan="2">WWC</td></tr>
<tr><td>Well control personnel</td><td colspan="2">WWC</td></tr>
<tr><td>Capping stack</td><td colspan="2">WWC</td></tr>
<tr><td>Termination Criteria</td><td colspan="3">Direct observation: Well control has been permanently re-established with no hydrocarbons flowing or leaking from the well.</td></tr>
<tr><td>Key Response Documents</td><td colspan="3">SapuraOMV Well Containment Plan (WCP).
Well Operations Management Plan (WOMP).
Kanga-1 Exploration Well OPEP for a Level 3 Spill – This document.</td></tr>
<tr><td>Environmental Performance Outcome</td><td colspan="3">Contain the unplanned release of hydrocarbons from a Level 3 spill.</td></tr>
<tr><td>Control Measure</td><td colspan="2">Performance Standard</td><td>Measurement Criteria</td></tr>
<tr><td rowspan="7">Source Control Planning</td><td colspan="2">The SapuraOMV Drilling Manager will ensure that the WCP is developed consistent with IOGP 594 (2019) and endorsed by WWC at least 3 months prior to commencement of the Activity.</td><td>WCP endorsed by WWC at least 3 months prior to commencement of the Activity.</td></tr>
<tr><td colspan="2">WCP details arrangements that ensure source control tasks completed within timeframes in OPEP Figure 3-3, including:
• Initiation of emergency BOP intervention by ROV within 7 days of LOWC
• SSDI capability available onsite (if required) within 16 days
• Mobilisation of debris clearance equipment to site within 21 days
• Deployable capping stack (with suitable vessel) available on site within 28 days
• Relief well drilled and dynamic kill, within 77 days</td><td>WCP demonstrates capability to meet required timelines per Figure 3-3 for well containment activities.</td></tr>
<tr><td colspan="2">Source Control Personnel Resourcing Plan included within WCP:
• Identifies required position/roles for Source Control Team
• Describes personnel sourcing arrangements to assure resourcing capability.</td><td>WCP demonstrates resourcing capability to meet source control personnel requirements for well containment activities.</td></tr>
<tr><td colspan="2">The SapuraOMV Drilling Manager will ensure that regular vessel/MODU availability forecasting is in place at least four months prior to the commencement of the Activity.</td><td>Monthly vessel/MODU availability forecasts for Activity period commence at least four months prior to commencement of the Activity.</td></tr>
<tr><td colspan="2">WCP Logistics Plan addresses:
• Availability of vessel/MODU for the Activity period based on forecasting and live vessel surveillance (via tracking/brokerage) during the Activity
• IMS risk for primary “likely” response vessels.
• Source control personnel mobilisation (including quarantine) arrangements to assure resourcing capability within required timeframes in the event of an incident.</td><td>1. WCP Logistics Plan that incorporates:
• Vessel/MODU availability for Activity period.
• Completed IMS risk assessments
• Mobilisation arrangements/constraints and associated timelines
• Capping Stack deployment feasibility.
2. Live vessel tracking/brokerage software in place.</td></tr>
<tr><td colspan="2">The SapuraOMV Drilling Manager will ensure that an exercise is conducted to test the WCP prior to the commencement of the Activity and that any learnings are fed back into the WCP.</td><td>1. Exercise Report issued.
2. Learnings captured in the Project Tracking Register.</td></tr>
<tr><td colspan="2">The SapuraOMV Drilling Manager will ensure that a contract with WWC remains active throughout</td><td>Executed contract with WWC.</td></tr>
</table>

	the Activity for provision of well intervention services.	
	The SapuraOMV Drilling Manager will ensure that debris removal equipment is available during the Activity on a call-off basis within the required timeframe.	Executed call-off contract for debris removal equipment with WWC.
	The SapuraOMV Drilling Manager will ensure that capping stack is available during the Activity.	Executed contract with WWC.
	The SapuraOMV Drilling Manager will ensure that capping stack Safety Case preparatory works, addressing any relevant learnings from the DISC and industry knowledge on comparable activities, are completed prior to entering the reservoir.	Contract in place with experienced/qualified Safety Case consultancy for completion of Safety Case preparatory works after primary MODU safety case is issued and prior to entering the reservoir.
	Relief well casing and wellhead pre-arranged prior to the Activity.	Agreement(s) in place.
	Geophysical site survey, mooring analysis and conductor fatigue analysis conducted for relief well location/MODU prior to entering the reservoir that address: • Most onerous MODU mooring • Heaviest feasible BOP.	1. Site survey report incorporating primary and relief well locations. 2. Mooring analysis report. 3. Conductor analysis report.
	Mutual Aid agreement MoU in place with other operators to allow use of their MODU, where available, for drilling relief well.	Signed APPEA Mutual Aid MoU.
	In the event that no MoU-MODUs are forecast to be in Australia during Activity, MODU Mobilisation Plan developed at least 3 months prior to the Activity, that: • Identifies suitable alternative MODU(s) • Evaluates reactivation/mobilisation requirements, including tow or heavy lift vessel availability and associated Safety Case and IMS approvals • Demonstrates capability to meet WCP timelines for relief well drilling*.	MODU Mobilisation Plan identifies suitable MODU, and associated Safety Case requirements, importation/reactivation requirements and anticipated timelines.
	IC initiates WCP within 3 hours of loss of well control notification.	Incident response logs.
Refer to **EP Section 8.8** for Environmental Performance Outcomes, Performance Standards and Measurement Criteria relating to potential environmental risks from implementation of oil spill response.		

*Note: It is currently expected that at least two and likely additional suitable MODUs will be on long term operational contract in Australian waters at the time of the Activity. MODUs operating within southeast Asia waters could also be mobilised to site within required timeframes. In the extremely unlikely event that no suitable MODU was forecast to be available in Australian waters or the broader region that could be mobilised within WCP timelines, the MOC process (EP Section 9.4.7) will be initiated, and additional/alternative measures considered to ensure risks continue to be managed to ALARP.

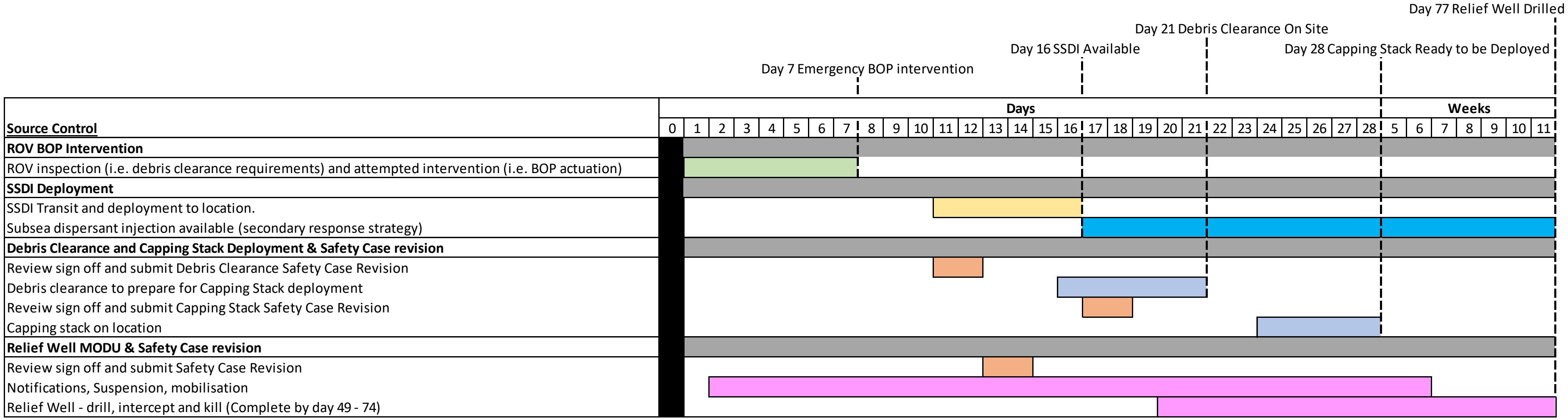

Figure 3-3 Source control plan timeline[2]

[2] Latest dates for each task in the timeline represent worst case timings.

3.4 Monitor and Evaluate Plan (Operational Monitoring)

In the event of a oil spill incident due to a loss of well control, the Operational and Scientific Monitoring Program (OSMP) will be implemented to inform spill response (the monitor and evaluate plan also referred to as operational monitoring) and to evaluate the impacts to and recovery of the marine environment (scientific monitoring, see **Section 3.5**). The overall structure of SapuraOMV's OSMP is illustrated in **Figure 3-4**.

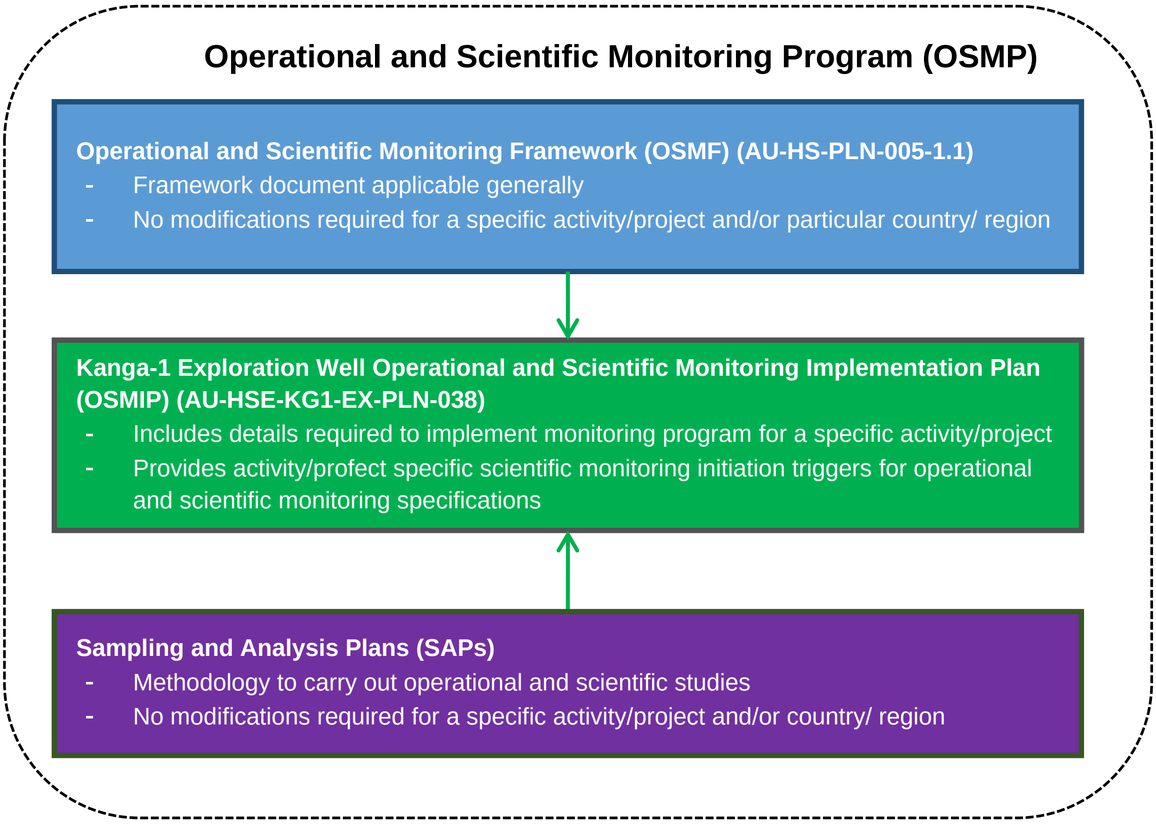

Figure 3-4 Overview of structure of OSMP

For a Level 2 or Level 3 crude oil spill, the monitor and evaluate plan (operational monitoring) is initiated by the IMT except for available onsite plant (e.g. available vessels, aircraft and/or oil spill tracking buoys) for immediate surveillance that is initiated by the On Scene Commander (OSC). The monitor and evaluate plan for a Level 3 oil spill is shown schematically in **Figure 3-5**. The overall aim of the operational monitoring is to:

- Understand the behaviour of the spill.
- Maintain situational awareness and to update the incident action plan (IAP, **Section 4.1**) and to inform the IMT.
- Provide ongoing information for the assessment of the response strategies.
- Provide ongoing information for scientific monitoring planning to assess environmental impacts from the spill.

Accurate and ongoing operational monitoring information is required to plan and to maintain appropriate response arrangements through:

- Forecasting environmental receptors at risk of impact.
- Identifying environmental receptors that have been impacted.
- Informing response escalation and de-escalation processes.

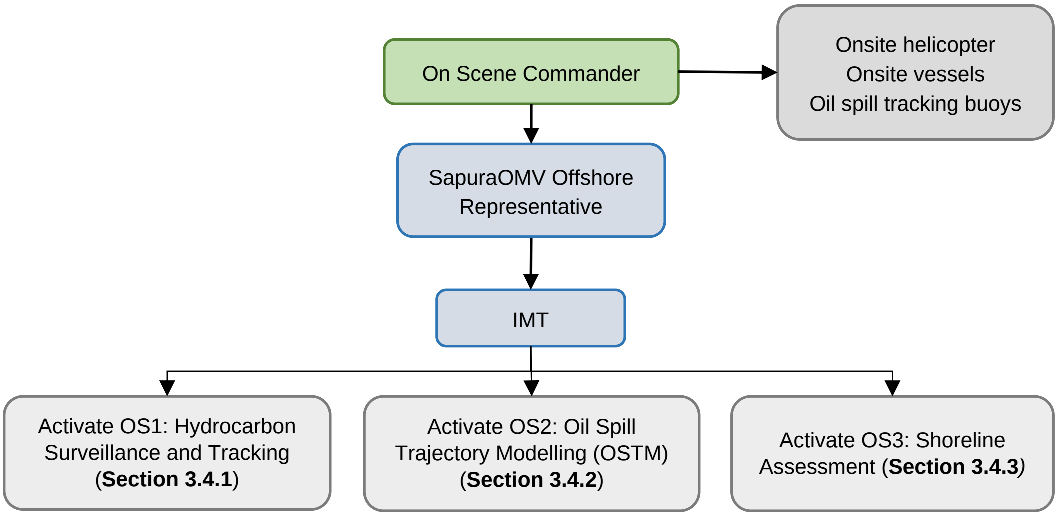

Figure 3-5 Overview of Level 3 spill monitor and evaluate plan

The monitor and evaluate plan for a Level 3 spill is comprised of the following three operational monitoring studies:

- Operational Monitoring Study (OS) 1: Hydrocarbon Surveillance and Tracking.
- OS2: OSTM.
- OS3: Shoreline Assessment.

The Kanga-1 Exploration Well OSMIP (Doc No AU-HSE-KG1-EX-PLN-038) provides performance objectives, performance standards and measurement criteria for each of the operational monitoring studies. The scientific monitoring plan is used to assess impacts and subsequent recovery of environmental receptors from the spill and is described in **Section 3.5**.

3.4.1 OS1: Hydrocarbon Surveillance and Tracking

Surveillance (aerial, vessel, tracking buoys and/ or satellite imagery) commences as instructed by the IMT (through IC or delegate) or On Scene Commander (OSC) when conditions are conducive (e.g. safety).

3.4.1.1 Oil Spill Tracking Buoys

Oil spill tracking buoys track a spill to estimate its trajectory to inform response planning. Two tracking buoys will be stored in the field during the Activity, with at least one on the MODU and the other on a support vessel. Monitoring of the buoys locations will be undertaken through arrangements with AMOSC, who will provide an online web-based tracking capability directly to the IMT. The need for additional tracking buoys will be assessed and these will be procured from other sources if escalation of this operational monitoring activity is needed.

3.4.1.2 Satellite Imagery

Satellite imagery will be used to identify surface oil distributions and to track surface oil movements. Satellite imagery service will be accessed by the IMT via AMOSC's Konsberg Satellite Service (KSAT) contract and/or with OSRL's MacDonald, Dettwiler and Associates Ltd. (MDA) satellite imagery contract.

Satellite imagery may also be used to track any vessels in the area that are not participating in the Automatic Identification System (AIS) system, such as smaller fishing vessels.

3.4.1.3 Aerial and Vessel Surveillance

Aerial surveillance will be the preferred method while vessel surveillance will be undertaken opportunistically. Initial observations will be provided by the MODU and/or support vessel crew, as well as aircraft of opportunity, including a helicopter, if available. At least two support vessels will be contracted with at least one on site at all times, during drilling operations. GPS coordinates and date/ time observations will be recorded to allow estimates of the spill extent. The thickness of slick(s) will be estimated by trained observers with the Bonn Agreement Oil Appearance Code (BAOAC) (Bonn Agreement 1998).

Records of marine fauna sightings and *ad hoc* notes from trained marine fauna observers (MFOs) (once mobilised after a spill) will be collated. Completed logs will be provided to the IMT upon shift changes or return to port/airport.

Aerial surveillance is preferred over vessel surveillance because of the greater spatial coverage of observations, though not as wide as coverage from satellite imagery. Trained observers in aircraft on a call-off arrangement will comprise the aerial surveillance team. The surveillance aircraft will be available at short notice from SapuraOMV IMT. Trained observers will be sourced from AMOSC. Observations will be recorded and filed with supporting photographic images or video records. GPS coordinates and date/time observations are to be recorded and archived to allow for estimates of the spill extent.

Table 3-5 OS1: hydrocarbon surveillance and tracking for a loss of well control

<table>
<tr><th colspan="4">OS1: Hydrocarbon Surveillance and Tracking</th></tr>
<tr><td>Initiation Trigger</td><td colspan="3">Notification of a spill incident from a loss of well control.</td></tr>
<tr><td>Aim</td><td colspan="3">Tracking buoy, satellite imagery, opportunistic and planned vessel and aerial surveillance used to determine the distribution of the slick, validate OSTM, monitor the effectiveness of response strategies on the slick, and identify the presence of marine fauna in the response area.</td></tr>
<tr><td rowspan="11">Procedure</td><td>Required Timeframe and Action</td><td>Responsible</td><td>Tick if Complete</td></tr>
<tr><td>30 minutes – Surveillance with contracted onsite support vessel(s) if not utilised for other tasks (e.g. evacuation of personnel).</td><td>OSC</td><td>□</td></tr>
<tr><td>1 hour – Launch tracking buoys from MODU or support vessel.</td><td>OSC</td><td>□</td></tr>
<tr><td>3 hours – Aerial surveillance by aircraft requested.</td><td>IMT</td><td>□</td></tr>
<tr><td>3 hours – Request initiation of satellite imagery surveillance.</td><td>IMT</td><td>□</td></tr>
<tr><td>3 hours – Request for mobilisation of trained vessel-based spill and marine fauna observers.</td><td>IMT</td><td>□</td></tr>
<tr><td>24 hours – Initial aerial (and vessel) surveillance observations carried out with untrained observers.</td><td>IMT</td><td>□</td></tr>
<tr><td>24 hours – Initial satellite imagery to IMT within 24 hours.</td><td>AMOSC</td><td>□</td></tr>
<tr><td>48 hours – Initial aerial (and vessel) surveillance observations carried out with trained observers.</td><td>IMT</td><td>□</td></tr>
<tr><td>Ongoing – Tracking buoy location provided via online web-based portal.</td><td>AMOSC</td><td>□</td></tr>
<tr><td>Ongoing – Vessel and aerial observations regularly recorded in observer log and reported to the IMT:
• Time, date and person recording the log
• Weather and sea-state
• Vessel or aircraft location and presence of oil
• Appearance of oil (using BAOAC)
• Any photos, sketches and videos
• Presence of any oiled or non-oiled wildlife</td><td>Vessel Observer</td><td>□</td></tr>
</table>

	• Presence of any marine fauna and actions taken to adhere to Part 8 of the EPBC Regulations 2000, Part 5 of the Biodiversity Conservation Regulations 2018 (in WA state waters) and the Australian Guidelines for Whale and Dolphin Watching (NRMMC, 2005[3]).		
	Ongoing – Provision of aerial/vessel observer logs to OSTM provider and monitoring leaders within 3 hours of receipt.	IMT	◻
	Ongoing • Request *ad hoc* satellite imagery as required. • Provision of satellite imagery data to OSTM service provider within 4 hours of receipt.	IMT	◻

	Resource	Available From: (Refer to Section 6.2)
Resources Required	Tracking buoys	AMOSC.
	Support vessels	Supplier(s) as per the external services contracting strategy (**Section 6.2**).
	Helicopter	
	Fixed wing aircraft	
	Oil spill observers	AMOSC (core group through AMOSPlan). AMSA (National Response Team [NRT] through NatPlan).
	Ad hoc satellite imagery	AMOSC (via KSAT) and/or OSRL (via MDA).

Escalation and Maintenance of Response	SapuraOMV will maintain an adequate level of surveillance to inform response planning and to gauge the effectiveness of response measures throughout an incident. SapuraOMV is capable of contracting on an as needs basis tracking buoys, vessels, aircraft and oil spill observers to escalate and to maintain surveillance of the spill over the duration of an incident. Refer to the external services contracting strategy in **Section 6.2**.
Termination Criteria	Oil source controlled. Surface water does not have an oiled appearance, specifically ‘silver/grey’ as per the Bonn Agreement Oil Appearance Code (BAOAC).
Key Response Documents	• The OS1 SAP provides guidance and a checklist for the IMT to initiate surveillance of a spill. • Operational and Scientific Monitoring Implementation Plan (OSMIP). • Operational and Scientific Monitoring Framework (OSMF).
Environmental Performance Outcome	Provide IMT and regulatory authorities with reliable and timely tracking buoy location and surveillance observations to inform response planning and operations.

Control Measure	Performance Standard	Measurement Criteria
Satellite Tracking Buoys	2x satellite tracking buoys deployed from MODU/support vessel within 1 hour of spill.	• MODU/ vessels storage logs confirm tracking buoys on-board. • Emails between IMT and AMOSC confirm commencement of tracking. • Incident log indicates tracking buoys deployed. • Operational web-based buoy tracking portal. • Archive of satellite tracking buoy data.
Vessel Surveillance	Surveillance with contracted support vessel(s) undertaken within 30 minutes (if it is available for surveillance activities) of spill notification.	• IMT logs. • Vessel logs. • Completed OS1 vessel observation sheets or similar reporting.
	Vessel surveillance with untrained observers within 24 hours of IMT activation.	
	Ongoing vessel surveillance information regularly available until termination criteria met.	

[3] NRMMC (Natural Resource Management Ministerial Council). (2005). The Australian National Guidelines for Whale and Dolphin Watching.

Aerial Surveillance	Aerial surveillance requested by IMT within 3 hours and initial survey within 24 hours (daylight permitting) with untrained observers and 48 hours with trained observers.	• IMT logs. • Flight logs. • Arrangement with AMOSC for core group access.
	Aerial surveillance observations made available to IMT within 1 hour of completion of flight.	• IMT logs. • Completed OS1 aerial observation data sheets or similar reporting. • Flight logs.
	Provision of aerial surveillance observations to OSTM service provider within 4 hours of receipt.	• Emails between IMT and OSTM service provider • Incident log indicates date and time of aerial surveillance observations sent to OSTM provider
Satellite Imagery	Satellite imagery provided *ad hoc* (as required) to IMT at frequency requested to track spill trajectory.	• Emails between IMT and AMOSC and/or OSRL. • Incident log. • Archive of satellite imagery.
	Provision of satellite imagery to OSTM service provider within 4 hours of receipt.	• Emails between IMT and OSTM service provider • Incident log indicates date and time of satellite imagery sent to OSTM provider
Refer to **EP Section 8.8** for Environmental Performance Outcomes, Performance Standards and Measurement Criteria relating to potential environmental risks from implementation of oil spill response.		

3.4.2 OS2: Oil Spill Trajectory Modelling (OSTM)

Oil Spill Trajectory Modelling (OSTM) is used to predict the transport and fate of hydrocarbon spills into the future (3-4 days) to inform response planning (operational) and potential impacts/risks to environmental receptors (scientific).

Table 3-6 OS2: OSTM for a loss of well control

OS2: Oil Spill Trajectory Modelling			
Initiation Trigger	Notification of a spill incident from a loss of well control or if OS1 predicts exposure to sensitive areas/ receptors.		
Aim	OSTM to forecast crude oil distributions (3-4 days into the future) to inform response planning (operational) and to inform potential impacts/risks to environmental sensitivities (scientific).		
Procedure	**Required Timeframe and Action**	**Responsible**	**Tick if Complete**
	Within 3 hours – OSTM initiated through notification of OSTM service provider via Modelling Activation Form in **Appendix C**.	IMT	□
	Ongoing – Provide daily OSTM forecasts to inform response planning, to evaluate effectiveness, and to plan operational and scientific monitoring.	IMT	□
	If and when available – Incorporate revised/improved inputs into OSTM forecasts (e.g. improved characterisation of crude oil properties and crude oil discharge estimates from well head).	IMT	□
Resources Required	**Resource**	**Available From: (Refer to Section 6.2)**	
	OSTM Service Provider	Supplier(s) as per the external services contracting strategy (**Section 6.2**)	
Escalation and Maintenance of Response	This response will be escalated (if required) and maintained through contractual assurances with OSTM service provider(s) via the external services contracting strategy to maintain services during an incident scenario.		

Termination Criteria	Oil source is controlled, and OSTM and other Monitor and Evaluate Plan activities predict that no further regions will be affected by the spill.		
Key Response Documents	• OS2 SAP provides guidance and a checklist for the IMT to rapidly initiate OSTM of a spill. • OSMIP. • OSMF.		
Environmental Performance Outcome	Provide IMT and regulatory authorities with reliable and timely OSTM predictions to inform response planning, operations and environmental impact/risk assessment.		
Control Measure	**Performance Standard**	**Measurement Criteria**	
OSTM	OSTM commissioned within 2 hours of OS1 initiation.	• Emails between IMT, and OSTM service provider show date and time of OSTM request • Completed SAP OS2 initiation checklist	
	OSTM continues until spill source is controlled and no further regions affected by the spill.	• IMT access-enabled web portal with quasi-real-time modelling results • OSTM forecast report(s) to IMT	

3.4.3 OS3: Shoreline Assessment

Shoreline assessments will obtain information on the physical and biological character of shorelines prior to potential forecasted oil exposure at priority shorelines to:

- Establish an operational shoreline baseline condition where possible.
- Monitor post-exposure hydrocarbon distributions.
- Characterise the physical and biological character of the shoreline and its amenability to shoreline clean-up.
- Measure the effectiveness of shoreline response measures.

Shoreline assessment team(s) (SAT) will be comprised of a wildlife specialist, a marine scientist and an oil spill response specialist. An assessment of shorelines that are predicted to be potentially oil impacted will be used to evaluate and to prioritise response options.

Table 3-7 OS3: Shoreline assesment for a loss of well control

OS3: Shoreline Assessment			
Initiation Trigger	Notification of a spill incident from a loss of well control or if OS1 or OS2 predicts exposure to shorelines.		
Aim	To obtain information on the physical and biological character of priority shorelines prior to and after exposure to: • Establish an operational baseline condition. • Assess the physical and biological character of the shoreline. • Monitor post-exposure oil distribution. • Provide inputs to NEBAs to guide IMT response planning and scientific monitoring. • Measure effectiveness of shoreline responses.		
Procedure	**Required Timeframe and Action**	**Responsible**	**Tick if Complete**
	Within 3 hours of incident - Shoreline assessments requested/activated by IMT and mobilisation (if required) initiated through DoT.	IMT	☐
	Within 1 day of incident - Request support vessel(s) and initial Shoreline Assessment Team (SAT) personnel (DoT, AMOSC, AMSA, GHD, other contractors) to be mobilised on short notice to the Marine Operations Base.	IMT	☐

	Within 1 week of incident - IMT to assess priority shorelines for initial SAT deployment with information from Operational Monitoring Activities OS1-OS2 and DoT advice.	IMT	□
	If high probability of shoreline contact – SAT team(s) mobilised to priority shorelines via vessel (islands) or 4WD vehicles (mainland) as directed.	IMT	□
	Ongoing - SAT shoreline evaluations provided to IMT on at least a daily basis.	IMT	□

	Resource	Available From: (Refer to Section 6.2)
Resources Required	Support vessels	Supplier(s) as per the external services contracting strategy (**Section 6.2**).
	Support aircraft	
	4WD vehicles	
	Shoreline Assessment Team	DoT, AMOSC, OSRL and other supplier(s) as per the external services contracting strategy (**Section 6.2**).

Escalation and Maintenance of Response	SapuraOMV in conjunction with DoT will maintain an adequate level of shoreline assessment to inform response planning and to evaluate response measures throughout an incident. Contractual arrangements are in place with plant and suitable personnel to participate in SATs with the provision to escalate. The external services contracting strategy in **Section 6.2** also considers the allocation of additional transport vessels or aircraft for SATs from Dampier/Karratha and Exmouth.
Termination Criteria	Oil source is controlled, and OSTM and other Monitor and Evaluate Plan activities predict that no shorelines will be affected by the spill. SAT assessments cease once shoreline response measures are completed (if initiated).
Key Response Documents	• OS3 SAP provides guidance and a checklist for the IMT to rapidly initiate shoreline assessments during a spill. • OSMIP. • OSMF.
Environmental Performance Outcome	Provide IMT and regulatory authorities with reliable and timely shoreline assessments to support and to inform response planning and operations, and environmental impacts/risks from shoreline oiling of a Level 3 spill.

Control Measure	Performance Standard	Measurement Criteria
Shoreline Assessments	Request and start mobilisation of SAT personnel within 3 hours of IMT notification and select shorelines for initial assessment.	• Incident log documenting request for SAT mobilisation preparedness. • NEBA documenting priority shorelines for shoreline assessment. • Incident log documenting mobilisation of SAT teams. • IAPs that incorporate shoreline assessments.
	Daily SAT shoreline assessments provided to IMT.	• Emails between IMT, AMOSC and DoT. • IMT log. • Completed shorelines assessment sheets (or similar). • Archive of satellite images.
	Shoreline assessments available to IMT within 2 hours of completion.	• IMT logs. • Completed data sheets or similar reporting. • Flight/vessel/shoreline logs.
	Shoreline assessments directed by IMT.	• IMT logs. • IAPs. • Shoreline assessment plan/schedule.

* Refer to **EP Section 8.8** for Environmental Performance Outcomes, Performance Standards and Measurement Criteria relating to potential environmental risks from implementation of oil spill response.

3.5 Scientific Monitoring Plan

The Operational and Scientific Monitoring Plan (OSMP) is comprised of an overarching Operational and Scientific Monitoring Framework (OSMF), a Kanga-1 exploration well Activity specific Operational and Scientific Monitoring Implementation Plan (OSIMP), and a library of Sampling and Analysis Plans (SAPs) as described in **Section 3.5**. The Monitor and Evaluate Plan (operational monitoring) is designed to rapidly provide key information to inform/guide response planning and implementation during an incident (**Section 3.4**). In the event of a Level 3 crude oil spill or if operational monitoring of any spill predicts exposure to sensitive areas/receptors, scientific monitoring studies will be initiated immediately to quantify impacts and subsequent recovery from the spilled oil and response activities. Thirteen scientific studies of the OSMP are listed in **Table 3-8** along with their initiation triggers. The OSMIP provides performance objectives, performance standards and measurement criteria for each of the scientific studies.

Table 3-8 OSMP scientific studies

Scientific Study	Initiation Trigger
SM01 Weathering Assessment	Immediately following a Level 3 crude oil spill or if operational monitoring predicts exposure to sensitive areas/ receptors; initiated by the Planning Section Chief (or delegate).
SM02 Dispersant Effects on Subsurface Concentrations	Immediately following the decision to utilise dispersant application as a response measure to combat a Level 3 crude oil spill that is initiated by the Planning Section Chief (or delegate).
SM03 Ecotoxicology	Immediately following a Level 3 crude oil spill or if operational monitoring predicts exposure to sensitive areas/ receptors; initiated by the Planning Section Chief (or delegate).
SM04 Marine Waters	Immediately following a Level 3 or Level 2 crude oil spill or if operational monitoring predicts exposure to sensitive areas/ receptors; initiated by the Planning Section Chief (or delegate).
SM05 Marine Sediments	
SM06 Intertidal and Subtidal Habitats	Immediately following a Level 3 crude oil spill or if operational monitoring predicts exposure to sensitive areas/ receptors; initiated by the Planning Section Chief (or delegate).
SM07 Mangrove Habitat	
SM08 Turtle Nesting	
SM09 Marine Megafauna	
SM10 Marine Avifauna	
SM11 Hydrocarbons in Representative Commercial and Recreational Fish	
SM12 Marine Invertebrates	
SM13 Hindcast Modelling	After cessation of response to a Level 3 crude oil spill; initiated by the SapuraOMV Senior Environmental Advisor (or delegate).

Table 3-9 Scientific monitoring plan for a Level 3 or Level 2 crude oil spill

<table>
<tr><th colspan="6">Scientific Monitoring Plan</th></tr>
<tr><td>Initiation Trigger</td><td colspan="5">Notification of a Level 3 or Level 2 crude oil spill or if operational monitoring of any spill predicts exposure to sensitive areas/receptors.</td></tr>
<tr><td>Aim</td><td colspan="5">Characterise short- (impact) and long- (recovery) term environmental effects from exposure to a spill. Scientific monitoring will also assess if oil spill response strategies have been effective in protecting and/or mitigating environmental sensitivities under threat from an incident.</td></tr>
<tr><td rowspan="5">Procedure</td><th colspan="3">Required Timeframe and Action</th><th>Responsible</th><th>Tick if Complete</th></tr>
<tr><td colspan="3">Within 1 day of the start of Level 3 crude oil spill incident – Activate scientific studies SM01 (Weathering Assessment), SM03 (Ecotoxicology), SM04 (Marine Waters), SM05 (Marine Sediments), SM06 (Intertidal and Subtidal Habitats), SM07 (Mangrove Habitat) and SM08 (Turtle Nesting), SM09 (Marine Megafauna), SM10 (Marine Avifauna), SM11 (Hydrocarbons in Representative Commercial and Recreational Fish) and SM12 (Marine Invertebrates).</td><td>IMT</td><td>□</td></tr>
<tr><td colspan="3">Within 1 day of the start of Level 2 crude oil spill incident – Activate scientific studies SM04 (Marine Waters) and SM05 (Marine Sediments).</td><td>IMT</td><td></td></tr>
<tr><td colspan="3">Ongoing – Evaluate need for initiation of other scientific studies on daily basis if not initiated.</td><td>IMT</td><td>□</td></tr>
<tr><td colspan="3">Ongoing – Implementation of the scientific monitoring program.</td><td>Scientific Monitoring Contractor(s)</td><td>□</td></tr>
<tr><td rowspan="2">Resources Required</td><th>Resource</th><th colspan="4">Available From: (Refer to Section 6.2)</th></tr>
<tr><td>Plant, equipment, personnel</td><td colspan="4">Refer to Sampling Analysis Plans (SAPs) of scientific studies for equipment needs and OSMIP for plant and personnel needs.
Vessel and aerial plant to be sourced from call-off arrangements as per the external services contracting strategy (Section 6.2).
Scientific personnel to be sourced from scientific monitoring supplier(s) as per the external services contracting strategy (Section 6.2).</td></tr>
<tr><td>Escalation and Maintenance of Response</td><td colspan="5">SapuraOMV will maintain an adequate level of scientific monitoring as required to characterise impacts and subsequent recovery from a Level 3 spill. Refer to the external services contracting strategy in Section 6.2.</td></tr>
<tr><td>Termination Criteria</td><td colspan="5">The short- and long-term environmental effects from the spill have been adequately characterised under endorsement by the Scientific Advisory Group (SAG)[4].</td></tr>
<tr><td>Key Response Documents</td><td colspan="5">• Scientific study SAPs provide guidance and a checklist for the IMT to initiate scientific monitoring.
• OSMIP.
• OSMF.</td></tr>
<tr><td>Environmental Performance Outcome</td><td colspan="5">Demonstrated readiness to implement scientific monitoring programs that will identify the extent, severity and duration of environmental impacts in the event of an oil spill incident (including response activities).</td></tr>
<tr><th colspan="2">Control Measure</th><th colspan="2">Performance Standard</th><th colspan="2">Measurement Criteria</th></tr>
<tr><td colspan="2">Scientific Monitoring</td><td colspan="2">Maintain capability to implement scientific monitoring program.</td><td colspan="2">Environmental consultant capability review completed prior to each drilling campaign to demonstrate readiness to implement scientific monitoring studies.</td></tr>
<tr><td colspan="6">Refer to EP Section 8.8 for Environmental Performance Outcomes, Performance Standards and Measurement Criteria relating to potential environmental risks from implementation of oil spill response.</td></tr>
</table>

[4] The SAG provides external review of scientific monitoring reports, and provides guidance regarding scientific monitoring including whether termination criteria have been satisfactorily met.

4. Ongoing Response Arrangements

4.1 Incident Action Plan (IAP)

The IAP describes the ongoing response strategies and its efficient implementation on a strategic and tactical level as selected via an operational NEBA[5].

The initial IAP is to undertake Immediate Actions as set out in **Section 3**.

The SapuraOMV IMT incident action planning process is based on Incident Command System (ICS). A brief overview of the process to develop and update the IAP is illustrated in **Figure 4-1**. This process will be used by the IMT to tailor the response to the Level 3 crude oil spill depending on the behaviour of the spill and effectiveness of the response measures.

Phase 1: Understand the situation

Gather information (Monitor and Evaluate Plan, responder feedback) to gain situational awareness

↓

Phase 2: Establish incident objectives

Update IAP objectives to guide appropriate response measures

↓

Phase 3: Develop the plan

i - Assess current response priorities and suitable response strategies
ii - Assess suitable response strategies by NEBA process
iii - Assess available response resources and need to increase/decrease to meet IAP objectives

↓

Phase 4: Prepare and disseminate the plan

Compile plan and distribute/brief the plan once approved by IC

↓

Phase 5: Execute, evaluate and revise plan

i - Brief the response team with command structures and tasks allocated
ii - Constantly evaluate the response strategies with feedback from onsite teams and information from the Monitor and Evaluate Plan
iii - Following completion of operational phase or new information regarding behaviour of spill, recommence IAP process at phase 1.

Figure 4-1 IAP process

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5 Refer to **Appendix A f**or a description of the strategic NEBA that served as a basis to select primary, secondary and rejected response strategies.

4.2 Shoreline Clean-Up (Secondary Response Strategy)

Shoreline clean-up has been identified as a secondary response strategy in the strategic NEBA for a Level 3 spill (**Appendix A**). Shoreline clean-up operations will occur in State waters and shoreline response activities will be under the control of DoT as the relevant Controlling Agency. SapuraOMV will undertake initial response actions and act as Controlling Agency/Lead IMT until such time as DoT assumes control. SapuraOMV will provide resources and appropriately qualified personnel to support DoT with shoreline clean-up activities.

A number of shoreline types may be impacted by oil, which will require tailored cleaning methods. The most appropriate clean-up method will be assessed and identified by the IMT, DoT and response team members (e.g. AMOSC) in the IAP (**Section 4.1**) at the start of each operational round.

Each shoreline clean-up response activity will be assessed via a NEBA at each potentially impacted sensitive shoreline with inputs from relevant organisations (e.g. DBCA, DoT, AMOSC, AMSA), the Monitor and Evaluate Plan (operational monitoring) information, and known key shoreline sensitivities and receptors as described in the EP and Oil Spill Response Atlas (OSRA). The decision to undertake shoreline clean-up for a particular shoreline segment will be documented within the operational NEBA and incorporated into the IAP if undertaken. The personnel, timeframes and resources detailed in **Section 6.3** represent a worst-case scenario for a Level 3 spill and are to be used as a guide only.

Table 4-1 Shoreline clean-up plan for a Level 3 crude oil spill

<table>
<tr><th colspan="4">Shoreline Clean-Up Plan</th></tr>
<tr><td>Initiation Trigger</td><td colspan="3">Selected as response measure by IMT through IAP process for a Level 3 crude oil spill.</td></tr>
<tr><td>Jurisdictional Authority</td><td colspan="3">DoT</td></tr>
<tr><td>Controlling Agency</td><td colspan="3">DoT
SapuraOMV will act as Controlling Agency/Lead IMT for shoreline clean-up response activities until such time DoT assumes control. SapuraOMV will provide resources and appropriate number of appropriately qualified personnel, to support DoT with shoreline clean-up activities.</td></tr>
<tr><td>Aim</td><td colspan="3">Removal of hydrocarbons from impacted shorelines:
• To accelerate shoreline recovery
• To reduce further impacts to the environment including wildlife and humans
• To reduce re-mobilisation of hydrocarbons to marine waters from the shore due to tides and waves</td></tr>
<tr><td rowspan="4">Procedure</td><td>Required Timeframe and Action when Implemented (if safe)</td><td>Person Responsible</td><td>Tick When Complete</td></tr>
<tr><td>Ongoing - (<u>Consideration of implementation of response strategy</u>) – Implementation of response strategy considered during IAP process.</td><td>IMT</td><td>□</td></tr>
<tr><td>Within 1 day of IMT decision to implement - Request support vessels, support aircraft, waste services, skimming and pumping equipment and support personnel (labourers, marine ecologists, AMOSC Core Group Members, Wildlife Specialists) to Marine Operations Base (likely in Dampier):
• AMOSC and AMSA equipment stockpiles at Broome, Dampier and Exmouth will be mobilised. Additional stockpiles at Perth and Geelong are available for escalation.</td><td>IMT</td><td>□</td></tr>
<tr><td>Within 2 days of IMT decision to implement - Operations Section Chief to direct Shoreline Assessment Teams (SATs) to locations of potential shoreline clean-up response on the basis of information from Monitor and</td><td>Operations Section Chief</td><td>□</td></tr>
</table>

	Evaluate Plan and DoT advice. Initiate mobilisation of shoreline clean-up resources.		
	Within 1 week of IMT decision to implement – Shoreline clean-up activities initiated where: • If required, establishment of Shoreline Staging Area(s) (TBD with DoT at time of incident response) and/or Forwards Operation Base(s) (TBD with DoT at time of incident response) for possible shoreline clean-up activities at shorelines likely to be contacted. • Appropriate vessels (shallow draft) to deliver personnel and equipment to shorelines and to deploy and retrieve equipment. 4WD vehicles will also be used for WA mainland sites. Larger vessels (supplied from the external services contracting strategy (**Section 6.2**) to support shoreline clean-up response measures as appropriate. • For island shoreline clean-up operations waste transfers (if required), vessels must come equipped with intermediate bulk container (IBC) containers or iso-containers for recovered oily water provided by waste contract manager.	IMT	☐
	Ongoing - SAT shoreline evaluation log to OSC (and a summary to be reported to the Operations Section Chief by the OSC in the daily operations report) detailing within 2 hours of completion of shoreline assessment the following to provide inputs for NEBA of shoreline clean-up response**:** • Shoreline habitats • Shoreline substrates • Observed or evidence of sensitive marine fauna or flora • Areas that require restricted or prohibited access (in terms of time or area) • Recommendations for shoreline clean-up methods • Effectiveness of shoreline clean-up response activities	SAT OSC	☐
	Ongoing - SAT team members will be responsible for preparing field maps and forms detailing the area surveyed and make specific clean-up recommendations. Team members will verify the effectiveness of clean-up, modifying guidelines as needed if conditions change through provision of SAT shoreline evaluation logs. The SAT team responsibilities include: • Evaluate oiling conditions; • Factor in shoreline types; • Identify sensitive resources; • Determine need for clean-up; • Recommend clean-up methods and endpoints; and • Place constraints on clean-up if necessary, due to safety, ecological, economic or cultural concerns.	SAT	☐
	Within 1 hour of completion of daily operations - Each shoreline clean-up team and vessels conducting transfers are required to report the following to the OSC and IMT in the Daily Operations Report: • Presence of any marine fauna and actions taken to adhere to Part 8 of the EPBC Regulations 2000, Part 5 of the Biodiversity Conservation Regulations 2018 and the Australian Guidelines for Whale and Dolphin Watching (NRMMC, 2005) • Presence of any oiled or non-oiled wildlife • Appearance of oil (using BAOAC) • Volume of oil recovered • Volume of oily wastes collected	SAT team/ Vessel Master	☐

	• Types of oiled habitats and oiled substrates present • Methods in which oiled habitats/substrates were cleaned • Areas that have prohibited or restricted entry		
	Ongoing - The IMT need to alert the OWR team (refer to **Section 4.8**) of the presence of large wildlife (such as birds, cetaceans or turtles)	IMT	□
	Ongoing – If required, liquids will be transferred into IBCs for transport to a less sensitive area with temporary bunding installed for storage of IBCs, pending one of three potential operations**:** • IBCs will be directly loaded onto tray/tautliner trucks for removal from the area; • IBCs will be decanted into iso-containers located within the warm zone, and sent back to the shoreline for ongoing use; and/or • IBCs will be drained with licensed vacuum tankers, and sent back to the shoreline for ongoing use.	Waste Contractor	□
	Ongoing - Recovered oily wastes will be transferred from the shoreline by vessel/freight using a licensed waste management contractor and dispose of wastes in a suitably classed State waste disposal site, as per the Waste Management Plan (**Section 4.8**).	Waste Contractor	□
	Ongoing - Volumes of recovered oil will be measured during offloading onshore. Recovered volumes will be recorded into SapuraOMV waste manifest**.**	Waste Contractor	□
	Ongoing - The IMT use the information contained in the Daily Operations Report, monitor and evaluate information and further SAT reports to decide on further shoreline clean-up responses or escalation of response depending on its effectiveness**.**	IMT	□
Net Benefit Assessment of Response	Implementation of shoreline clean-up response measures to be carefully considered: • In areas with intense fauna activity (nesting turtles, turtle hatchings, shorebird nesting) where shoreline clean-up could cause greater impact than the hydrocarbons. • Where clean-up option will potentially/likely cause greater impact to shoreline habitat than the hydrocarbons. • If access to shorelines is limited to sensitive terrestrial and/or marine habitats. • Re-assess during incident.		
Resources Required	**Resource (For First Strike and Peak Escalation estimates refer to Section 6.3)**	**Available From: (Refer to Section 6.2)**	
	Support vessel(s)	Supplier(s) as per the external services contracting strategy (**Section 6.2**)	
	4WD vehicles	Local Suppliers	
	Boom and skimming equipment	AMOSC, AMSA, OSRL	
	Team Leaders	AMOSC core group WA SRT and NRT (escalation)	
	Waste Contractor	Supplier(s) as per the external services contracting strategy (**Section 6.2**)	
	Support personnel		
	Shoreline staging area(s)		
	Forward Operations Base(s)		
	Machinery and tools		
Escalation and Maintenance of Response	The external services contracting strategy (**Section 6.2**) will be followed to secure vessels and trained responders to escalate and to maintain shoreline clean-up as a response measure over the duration of an incident. The external services contracting strategy in **Section 6.2** also considers the allocation of additional vessels, personnel, equipment and		

	service providers. Regular rotations of personnel will be timed appropriately to maintain the response. SapuraOMV has access to AMOSC and OSRL personnel and equipment though valid contracts and MoUs to escalate the response if required.
Termination Criteria	Clean-up activities can have no further benefit to reducing long lasting impacts to environmental and social sensitivities caused by the spill. This criteria will only be met with consultation from stakeholders and the WA DoT.
Key Response Documents	OSRA
Environmental Performance Outcome	Hydrocarbon impacted shorelines cleaned up to satisfaction of both IMT and WA DoT.

Management Control	Performance Standard	Measurement Criteria
Shoreline Assessment Team (SAT)	Deploy trained SAT personnel to shorelines with predicted hydrocarbon contact within 2 days of IMT decision to implement response measure.	• IAP records and daily SAT reports • Current memberships and/or agreements prior to operational initiation of the Activity for personnel (e.g. AMOSC, AMSA, OSRL)
	SAT shoreline assessment informs shoreline clean-up activities by identifying areas that will and will not benefit from clean-up, and assist in reducing the risks to sensitive receptors to ALARP from this response option.	• SAT shoreline assessment logs communicated to IMT and incorporated into subsequent IAPs
Shoreline Clean-up	IAP developed with consideration given to SAT recommendations.	IAP records compliance with SAT shoreline evaluation reports
	Shoreline clean-up teams will be mobilised to priority shorelines and shoreline clean-up undertaken as per IAP.	• Incident response report • Current memberships and/or agreements prior to operational initiation of the Activity for personnel (e.g. AMOSC, OSRL)
Refer to **EP Section 8.8** for Environmental Performance Outcomes, Performance Standards and Measurement Criteria relating to potential environmental risks from implementation of oil spill response.		

4.3 Surface Dispersant Application (Secondary Response Strategy)

Surface application of chemical dispersants to surface oil from vessels or aircraft has been identified as a secondary response strategy in the strategic NEBA for a Level 3 spill (**Appendix A**). The preferred approach is to allow natural dispersion processes to occur (e.g. evaporation, natural mixing and dispersion) to reduce the area and volume of surface slicks. In the event that the dispersal of the spilled oil is amenable to chemical dispersant and sensitive surface receptors (e.g. seabirds, shorelines) are (or forecasted to be) threatened by surface slicks, this response strategy may provide net environmental benefit.

An assessment of the oil spill characteristics (e.g. trajectory, oil type, density), environmental conditions (sea state and weather) and surrounding environmental/social/cultural sensitivities will be used to inform a decision by the IMT as to whether vessel-based or fixed wing aircraft chemical dispersant application are viable options through an operational NEBA. Oil spill modelling of a surface dispersant application strategy with two fixed wing aircraft and five vessels reduced the worst case credible shoreline loading from ~940 to ~600 tonnes, a net environmental benefit to shoreline receptors of ~30% (GHD 2020b, **EP Section 8.1**), In the event vessel-based and/or fixed wing chemical aircraft dispersant application is deemed appropriate for a given set of circumstances and are invoked through the IAP process, additional resources (**Section 6**) will be mobilised if required.

Table 4-2 Surface dispersant plan for a Level 3 crude oil spill

<table>
<tr><th colspan="4">Surface Dispersant Application Plan</th></tr>
<tr><td>Initiation Trigger</td><td colspan="3">Selected as response measure by IMT through IAP process for a Level 3 crude oil spill.</td></tr>
<tr><td>Jurisdictional Authority</td><td colspan="3">NOPSEMA
DoT (potentially for spills moving into State waters)</td></tr>
<tr><td>Controlling Agency</td><td colspan="3">SapuraOMV
For spills moving into State waters, the DoT may assume Controlling Agency designation for some activities; however, SapuraOMV will likely be the Lead IMT for chemical dispersant (vessel and aircraft application).</td></tr>
<tr><td>Aim</td><td colspan="3">• Reduce the amount of hydrocarbons on the surface to mitigate exposure risks of sensitive offshore, inshore and shoreline receptors.
• Reduce the amount of hydrocarbons ashore.</td></tr>
<tr><td rowspan="7">Procedure</td><td>Required Timeframe and Action when Implemented (if safe)</td><td>Person Responsible</td><td>Tick When Complete</td></tr>
<tr><td>Ongoing - (<u>Consideration of implementation of response strategy</u>) – Implementation of response strategy considered during IAP process.</td><td>IMT</td><td>□</td></tr>
<tr><td>If required - (<u>Rapid dispersant efficacy assessment via surface application trial</u>): IMT to consider results of the rapid surface dispersant trial (by Day 5 in Section 3.3) for a Level 3 spill to inform the efficacy of surface application of available chemical dispersant types. Forecasting of environmental benefit from surface application of chemical dispersant types to be carried out via operational study OS2 (OSTM). Both the efficacy trial and forecast modelling to inform IAP to optimise the use of available dispersant types.</td><td>IMT</td><td>□</td></tr>
<tr><td>If required – (<u>Continued dispersant efficacy assessment via surface application trial and detailed laboratory study(s)</u>): If necessary, further justification for surface dispersant application in regards to the amenability and effectiveness of available chemical dispersants on the spilled oil to be carried out (OS1 Hydrocarbon Surveillance and Tracking, OS2 OSTM, SM02 Dispersant Effect on Subsurface Concentrations, SM03 Ecotoxicology) to inform the NEBA process with findings to prioritise the use of available dispersant types and to develop an appropriate combat strategy.</td><td>IMT</td><td>□</td></tr>
<tr><td>If required – If surface slick approaches (<10 km) shallower areas (<20 m), forecasting of exposure risk to sensitive environmental resources from surface application of chemical dispersant to be carried out via operational study OS2 (OSTM) to inform the NEBA process.</td><td>IMT</td><td>□</td></tr>
<tr><td>Ongoing, if required - Suitable locations for vessel-based and/or fixed wing aircraft chemical dispersant application selected on basis of information from Monitor and Evaluate Plan (Section 3.4).</td><td>IMT</td><td>□</td></tr>
<tr><td>Prior to Vessel-Based and/or Aerial Chemical Dispersant Application - Vessel and/or aircraft observers report the following to IMT:
• Identification of surface hydrocarbon sheens likely to be amenable to chemical dispersant application;
• Presence of coral spawn;
• Presence of any marine fauna and actions taken to adhere to Part 8 of the EPBC Regulations 2000, Part 5 of the Biodiversity Conservation Regulations 2018 and the Australian Guidelines for Whale and Dolphin Watching (NRMMC, 2005);</td><td>Vessel observer</td><td>□</td></tr>
</table>

	• Vessel and/or aircraft observer log of hydrocarbons; • Water depth and location of the slick; and • Presence of any oiled wildlife.		
	Prior to Vessel-Based and/or Fixed Wing Aircraft Chemical Dispersant Application - The IMT grant permission to begin chemical dispersion if all conditions are confirmed: • There is no coral spawn present; • There are suitable breakaway slicks of surface oil to disperse via vessel-based and/or fixed wing aircraft chemical dispersant; • The slick is confirmed to not be in water depths <20 m, within 10 km of waters depths <20 m (unless OSTM [OS2] has demonstrated no/minimal exposure risk to sensitive areas), within exclusion zones for offshore facilities, within a Habitat Protection Zone or National Park Zone of an Australian Marine Park (application considered in the Multiple Use Zone), and within State waters; and • Any marine fauna is sighted moving away from the area.	IMT	☐
	Within 1 hour of ceasing daily response - The daily operations report to the IMT to include:- • Time, date and person recording the log; • Weather and sea-state; • Tracked locations of vessel-based and/or fixed wing aircraft chemical dispersant application (including water depths and distances from shorelines, emergent features and protected areas); • Presence and appearance of oil (using BAOAC) before and after dispersion; • Any photos, sketches and videos; • Presence of any oiled or non-oiled wildlife; and • Presence of any marine fauna and actions taken to adhere to Part 8 of the EPBC Regulations 2000 and the Australian Guidelines for Whale and Dolphin Watching (NRMMC, 2005) and that fauna were seen to be moving away from the area before Mechanical Dispersion was continued.	Vessel Observer	☐
	Ongoing - IMT assess vessel-based and/or aerial chemical dispersant application effectiveness and whether to maintain, escalate or terminate during next IAP.	IMT	☐
Net Benefit Assessment of Response	Implementation of vessel-based and/or aerial chemical dispersant application to be carefully considered: • In areas with intense marine fauna (whales, dolphins, turtles, whale sharks etc.). • In waters approaching shallower features. • Where OSTM indicates risk of entrainment into sensitive areas. • Within 10 km from a Marine National Park (IUCN II) and State Marine Parks. • In areas where coral spawning is occurring. Re-assess during incident.		
Resources Required	**Resource (For First Strike and Peak Escalation estimates refer to Section 6.3)**	**Available From: (Refer to Section 6.2)**	
	Support vessel	Supplier(s) as per the external services contracting strategy (**Section 6.2**)	
	Fixed wing aircraft – dispersant	AMOSC Hercules (Johor Bahru, Malaysia [Senai International Airport]) and Boeing 727 (Doncaster Sheffield Airport, UK) via OSRL.	
	Vessel and/or aircraft observers	Trained observers from AMOSC	
	Dispersant	AMOSC stockpiles AMSA stockpiles OSRL stockpiles	
	Trained personnel	AMSA air tractors	

		OSRL air tractors AMOSC core group to apply dispersant
Escalation and Maintenance of Response	The external services contracting strategy (**Section 6.2**) includes fixed wing aircraft, vessels, observers and trained personnel from AMOSC to implement, escalate and maintain chemical dispersant application response measures over the duration of an incident. Regular rotations of vessel and aircraft crews and refuelling runs will be timed appropriately to maintain the response.	
Termination Criteria	The strategy is no longer practical and/or beneficial (e.g. poor dispersant amenability, thin surface oil thickness) as a response measure by the IMT and terminated as per the IAP.	
Key Response Documents	NatPlan NP-POL-004: National Plan Register of OSCAs for Maritime Response Use IPIECA Dispersants: surface application, IOGP Report 532, 2016 Revision	
Environmental Performance Outcome	Hydrocarbon impacts to shorelines or surface-based environmental receptors are minimised by chemical dispersant application.	

Control Measure	Performance Standard	Measurement Criteria
Vessel-based and/or aerial chemical dispersant application	Implementation of vessel-based and/or aerial chemical dispersant application on surface hydrocarbons that could contact key sensitive areas if identified as a net environmental benefit.	• Daily reports from monitoring and evaluation (spill fate modelling and surveillance reports) predict key sensitive areas are within the spill trajectory. • IAP and other/supporting documentation provides evidence that NEBA identifies key sensitivities will have a net environmental benefit from vessel-based and/or fixed wing chemical dispersant application response measure. • Daily logs of vessel-based and/or aerial chemical dispersant application response activities were assessed and deployed when conditions were conducive to effective operations.
	Operational NEBA undertaken prior to chemical dispersant activities and daily thereafter to determine they will have a net environmental benefit.	• IAP and other/supporting documentation provides evidence that Operational NEBA undertaken prior to chemical dispersant activities, and daily thereafter.
	Selection of chemical dispersants are those listed as approved in the National Plan (OSCA) from AMSA approved list.	• Incident response report records chemical dispersants are those listed as approved in the National Plan (OSCA) from AMSA approved list.
	Chemical dispersant application in consultation with HMA and relevant Statutory Authority.	• IAP and other/supporting documentation provides evidence that chemical dispersant application undertaken in consultation with HMA and/or relevant Statutory Authority.
	Chemical dispersant application only in daylight hours.	• Incident response report provides evidence of timing, location, volumes, dosage, etc. of chemical dispersant application.
	Response measure continues until termination criteria are met.	• Incident response report details vessel observer logs that detail hydrocarbon slick(s) has been broken up and/or chemically dispersed to an extent that improves dispersion and biodegradation. • IMT logs document IAP and NEBA processes that support decision to no longer implement vessel-based and/or fixed wing chemical dispersant application response.
Refer to **EP Section 8.8** for Environmental Performance Outcomes, Performance Standards and Measurement Criteria relating to potential environmental risks from implementation of oil spill response.		

4.4 Subsea Dispersant Application (Secondary Response Strategy)

The use of subsea dispersant application has been identified as a secondary response strategy in the strategic NEBA for a Level 3 loss of well control spill (**Appendix A**). The preferred approach is to allow natural dispersion processes to occur (e.g. evaporation, natural mixing) to reduce the area and volume of surface slicks. In the event sensitive surface receptors (e.g. seabirds, shorelines) are threatened by surface slicks this response strategy may provide net environmental benefit.

Subsea intervention tool kit provides the ability to clear the area around the wellhead, to enable intervention and to facilitate capping stack installation (assuming the well architecture remains to do so). This also includes the subsea dispersant kit, which will be utilised for subsea dispersant application. Subsea dispersant application is the direct application of dispersant at the release point of the wellhead with SITS. Subsea dispersant application is used to disperse oil to enable safe implementation of the subsequent controls (e.g. capping stack installation) and/or to enhance dispersion in the water column and avoid/reduce surface oil concentrations and resultant shoreline loading. Oil spill modelling of a subsea dispersant application strategy was predicted to decrease the worst case credible shoreline loading from ~940 to ~910 tonnes, a small net environmental benefit to shoreline receptors that was counterbalance by increased loading of ~35 to ~80 tonnes at the Ningaloo geographic receptor (GHD 2020b, **EP Section 8.1**), The low simulated environmental benefit of this strategy is related to expected low gas in the target reservoir that does not generate small oil droplets upon release from the wellhead orifice, and thereby the chemical dispersant is not predicted to be overly effective. However, if the gas content is greater in the target reservoir, this may be an effective response for a loss of well control incident, and so has been retained.

Table 4-3 Subsea dispersant plan for a Level 3 crude oil spill

Subsea Dispersant Application Plan			
Initiation Trigger	Selected as response measure by IMT through IAP process during a Level 3 crude oil spill.		
Jurisdictional Authority	NOPSEMA		
Controlling Agency	SapuraOMV		
Aim	• Reduce the amount of hydrocarbons on the surface and exposure to sensitive surface based receptors. • Reduce safety hazard (VOCs and explosion risk) above the well head to allow use of other response strategies (e.g. install capping stack). • Reduce the amount of hydrocarbons ashore. • Reduce volumes of dispersant required via aerial and/ or vessel application.		
Procedure	**Required Timeframe and Action when Implemented (if safe)**	**Person Responsible**	**Tick When Complete**
	Ongoing - (<u>Consideration of implementation of response strategy</u>) – Implementation of response strategy considered during IAP process.	IMT	□
	If required – Response strategy effectiveness evaluated via IAP process and whether to maintain, escalate or terminate implementation.	IMT	□
	If required – (<u>Concurrent to understanding subsea dispersant application</u>): If necessary, further justification for subsea dispersant application in regards to the amenability, effectiveness and potential impacts of chemical dispersant on the spilled oil to be carried out (OS1 Hydrocarbon Surveillance and Tracking, OS2 OSTM, SM02 Dispersant Effect on Subsurface Concentrations, SM03 Ecotoxicology) to inform	IMT	□

	the NEBA process with findings to prioritise available dispersant types and to determine appropriate combat strategy.		

Net Benefit Assessment of Response	Implementation of subsea dispersant application to be determine if meaningful decrease in surface oil and/or shoreline oiling. Re-assess during incident.	
Resources Required	**Resource (For First Strike and Peak Escalation estimates refer to Section 6.3)**	**Available From: (Refer to Section 6.2)**
	Support vessel	Supplier(s) as per the external services contracting strategy (**Section 6.2**).
	ROV(s)	Supplier(s) as per the external services contracting strategy (**Section 6.2**).
	Subsea intervention tool kit	WWC
	Dispersant	AMOSC stockpiles AMSA stockpiles OSRL stockpiles
	Trained personnel	WWC personnel to direct and apply subsea dispersant via WWC dispersant injection package from capping stack landing perspective. AMOSC personnel to advise from efficacy perspective.
Escalation and Maintenance of Response	The external services contracting strategy (**Section 6.2**) includes vessels, hose package and ROV(s) to implement, escalate and maintain subsea dispersant application response measures over the duration of an incident. The external services contracting strategy (**Section 6.2**) also considers the allocation of additional vessels and ROV(s). Regular rotations of vessel crews and refuelling runs will be timed appropriately to maintain the response.	
Termination Criteria	The strategy is no longer practical and/or beneficial (e.g. poor dispersant amenability) as a response measure by the IMT and terminated as per the IAP.	
Key Response Documents	NP-POL-004: National Plan Register of OSCAs for Maritime Response Use IPIECA Dispersants: subsea application, IOGP Report 532, 2016 Revision SapuraOMV WCP	
Environmental Performance Outcome	Hydrocarbon impacts to shorelines or surface-based environmental receptors are minimised by subsea dispersant application.	

Control Measure	**Performance Standard**	**Measurement Criteria**
Subsea dispersant application	Implementation of subsea dispersant application on hydrocarbons that could contact key sensitive areas if identified as a net environmental benefit.	• Daily reports from monitoring and evaluation (spill fate modelling and surveillance reports) predict key sensitive areas are within the spill trajectory. • IAP and other/supporting documentation provides evidence that NEBA identifies key sensitivities will have a net environmental benefit from subsea dispersant application response measure.
	Operational NEBA undertaken prior to subsea dispersant application activities and daily thereafter to determine they will have a net environmental benefit.	• IAP and other/supporting documentation provides evidence that Operational NEBA undertaken prior to subsea dispersant application activities, and daily thereafter.
	Selection of chemical dispersants are those listed as approved in the National Plan (OSCA) from AMSA approved list.	• Incident response report records chemical dispersants are those listed as approved in the National Plan (OSCA) from AMSA approved list.
	Subsea dispersant application in consultation with HMA and relevant Statutory Authority.	• IAP and other/supporting documentation provides evidence that subsea dispersant application undertaken in consultation with HMA and relevant Statutory Authority.

	Response measure continues until termination criteria are met.	• Incident response report details vessel observer logs that detail hydrocarbon slick(s) has been broken up and/or chemically dispersed to an extent that improves dispersion and biodegradation. • IMT logs document IAP and NEBA processes that support decision to no longer implement subsea dispersant application response.
Refer to **EP Section 8.8** for Environmental Performance Outcomes, Performance Standards and Measurement Criteria relating to potential environmental risks from implementation of oil spill response.		

4.5 Mechanical Dispersion (Secondary Response Strategy)

Mechanical dispersion has been identified as a secondary response strategy in the strategic NEBA (**Appendix A**) and will only be undertaken (when safe to do so) opportunistically to steam through spill areas to disperse surface oil into the water column. The preferred approach is to allow natural dispersion processes to occur (e.g. evaporation, natural mixing) to reduce the area and volume of surface slicks. In the event sensitive surface receptors (e.g. seabirds, shorelines) are threatened by surface slicks this response strategy may provide net environmental benefit.

An assessment of the oil spill characteristics (trajectory, oil type, density, etc.), environmental conditions (sea state and weather) and surrounding environmental/social/cultural sensitivities will be used to inform a decision by the IMT as to whether mechanical dispersion is a viable option through an operational NEBA. In the event mechanical breakup is deemed adequate to transition into a primary response through the IAP process, additional resources (**Section 6.2**) can be hired and mobilised if required.

Table 4-4 Mechanical dispersion plan for a crude oil spill

Mechanical Dispersion Plan			
Initiation Trigger	Selected as response measure by IMT through IAP process during a crude oil spill.		
Jurisdictional Authority	NOPSEMA (Commonwealth waters) and DoT (for spills moving into State waters)		
Controlling Agency	SapuraOMV (Commonwealth waters) For spills moving into State waters, WA DoT may assume Controlling Agency for some activities; however, SapuraOMV will likely be the Lead IMT for mechanical dispersion.		
Aim	• Reduce the amount of hydrocarbons on the surface; • Reduce surface exposure area to sensitive surface-based receptors; and • Reduce the amount of hydrocarbons ashore.		
Procedure	**Required Timeframe and Action when Implemented (if safe)**	**Person Responsible**	**Tick When Complete**
	Ongoing - (Consideration of implementation of response strategy) – Implementation of response strategy considered during IAP process.	IMT	◻
	Ongoing - Potential locations for mechanical dispersion application selected on basis of information from Monitor and Evaluate plan (**Section 3.4**).	IMT	◻
	Prior to Mechanical Dispersion - Vessel observers are required to report the following to the OSC (and a summary to be reported to the Operations Section Chief by the OSC in the daily operations report): • Identification of breakaway sheens of surface hydrocarbons that can be dispersed by propeller turbulence (mechanical dispersion); • Presence of any marine fauna and actions taken to adhere to Part 8 of the EPBC Regulations 2000, Part 5 of the Biodiversity Conservation Regulations 2018 and the	Vessel observer OSC	◻

	Australian Guidelines for Whale and Dolphin Watching (NRMMC, 2005); • Vessel observer log of hydrocarbons; • Presence of any oiled wildlife.		
	Prior to Mechanical Dispersion - The IMT grant permission to begin mechanical dispersion if all conditions are confirmed: • There is suitable breakaway sheens of surface oil to disperse via mechanical dispersion.	IMT	☐
	Within 1 hour of ceasing daily response - The daily operations report to IMT to include: • Tracked locations of mechanical dispersion (including water depths and distances from shorelines, emergent features and protected areas) • Presence and appearance of oil (using BAOAC) before and after dispersion • Presence of any oiled or non-oiled wildlife • Presence of any marine fauna and actions taken to adhere to Part 8 of the EPBC Regulations 2000, Part 5 of the Biodiversity Conservation Regulations 2018 and the Australian Guidelines for Whale and Dolphin Watching (NRMMC, 2005) and that fauna were seen to be moving away from the area before Mechanical Dispersion was continued	Vessel Observer	☐
	Ongoing - IMT assess mechanical dispersion effectiveness and whether to maintain, escalate or terminate during next IAP.	IMT	☐

Net Benefit Assessment or Response	Implementation of mechanical dispersion to be carefully considered: • In areas with intense marine fauna (whales, dolphins, turtles, whale sharks etc.). • Safety risks in close proximity to the releases (LEL) or health risks from prolonged physical exposure to oil by vessel staff. • Re-assess during incident.	
Resources Required	**Resource**	**Available From: (Refer to Section 6.2)**
	Support vessel	Supplier(s) as per the external services contracting strategy (**Section 6.2**)
	Vessel observers	Trained observers from AMOSC
Escalation and Maintenance of Response	The external services contracting strategy (**Section 6.2**) will be followed to secure vessels to implement, escalate and maintain mechanical dispersion response measures over the duration of an incident. The external services contracting strategy in **Section 6.2** also considers the allocation of additional vessels. Regular rotations of vessel crews and refuelling runs will be timed appropriately to maintain the response.	
Termination Criteria	When the strategy is assessed as no longer practical or beneficial (e.g. ineffective) as a response measure by the IMT and terminated as per the IAP.	
Key Response Documents		
Environmental Performance Outcome	Impacts to shorelines or surface-based environmental receptors are minimised by enhanced vessel-induced mechanical dispersion.	

Control Measure	Performance Standard	Measurement Criteria
Vessel-induced mechanical dispersion	Implementation of mechanical dispersion on surface hydrocarbons that could contact key sensitive areas if identified as a net environmental benefit.	• Daily reports from monitoring and evaluation (spill fate modelling and surveillance reports) predict key sensitive areas are within the spill trajectory. • IAP and other/supporting documentation provides evidence that NEBA identifies key sensitivities will have a net environmental benefit from mechanical dispersion response measure. • Daily vessel logs of mechanical dispersion response activities assessed and deployed when conditions conducive to effective operations.
	Operational NEBA undertaken prior to mechanical dispersion and daily thereafter to	• IAP and other/supporting documentation provides evidence that Operational NEBA undertaken prior to mechanical dispersion and daily thereafter.

	determine they will have a net environmental benefit.	
	Response measure continues until termination criteria are met.	• Incident response report details vessel observer logs that detail hydrocarbon slick(s) has been broken up to an extent that improves dispersion and biodegradation. • IMT logs document IAP and NEBA processes that support decision to no longer implement mechanical dispersion application response.
Refer to **EP Section 8.8** for Environmental Performance Outcomes, Performance Standards and Measurement Criteria relating to potential environmental risks from implementation of oil spill response.		

4.6 Shoreline Protection and Deflection (Secondary Response Strategy)

Shoreline protection and defection has been identified as a secondary response strategy in the strategic NEBA (**Appendix A**) for a Level 3 crude oil spill. WA DoT is the HMA for oil pollution in WA State waters under the *Emergency Management Act 2005* and the Emergency Management Regulation 2006.

The WA DoT can declare a Level 3 incident with subsequent authority (powers) to assist in the management of marine pollution via:

- Authority to access shorelines and develop shoreline staging areas and temporary waste storage facilities as required.
- Coordinate the State Response Team (SRT) during oil spill response.
- Advise, approve, and direct SapuraOMV shoreline operations.
- In consultation with the SapuraOMV IMT, define termination criteria for shoreline operations.

In short, all shoreline protection and deflection operations will be conducted in consultation with WA DoT (the HMA) in State waters.

Booms can be used to create physical barriers on the water surface to protect sensitive areas and receptors. This option is used in nearshore environments in close proximity to the area requiring protection. Response equipment can be installed in deeper waters further from the protection priority with the intent of deflecting the hydrocarbons off their trajectory path to a sensitive receptor(s). Effectiveness of booming operations are dependent on weather and sea state conditions that must be taken into account during planning. Protection and deflection response has been included as a secondary response measure if deemed appropriate (via operational NEBA-IAP process) to protect selected sensitive sites if required.

Table 4-5 Shoreline protection and deflection plan for a Level 3 crude oil spill

Shoreline Protection and Deflection Plan	
Initiation Trigger	Selected as response measure by IMT through IAP process during a Level 3 crude oil spill.
Jurisdictional Authority	DoT
Controlling Agency	DoT Note: SapuraOMV will act as Controlling Agency/Lead IMT for shoreline protection and deflection response activities until such time DoT assumes control. SapuraOMV will provide resources and appropriate number of appropriately qualified personnel, to support DoT with shoreline protection and deflection response activities.

Aim	To reduce the amount of oil impacting shorelines or coastal sensitivities		
Procedure	**Required Timeframe and Action when Implemented (if safe)**	**Person Responsible**	**Tick When Complete**
	Ongoing - (Consideration of implementation of response strategy) – Implementation of response strategy considered during IAP process.	IMT	◻
	Within 1 day of IMT decision to implement - Request support vessels, support aircraft, waste services, booming and skimming equipment and support personnel (labourers, at least one AMOSC and/or AMSA trained boom operators per vessel/ shoreline boom) to Marine Operations Base (likely at Dampier) and/or Forward Operations Base (TBD with DoT at time of incident response) and the following: • Appropriate vessels (shallow draft) to deliver personnel and equipment to shorelines, and to deploy and retrieve equipment will be required, as well as 4WD vehicles on the WA mainland. Supported by larger vessels sourced from Contracting Strategy (**Section 6.2**). • AMOSC and AMSA equipment stockpiles will be mobilised with availability of further supplies (if required) from AMSA's and AMOSC's Exmouth, Broome, Fremantle and Geelong stockpiles, and OSRL's Singapore stockpiles if needed. • Equipment and personnel requirements have been reviewed and approved (e.g. nearshore booms include beach guardians, zoom booms, short curtain booms and sorbent booms). • If recovery of oily water planned then vessels must come equipped with IBC containers or iso-containers.	IMT	◻
	Within 3 days of IMT decision to implement - IMT to assess deployment locations for booms with information from Monitor and Evaluate Plan (**Section 3.4** with particular reference to the OS3 Shoreline Assessment in **Section 3.4.3**), IAP procedure (**Section 4.1**) and DoT/AMOSC/AMSA recommendations. IMT to evaluate use of offshore booms to restrict response impact on highly sensitive shorelines via deflection of hydrocarbons to other less sensitive areas as part of the NEBA. Use of OSRA and SAT information to develop tactical response plans for key priority sensitivity areas that may be impacted by small weathered hydrocarbon slicks.	IMT	◻
	Within 1 week of IMT decision to implement - Deploy booms as instructed by the IMT where shoreline contact of sensitive areas has been predicted.	IMT	◻
	Prior to and during boom deployment - Vessel observers are required to report the following to the OSC (and a summary to be reported to the Operations Section Chief by the OSC in the daily operations report): • Presence of any marine fauna and actions taken to adhere to Part 8 of the EPBC Regulations 2000, Part 5 of the Biodiversity Conservation Regulations 2018 and the Australian Guidelines for Whale and Dolphin Watching (NRMMC, 2005). • Vessel observer log of hydrocarbons. • Visible shallow habitats. • Presence any oiled or non-oiled wildlife.	Vessel Observers OSC	◻
	Prior to and during boom deployment - The Operations Section Chief (or delegate) will grant permission to deploy 'nearshore' booms if all conditions are confirmed including: • Vessel observers/aerial observers/SAT confirm that there are no sensitive marine fauna currently utilising the shoreline. • There is suitable habitat to anchor the booms upon (not on seagrass or coral reef).	Operations Section Chief	◻

	• That Protection and Deflection team will be aware of sensitive shoreline areas with restricted or prohibited access on the basis of SAT reports and DoT/AMOSC/AMSA guidance. If required barriers will be erected to guide this.		
	Ongoing - Vessels and shoreline crews will store the recovered oily water in suitable containers that will remain in the collection tanks and will be handled as per the Waste Management Plan (**Section 4.9**).	Vessel Master	◻
	Ongoing – Operations Section Chief to alert the OWR team (refer to **Section 4.8**) of the presence of large wildlife (such as birds, cetaceans or turtles) during protect and deflect response operations.	Operations Section Chief	◻
	Ongoing - Protect and deflect response vessels to report the following daily within 1 hour of ceasing daily response activities (and a summary to be reported to the Operations Section Chief by the OSC in the daily operations report): • Vessel location and presence of oil • Length, type and amount of booms deployed • Volume of oil recovered • Appearance of oil (using BAOAC) • Presence of any oiled or non-oiled wildlife • Presence of any marine fauna and actions taken to adhere to Part 8 of the EPBC Regulations 2000, Part 5 of the Biodiversity Conservation Regulations 2018 and the Australian Guidelines for Whale and Dolphin Watching (NRMMC, 2005) • HSE, logistical requirements, any impacts of operation and areas for improvement.	Vessel Master OSC	◻
	Ongoing - The IMT use the information in the daily operations report to decide the status (maintain, escalate, terminate) of protection and deflection response activities.	IMT	◻
	Ongoing - Before vessels return to base, containment booms to be set-up around the vessel in open water in proximity to the spill (immediately after they have exited the operational area) and high-pressure water used to wash oil from the hull. Sorbent boom is to be used to recover the oil from within the containment boom.	Vessel Master	◻
	Ongoing - Booms will be cleaned (and repaired if needed) in a dedicated area within the Marine Operations Base that is covered with HDPE plastic that drain into a collection sump augmented with a submersible pump to allow transfer of washdowns to an above ground temporary waste storage tank. Waste contractor will collect the liquid waste and transport it to nominated facility for disposal or recycling as per the Waste Management Plan (**Section 4.8**).	Waste Contractor	◻
	Ongoing - Recovered oily water will be transferred onshore when a vessel returns to shore with a licensed waste management contractor and dispose of wastes in a suitably classed State waste disposal site as per the Waste Management Plan (**Section 4.8**).	Waste Contractor	◻
	Ongoing - Volumes of recovered oil will be measured during offloading at the Marine Operations Base (likely at Dampier) and recorded into SapuraOMV waste manifest as per the Waste Management Plan (**Section 4.8**).	Waste Contractor	◻
Net Benefit Assessment of Response	Implementation of protection and deflection response measures to be carefully considered: • In areas with intense marine fauna (whales, dolphins, turtles, whale sharks etc.) activity that could lead to entanglement with booms. • In areas of shallow sensitive habitats such as coral reef, seagrass or macroalgae. • Deflection of oil onto other sensitive shoreline habitats that are more difficult to clean or have greater environmental sensitivity. • Deployment may cause severe impact to sensitive shoreline marine fauna. • Re-assess during incident.		

Resources Required	**Resource (For First Strike and Peak Escalation estimates refer to Section 6.3)**	**Available From: (Refer to Section 6.2)**
	Support vessels	Supplier(s) as per the external services contracting strategy (Section **Section 6.2**)
	Booms and skimming equipment	AMOSC, OSRL, AMSA. Mutual Aid MoU
	Team Leaders	AMOSC core group WA SRT and NRT (escalation)
	Vessel Observers	AMOSC core group WA SRT and NRT (escalation)
	Waste Contractor	Supplier(s) as per the external services contracting strategy (**Section 6.2**)
	Support personnel	Supplier(s) as per the external services contracting strategy (**Section 6.2**)
Escalation and Maintenance of Response	The external services contracting strategy (**Section 6.2**) includes vessels and trained responders to escalate and to maintain shoreline protection and deflection as a response measure over the duration of an incident. The external services contracting strategy in **Section 6.2** also considers the allocation of additional vessels. Regular rotations of vessel crews and refuelling runs will be timed appropriately to maintain the response.	
Termination Criteria	Monitor and Evaluate Plan indicates hydrocarbons no longer predicted or observed to impact the identified priority protection area or the strategy is assessed as no longer practical as a response measure by the IMT and terminated as per the IAP.	
Key Response Documents	OSRA	
Environmental Performance Outcome	Protection of highest priority shoreline sites from hydrocarbon impacts.	
Management Control	**Performance Standard**	**Measurement Criteria**
Shoreline protection and deflection	Deploy protection and deflection equipment to key sensitivities of shorelines that are predicted to be impacted by surface oil where NEBA identifies net benefit as per the IAP and advice from the DoT.	• Monitor and evaluate reports. • Communications between WA DoT and SapuraOMV. • Daily response logs show protection and deflection operations were evaluated and deployed when conditions were conducive to effective operations. • Documented IMT IAP and logs demonstrating implementation of the NEBA
	Booming and skimming operations from each vessel/shoreline boom will be under the direction of skilled and experienced personnel (i.e. AMOSC Core Group or others as required by DoT).	Induction and training records.
Refer to **EP Section 8.8** for Environmental Performance Outcomes, Performance Standards and Measurement Criteria relating to potential environmental risks from implementation of oil spill response.		

4.7 Offshore Containment and Recovery (Secondary Response Strategy)

Offshore containment and recovery has been identified as secondary response strategy in the strategic NEBA for a Level 3 oil spill (**Appendix A**). Surface oil concentrations are only anticipated to be sufficiently high for containment and recovery operations in the Commonwealth waters in the locale of the Kanga-1 well. On the basis of deterministic oil spill modelling, surface oil thicknesses are predicted to be >50 g/m^2 within 50 km of the well (EP Section 8.1) with mean viscosities of <1,000 cSt, <2,000 cSt and <4,000 cSt within radii of ~10 km, ~20 km and ~50 km from the well, respectively (GHD 2020b). Hence, oil viscosity through weathering and/or emulstification is not expected to limit the recovery of oil from booms via skimmers (e.g. oleophilic skimmer effective with medium viscosity oils between 100-2,000 cSt [ITOPF 2012]) in proximity to the well during containment and recovery operations.

Table 4-6 Offshore containment and recovery plan for a Level 3 crude oil spill

<table>
<tr><th colspan="4">Offshore Containment and Recovery Plan</th></tr>
<tr><td>Initiation Trigger</td><td colspan="3">Selected as response measure by IMT through IAP process during a Level 3 crude oil spill.</td></tr>
<tr><td>Jurisdictional Authority</td><td colspan="3">NOPSEMA in Commonwealth waters</td></tr>
<tr><td>Controlling Agency</td><td colspan="3">SapuraOMV in Commonwealth waters</td></tr>
<tr><td>Aim</td><td colspan="3">To reduce the amount of oil impacting sensitive receptors and shorelines</td></tr>
<tr><td rowspan="7">Procedure</td><td>Required Timeframe and Action when Implemented (if safe)</td><td>Person Responsible</td><td>Tick When Complete</td></tr>
<tr><td>Ongoing - <u>Consideration of implementation of response strategy</u> – Implementation of response strategy considered during IAP process.</td><td>IMT</td><td>□</td></tr>
<tr><td>Within 1 day of IMT decision to implement - Request support vessels, waste services, containment and recovery equipment, and support personnel (labourers and AMOSC/AMSA trained operators) and the following:
• Appropriate offshore vessels to collect oil in proximity to the spill site. Supported by waste transfer vessels sourced from Contracting Strategy (Section 6.2).
• AMOSC and AMSA equipment (offshore booms, skimmers) stockpiles will be mobilised to Marine Operations Base (likely at Dampier) and the Forward Operations Base (TBD with DoT at time of incident response).
• Equipment and personnel requirements have been reviewed and approved (e.g. offshore booms, skimmers, waste transfer vessels with appropriate storage (IBC, iso-containers, vessel deck storage units, towable storage units).</td><td>Operations Section Chief</td><td>□</td></tr>
<tr><td>Within 1 week of IMT decision to implement – Containment and recovery operations carried out as instructed by the IMT with emphasis on slicks where elevated probability of shoreline contact of sensitive areas has been predicted.</td><td>IMT</td><td>□</td></tr>
<tr><td>Prior to and during containment and recovery operations - Vessel observers are required to report the following to the OSC (and a summary to be reported to the Operations Section Chief by the OSC in the daily operations report):
• Presence of any marine fauna and actions taken to adhere to Part 8 of the EPBC Regulations 2000, Part 5 of the Biodiversity Conservation Regulations 2018 and the Australian Guidelines for Whale and Dolphin Watching (NRMMC, 2005).
• Vessel observer log of hydrocarbons.
• Visible shallow habitats.
• Presence any oiled or non-oiled wildlife.</td><td>Vessel Observers
OSC</td><td>□</td></tr>
<tr><td>Ongoing – Recovery and waste transfer vessels will store the recovered oily water in suitable containers that will remain in the collection tanks and will be handled as per the Waste Management Plan (Section 4.8).</td><td>Vessel Master</td><td>□</td></tr>
<tr><td>Ongoing - IMT to alert the OWR team (refer to Section 4.8) of the presence of large wildlife (such as birds, cetaceans or turtles) during containment and recovery response operations.</td><td>IMT</td><td>□</td></tr>
</table>

<table>
<tr><td rowspan="6"></td><td>Ongoing – Containment and recovery response vessels to report the following daily (daily operations report) within 1 hour of ceasing daily response activities:
• Vessel location and presence of oil
• Summary of oil recovery operations
• Volume of oil recovered
• Appearance of oil (using BAOAC)
• Presence of any oiled or non-oiled wildlife
• Presence of any marine fauna and actions taken to adhere to Part 8 of the EPBC Regulations 2000, Part 5 of the Biodiversity Conservation Regulations 2018 and the Australian Guidelines for Whale and Dolphin Watching (NRMMC, 2005)
• HSE, logistical requirements, any impacts of operation and areas for improvement</td><td>Vessel Master</td><td>□</td></tr>
<tr><td>Ongoing - The IMT use the information in the daily operations report to decide the status (maintain, escalate, terminate) of containment and recovery response activities.</td><td>IMT</td><td>□</td></tr>
<tr><td>Ongoing - Before vessels (recovery or waste transfer) return to base, containment booms to be set-up around the vessel in open water in proximity to the spill (immediately after they have exited the operational area) and high-pressure water used to wash oil from the hull. Sorbent boom is to be used to recover the oil from within the containment boom.</td><td>Vessel Master</td><td>□</td></tr>
<tr><td>Ongoing – Offshore booms and skimmers will be cleaned (and repaired if needed) in a dedicated area within the Marine Operations Base that is covered with HDPE plastic that drain into a collection sump augmented with a submersible pump to allow transfer of washdowns to an above ground temporary waste storage tank. Waste contractor will collect the liquid waste and transport it to nominated facility for disposal or recycling as per the Waste Management Plan (Section 4.8).</td><td>Waste Contractor</td><td>□</td></tr>
<tr><td>Ongoing - Recovered oily water will be transferred onshore when a vessel returns to shore with a licensed waste management contractor and dispose of wastes in a suitably classed State waste disposal site as per the Waste Management Plan (Section 4.8).</td><td>Waste Contractor</td><td>□</td></tr>
<tr><td>Ongoing - Volumes of recovered oil will be measured during offloading at the Marine Operations Base (likely at Dampier) and recorded into SapuraOMV waste manifest as per the Waste Management Plan (Section 4.8).</td><td>Waste Contractor</td><td>□</td></tr>
<tr><td>Net Benefit Assessment of Response</td><td colspan="3">Implementation of containment and recover response measures to be carefully considered:
• In areas with intense marine fauna (whales, dolphins, turtles, whale sharks etc.) activity that could lead to entanglement with offshore booms.
• Safety risks in close proximity to the releases (LEL) or health risks from prolonged physical exposure to oil by vessel staff.
• Re-assess during incident.</td></tr>
<tr><td rowspan="5">Resources Required</td><td>Resource (For First Strike and Peak Escalation estimates refer to Section 6.3)</td><td colspan="2">Available From: (Refer to Section 6.2)</td></tr>
<tr><td>Recovery and waste transfer vessels</td><td colspan="2">Supplier(s) as per the external services contracting strategy (Section 6.2)</td></tr>
<tr><td>Offshore containment and recovery equipment (booms, recovery devices, vessel deck / towable storage</td><td colspan="2">AMOSC, AMSA, OSRL, Mutual Aid MOU</td></tr>
<tr><td>Team Leaders</td><td colspan="2">AMOSC core group
OSRL (escalation)</td></tr>
<tr><td>Vessel Observers</td><td colspan="2">AMOSC core group</td></tr>
</table>

	Waste Contractor	Supplier(s) as per the external services contracting strategy (**Section 6.2**)
	Support personnel	
Escalation and Maintenance of Response	The external services contracting strategy (**Section 6.2**) includes vessels and trained responders to escalate and to maintain offshore containment and recovery as a response measure over the duration of an incident. The external resourcing strategy in **Section 6.2** also considers the allocation of additional vessels. Regular rotations of vessel crews and refuelling runs will be timed appropriately to maintain the response.	
Termination Criteria	The Monitor and Evaluate Plan indicates hydrocarbons no longer predicted or observed to impact sensitive receptors and shorelines, or the strategy is assessed as no longer practical as a response measure by the IMT and terminated as per the IAP.	
Key Response Documents	IPIECA At-sea containment and recovery, IOGP Report 522, 2016 Revision	
Environmental Performance Outcome	Recovery of offshore surface oil if feasible and practicable with a net environmental benefit.	
Management Control	**Performance Standard**	**Measurement Criteria**
Offshore Containment and Recovery	Carry out offshore containment and recovery operations, particularly when surface oil is predicted to impact sensitive receptors and/or shorelines where NEBA identifies net benefit as per the IAP.	• Monitor and evaluate reports • Daily logs of response activities show containment and recovery operations were evaluated and deployed when conditions were conducive to effective operations. • Documented IMT IAP and logs demonstrating implementation of the NEBA
	Offshore booming and skimming operations will be under the direction of skilled and experienced personnel (e.g. AMOSC Core Group).	Induction and training records.
Refer to **EP Section 8.8** for Environmental Performance Outcomes, Performance Standards and Measurement Criteria relating to potential environmental risks from implementation of oil spill response.		

4.8 Oiled Wildlife Response (OWR) Plan

The Oiled Wildlife Response (OWR) Plan includes pre-emptive capture or hazing of wildlife to prevent contact with hydrocarbons, treatment and rehabilitation of impacted wildlife and euthanasia of critically impacted wildlife individuals. The severity of potential impacts is dependent on the oil type and spill volume.

The decision to implement OWR will be made by the IMT with advice from Oiled Wildlife Advisors (OWAs) on the basis of operational monitoring information (OS1 Hydrocarbon Surveillance and Tracking, OS3 Shoreline Assessment) and the operational NEBA process.

The Western Australian Oiled Wildlife Response Plan (WAOWRP) (DPaW, 2014a) sets out the minimum standard required for an OWR in Western Australia in both Commonwealth and State waters. The Pilbara Region Oiled Wildlife Response Plan (PROWRP) (DPaW, 2014b) outlines specific 'on ground' information required to carry out an OWR specific to this region (e.g. environmental values, high risk environmental areas, designated oiled wildlife facilities, equipment / resource / contact lists). In the event that wildlife has been impacted or there is imminent threat of impact requiring OWR, the WAOWRP and PROWRP will be activated. A Wildlife Division Coordinator (WDC) will be established and will liaise with the IMT via the Planning Officer to identify and coordinate the necessary OWR functional units of the Oiled Wildlife Division (OWD), as per the WAOWRP. The OWAs and WDC will provide advice to the IMT on the level of OWR required and will ensure provision of resources to support OWR operations.

Table 4-7 OWR plan for a crude oil spill

OWR Plan			
Initiation Trigger	Selected as response measure by IMT through IAP process during a crude oil spill.		
Jurisdictional Authority	DBCA		
Controlling Agency	DoT SapuraOMV will act as Controlling Agency/Lead IMT for OWR activities until such time DoT assumes control. SapuraOMV will provide resources and appropriate number of appropriately qualified personnel, to support DoT with OWR activities.		
Aim	• Safely and effectively capture oiled wildlife for treatment and subsequent rehabilitation and release. • Prioritise treatment of priority species of conservation value and to carry out humane triage operations when necessary and resources are limited. • Prevent (e.g. hazing) oiling of wildlife threatened by slicks.		
Procedure	**Required Timeframe and Action**	**Responsible**	**Tick if Complete**
	Ongoing - Consideration of implementation of response strategy – Implementation of response strategy considered during IAP process.	IMT	□
	Within 1 day of IMT decision to implement – OWA(s) mobilised (if required) through notification of DBCA, and AMOSC.	IMT	□
	Within 1 day of IMT decision to implement – Request AMOSC to mobilise OWR initial response equipment (if required) situated in Exmouth, Karratha and Broome, and containerised washing facility in Perth.	IMT	□
	Within 1 day of IMT decision to implement – Notify DoT Maritime Environmental Emergency Response (MEER) unit and DBCA that OWR equipment is being mobilised (if required).	IMT	□
	Within 1 day of IMT decision to implement – Request AMOSC to establish Oiled Wildlife Division (OWD) and Wildlife Division Coordinator (WDC) (if required) as described in the WAOWRP and PROWRP.	IMT	□
	Within 1 week of IMT decision to implement – Request AMOSC to mobilise trained OWR responders and resources (if required) as described in the WAOWRP and PROWRP.	IMT	□
	Ongoing[6] - Pre-emptive capture of turtles (particularly juvenile life stages) if shoreline contact occurs during turtle nesting season should be considered on a case-by-case basis and decided upon following consultation with State regulatory agencies. Auditory hazing techniques may also be used for moving large flocks of shorebirds out of 'at risk' areas.	IMT	□
	Ongoing[5] - Oiled wildlife recovery teams deployed to assigned shoreline segments as described in the IAP. Oiled wildlife to be transported from oiled location to a staging area, and then onwards to the wildlife washing and rehabilitation facility.	IMT	□
	Ongoing[5] - Staging sites will be opportunistically established at existing beach access points along the WA coastline (multiple access points may be available). To minimise the impact on economic activities in the area, staging sites should be established away from National Park camping grounds	IMT	□

[6] Ongoing response will be implemented per the WAOWRP and PROWRP once activated and this specific response may or may not be required.

	unless closed to the public due to oiled beaches. DBCA will be the lead agency for these decisions.		

Net Benefit Assessment of Response	If hazing likely to result in a net adverse impact (abandonment of adults from eggs or young, causes severe stress and mortality, forces separation of animal from group) then do not carry out. If capture and rehabilitation causes a net impact (taking adult away from eggs or young, stress of capture causes increased mortality than presence of oil alone, disruption or prevention causes a loss of breeding cycle) then do not carry out. Re-assess during incident.	
Resources Required	**Resource**	**Available From: (Refer to Section 6.2)**
	OWA and WDC	DBCA. AMOSC core group.
	Trained OWR (operations) personnel to act as field supervisors of OWR recovery and rehabilitation teams	AMOSC core group. WA SRT and AMSA NRT (escalation).
	Support personnel	Supplier(s) as per the external services contracting strategy (**Section 6.2**).
	DBCA and veterinarians	Guidance on basis of WAWORP and PROWRP for Western Australia.
	OWR kits	AMOSC at Broome and Exmouth. OSRL Singapore (escalation). AMSA at Fremantle and Karratha.
	OWR container cleaning station	AMOSC mobilised from Fremantle and Geelong. OSRL Singapore (escalation).
	Support aircraft	Supplier(s) as per the external services contracting strategy (**Section 6.2**).
	Support vessels	
	Waste contractor	
Escalation and Maintenance of Response	SapuraOMV is a member of OSRL and AMOSC with access to OWR equipment as per the external services contracting strategy in **Section 6.2**. SapuraOMV can also request additional AMOSC resources through the AMOSPlan if required. If even greater escalation is required then additional resources can be accessed through the NatPlan via AMSA.	
Termination Criteria	DBCA is satisfied that OWR efforts are no longer required and accepts IMT request to terminate the response.	
Key Response Documents	Western Australian OWR Plan (WAOWRP) (DPaW, 2014a). Pilbara Region OWR Plan (PROWRP) (DPaW, 2014b).	
Environmental Performance Outcome	Provide resources to support OWR strategies as directed by DBCA.	
Control Measure	**Performance Standard**	**Measurement Criteria**
OWR	Maintain AMOSC and OSRL membership to ensure that equipment and personnel can be provided.	• AMOSC and OSRL membership contract.
	DBCA notified as soon as possible after sighting of oiled wildlife.	• IMT records verify that verbal and/or written notification was provided to DBCA as soon as possible after sighting.
	AMOSC OWR deployed to site within timeframes as directed by DBCA.	• Incident records verify oiled wildlife response kits are deployed to site as directed by DBCA.
Refer to **EP Section 8.8** for Environmental Performance Outcomes, Performance Standards and Measurement Criteria relating to potential environmental risks from implementation of oil spill response.		

4.9 Waste Management Plan

Oil spill response options may generate significant amounts of waste, primarily from shoreline clean-up and containment and recovery operations. Appropriate waste management is required during implementation of spill response options to not inhibit clean-up activities or further impact the environment. Types of waste to be managed in the event of a Level 3 spill will likely include:

- Contaminated hard waste (sand, rocks, vegetation, etc.)
- Liquids (hydrocarbons and contaminated water)
- Contaminated personal protective equipment (PPE) and other consumables.

All solid wastes will be managed, containerised and transported onshore for recycling and disposal by licensed waste contractors. All hazardous waste materials will be stored in appropriate containers as per requirements of the material safety data sheet (MSDS or SDS) for each substance, and in line with all applicable regulations.

The DoT is the Controlling Agency who will direct clean-up activities on WA shorelines and the Department of Water and Environment Regulation (DWER) is the State regulating authority in the management of the wastes. The SapuraOMV arrangement with Waste Contractor(s) for waste handling services is provided in **Section 6.2**.

Table 4-8 Waste management plan for a Level 3 crude oil spill

Waste Management Plan			
Initiation Trigger	Selected as response measure by IMT through IAP process during a Level 3 crude oil spill.		
Jurisdictional Authority	DoT		
Controlling Agency	DoT Note: SapuraOMV will act as Controlling Agency/Lead IMT for waste management clean-up response activities in Commonwealth waters and in State waters until such time DoT assumes control. SapuraOMV will provide resources and appropriate number of appropriately qualified personnel to support DoT with waste management activities in State waters.		
Aim	Removal of waste hydrocarbons generated from various oil spill responses (e.g. source control (for veself fuel tank spills), containment and recovery, protection and deflection and shoreline clean-up): • To support spill site and shoreline clean-up recovery • To reduce further impacts to the environment including wildlife and humans • To reduce re-mobilisation of hydrocarbons to marine waters from the shore due to tides and waves		
Procedure	**Required Timeframe and Action when Implemented (if safe)**	**Person Responsible**	**Tick When Complete**
	Ongoing - <u>Consideration of implementation of response strategy</u> – Implementation of response strategy considered during IAP process.	IMT	◻
	Within 1 day of IMT decision to implement - Request support vessels, waste services (e.g. trucks, IBCs, clean-up equipment, disposal receptacles) and support personnel (labourers) to Marine Operations Base (likely at Dampier), Forwards Operation Base (TBD with DoT at time of incident) and/or Shoreline Staging Area(s) if readily accessible (TBD with DoT at time of incident) and the following: • If required, establish additional Staging Areas (with DoT) for possible waste management activities for the likely shoreline to be contacted along the mainland coasts. • Waste transfer vessels sourced according to the external services contracting strategy (**Section 6.2**) supporting offshore vessels collecting oil in proximity to the spill site	IMT	◻

	• Appropriate vessels (shallow draft) to deliver waste management personnel and waste storage equipment to shorelines and to deploy and retrieve stored waste material. 4WD vehicles will also be used for WA mainland sites. Larger vessels (sourced according to the external services contracting strategy (**Section 6.2**)) to support waste management response measures as appropriate. • Depending on how much oil is likely to be at the spill site and to reach shorelines, refer to **Section 6.3** of worst-case shoreline loading estimates to guide waste management resources needs. • For marine containment and recovery operations, appropriate vessel deck and/or towable storage units for recovered oily water provided by waste contractor from existing stockpiles and procured. • For island shoreline clean-up operations waste transfers (if required), vessels must come equipped with IBC containers or iso-containers for recovered oily water/solids provided by waste contractor or, existing stockpiles and procured.		
	Within 1 day of IMT decision to implement - Initiate mobilisation of waste management resources.	IMT	◻
	Within 1 week of IMT decision to implement – Waste management activities initiated.	IMT	◻
	Ongoing – OSC (and a summary to be reported to the Operations Section Chief by the OSC in the daily operations report) detailing within 2 hours of completion of shoreline assessment the following to provide inputs for waste management response**:** • Recommendations for waste management methods • Effectiveness of waste management response activities	SAT OSC	◻
	Within 1 hour of completion of daily operations - Each waste management team and vessels conducting waste transfers are required to report the following to the OSC: • Volume of oil recovered • Volume of oily wastes collected	SAT team/ Vessel Master	◻
	Ongoing – If required, liquids will be transferred into IBCs for transport to a less sensitive area with temporary bunding installed for storage of IBCs, pending one of three potential operations**:** • IBCs will be directly loaded onto tray/tautliner trucks for removal from the area; and/or • IBCs will be drained with licensed vacuum tankers, and sent back to the shoreline for ongoing use.	Waste Contractor	◻
	Ongoing - Recovered oily wastes will be transferred from the shoreline by vessel/freight using a licensed waste management contractor and dispose of wastes in a suitably classed State waste disposal site, as per this Waste Management Plan.	Waste Contractor	◻
	Ongoing - Volumes of recovered oil will be measured during offloading at port. Recovered volumes will be recorded into SapuraOMV waste manifest**.**	Waste Contractor	◻
	Ongoing - The IMT use the information contained in the Daily Operations Report, containment and recovery/shoreline protection and deflection/shoreline clean-up reports to decide on further waste management responses or escalation of response depending on its effectiveness**.**	IMT	◻
Net Benefit Assessment of Response	Implementation of waste management response measures to be carefully considered:		

<table>
<tr><td></td><td colspan="3">In areas with intense fauna activity (nesting turtles, turtle hatchings, shorebird nesting) where waste management activities could cause greater impact than the removal of hydrocarbons.
Where waste management activities will potentially/likely cause greater impact to shoreline habitat than the removal of hydrocarbons.
If access to shorelines is limited to sensitive terrestrial and/or marine habitats.
Re-assess during incident.</td></tr>
<tr><td rowspan="8">Resources Required</td><td colspan="2">Resource</td><td>Available From: (Refer to Section 6.2)</td></tr>
<tr><td colspan="2">Support vessel(s)</td><td>Supplier(s) as per the external services contracting strategy (Section 6.2)</td></tr>
<tr><td colspan="2">4WD trucks and vehicles</td><td>Local Suppliers</td></tr>
<tr><td colspan="2">Waste Contractor</td><td rowspan="5">Supplier(s) as per the external services contracting strategy (Section 6.2)</td></tr>
<tr><td colspan="2">Support personnel</td></tr>
<tr><td colspan="2">Shoreline staging area(s)</td></tr>
<tr><td colspan="2">Forward Operations Base</td></tr>
<tr><td colspan="2">Machinery and tools</td></tr>
<tr><td>Escalation and Maintenance of Response</td><td colspan="3">The external services contracting strategy (Section 6.2) will be followed to secure waste transport vessels, waste transport vehicles and trained waste personnel to escalate and to maintain waste management as a response measure over the duration of an incident. The external resourcing strategy in Section 6.2 also considers the allocation of additional waste transport vessels, waste transport vehicles, personnel, equipment and service providers. Regular rotations of personnel will be timed appropriately to maintain the response.
SapuraOMV has access to further personnel and equipment though valid contracts and MoUs to escalate the response if required. See Section 4.9.3 for further details on scalability of response.</td></tr>
<tr><td>Termination Criteria</td><td colspan="3">Waste management activities no longer required as oil spill response arrangements (containment and recovery, shoreline protection and deflection, and shoreline clean-up) have no further benefit to long lasting impacts to environmental and social sensitivities caused by the spill. This criteria will only be met with consultation from stakeholders and the DoT.</td></tr>
<tr><td>Key Response Documents</td><td colspan="3">OSRA.
AMSA Marine Order 32 – Cargo Handling Equipment 2011.
IMO MSC/Circ.860 Guidelines for the Approval of Offshore Containers Handled in Open Seas.
IPIECA Guidelines for Oil Spill Waste Minimisation and Management (IPIECA-OGP, 2014).
DNV 2.7-1 certified units.</td></tr>
<tr><td>Environmental Performance Outcome</td><td colspan="3">Waste generated from a Level 3 spill handled, stored and disposed in accordance with this waste management plan and applicable state regulations.</td></tr>
<tr><td colspan="2">Management Control</td><td>Performance Standard</td><td>Measurement Criteria</td></tr>
<tr><td colspan="2" rowspan="4">Waste Management Plan</td><td>Contract in place with waste contractor licensed to handle oily wastes.</td><td>Executed contract.</td></tr>
<tr><td>Movement of wastes from collection points and return of containers in line with collection volumes.</td><td>% down-time of collection and recovery operations records.</td></tr>
<tr><td>All vehicles are licensed for controlled waste.</td><td>Manual checking of vehicles prior to dispatch records.</td></tr>
<tr><td>ISO containers to be certified to IMO standards.
IBCs dangerous goods (DG) rated.</td><td>Visual inspection of compliance plates on delivery records.</td></tr>
<tr><td colspan="4">Refer to EP Section 8.8 for Environmental Performance Outcomes, Performance Standards and Measurement Criteria relating to potential environmental risks from implementation of oil spill response.</td></tr>
</table>

4.9.1 Upper Estimates of Oily Waste Volumes

Oil spill modelling of a loss of well control (refer to GHD (2020b), also **EP Section 8.1**) for the worst-case loading onto shorelines were used to derive upper estimates of oily waste volumes in **Table 4-9** (refer to **Appendix D**).[7] These oily waste estimates serve as a guide of the upper potential scale of the Waste Management Plan for contingency planning.

Table 4-9 Maximum predicted oil waste generated during primary response activities

Source of Hydrocarbon	Target Collection Volume
Offshore Containment and Recovery	10,500 m^3 of oily water
Stage 1 Shoreline Clean-Up: Pumps and Skimmers of Shoreline Oily Water	9,275 m^3 of oily water
Stage 2 Shoreline Clean-Up: Mechanical Removal	Not carried out
Stage 2 Shoreline Clean-Up: Manual Removal	3,710 m^3 of solid (substrate) oil waste
Stage 3 Shoreline Clean-Up: Manual Polishing	1,113 m^3 of solid (substrate) oil waste
Nearshore Protection and Deflection	3,430 m^3 of solid oil waste
PPE from all Operations	1,200 m^3 of material

4.9.2 Handling, Storage, Transport and Disposal of Oily Waste

4.9.2.1 Offshore Waste Collection and Transport

If offshore waste collection responses (e.g. containment and recovery, shoreline clean-up of islands) are invoked by the IMT, then the available liquid storage capacity of vessels will be maximised through the use of IBCs or similar, stored on the decks of each vessel. With respect to the movement of these containers, either full or empty from shore-to-vessel, from vessel-to-vessel, or from vessel-to-shore, different standards apply as specified by AMSA, the IMO, namely:

- For shore to vessel or vessel to shore the standards for loading and unloading of equipment to vessels are AMSA Marine Order 32 – Cargo Handling Equipment 2011 (AMSA, 2011), which covers the requirements for responsibilities, loading/unloading procedures and equipment, certification and maintenance.
- For vessel to vessel (dynamic lifting) AMSA has adopted the *IMO MSC/Circ.860 Guidelines for the Approval of Offshore Containers Handled in Open Seas, and accepts DNV 2.7-1 certified units* (DNV, 2006).
- Operational considerations to reduce the potential for the accidental release of recovered oily waste will include the following:
  - Check temporary storage devices prior to use to ensure they are not contaminated with residues from previous use.
  - Appropriate settling time to be allowed to enable gravity separation to occur prior to decanting and discharge of the free water.
  - Where possible, employ the use of internal baffles in the temporary storage device to help speed up separation and prevent remixing of the oil and water.

[7] Oil waste volumes from shoreline clean-up include a ~3.22 fold increase in the oil volume due to emulsification as simulated by GHD (2020b).

- ○ Free water to be discharged either into a secondary storage container or within the apex of containment booms in the path of the recovery device (so that any accidentally discharged oil can be contained and recovered).
- ○ Visual monitoring to be undertaken at the discharge site while decanting to ensure that only water is released. If possible, the oil-water interface in the storage device will also be monitored to ensure that the discharge hose is only drawing from the layer of free water at the bottom.
- ○ Consider environmental and socio-economic sensitivities when planning decanting operations.

4.9.2.2 Shoreline Waste Collection

Shoreline clean-up operations on the mainland will use conventional response techniques with waste handling operations at local storage areas in the hot zone to be loaded onto trucks with typically subsequent transport directly to a final disposal site.

Any shoreline clean-up operations on islands will also use conventional response techniques as the mainland operations. However, waste will be trans-shipped via containers to the shoreline with transfers directly to trucks with subsequent transport to the final disposal site.

Table 4-10 describes the waste storage, disposal and treatment options to be available at the shore waste transfer area for recovered weathered oil. These disposal options will be available through the State licensed waste contractors.

The waste contractor will be licensed for Controlled Wastes and Dangerous Goods transport.

Table 4-10 Oily waste storage, disposal and treatment options

<table>
<tr><th>Waste Category</th><th>On-site Storage Option</th><th>Handling Suggestion</th><th>Disposal and Treatment Options</th></tr>
<tr><td rowspan="4">Oily Residue (liquids etc.)
Oiled Organic Materials (sand, etc.)</td><td>Lined skips</td><td>Bottom drainage hole to be plugged</td><td rowspan="4">Water: Oily water separation unit.
Oil: Recycle.
Bioremediation.
Incineration/landfill (after oil content reduced to no greater than 30 ppm).</td></tr>
<tr><td>Oil drums</td><td>Half fill only</td></tr>
<tr><td>Industrial Waste Bags</td><td>Half fill only</td></tr>
<tr><td>Plastic Rubbish Bags</td><td>Half fill only</td></tr>
<tr><td rowspan="4">Oiled Man-made Products (e.g. PPE, booms)</td><td>Lined skips</td><td>Bottom drainage hole to be plugged</td><td rowspan="4">Recovery and Recycling.
Incineration/landfill (after oil content reduced to no greater than 30 ppm).</td></tr>
<tr><td>Oil drums</td><td>Half fill only</td></tr>
<tr><td>Industrial Waste Bags</td><td>Half fill only</td></tr>
<tr><td>Plastic Rubbish Bags</td><td>Half fill only</td></tr>
<tr><td rowspan="2">Oiled Deceased Wildlife</td><td>Industrial Waste Bags</td><td>Half fill only</td><td rowspan="2">Incineration.
Landfill.</td></tr>
<tr><td>Plastic Rubbish Bags</td><td>Half fill only</td></tr>
</table>

The procedure for storage of onshore waste storage will be as follows:

- Oily sediment with no free oil:
  - ○ Stored above the high-tide mark in pits lined with plastic and no deeper than 1 m.
  - ○ The storage site will avoid vegetated areas and low-lying areas.
- Oily sediment or debris with some free oil:

- Stored in a shallow pit lined with plastic. Edges will be elevated above sediment level. Depth of pit should not be such that intrusion of sediment water occurs.
    - Plastic bags to be no more than one half full and stored above the high-tide mark.
    - When 200 litre drums are utilised they will not be filled to the top (half full is recommended). Drums will be covered if possible to prevent the entry of rainwater with consequent overflow.
- Free oil with oily debris:
    - Storage pits and drums as per oily sediment/some free oil except that greater care will be needed in the siting of temporary storage pits;
    - Unless groundwater / water (at bottom of pit) is encountered, pits will be deeper than above and left no more than two thirds full if possible: and
    - Storage pits will be covered and wildlife ingress prevented.

4.9.2.3 Secondary Contamination

While handling waste there is a risk of secondary contamination (e.g. leaks from trucks transporting waste to disposal sites, vessels transporting hydrocarbons into harbour on their hulls). The following procedures will be adhered to minimise secondary contamination:

- All road transport trucks leaving a spill response site will be inspected to ensure they are not overfilled and they are not prone to leaking oil.
- Onshore equipment and plant used in onsite clean-up will undergo wash-down in a designated and appropriately designed decontamination unit.
- Vessels that have been operating in the slicks will be inspected prior to returning to port. Once a vessel has been in a slick, it will be kept at sea as long as is reasonable to minimise the potential impact to ports and to reduce the amount of vessel inspection and cleaning required. Port authorities will be briefed on vessel movements and can observe inspection and cleaning processes. Vessel cleaning typically involves putting a boom around the vessel in sheltered water, and then using a work boat with a pressure washer to wash the oil off the hull and a small recovery system (skimmer or nets) to recover the hydrocarbons inside the containment boom. The boom required for this sort of operation is typically a Level 1 type boom and adequate supplies are available from suppliers in Perth and AMOSC on demand.

SapuraOMV has significant capability to procure logistics services, locally, regionally and nationally. SapuraOMV has procurement personnel and logistics specialists who are well placed to access additional equipment (plant, storage and handling equipment, etc.) as required.

4.9.2.4 Onshore Waste Disposal

The waste management contractor will dispose of all waste products at an appropriately classed waste disposal site and comply with all State Laws and Regulations including the Environmental Protection (Controlled Waste) Regulations 2004 and the *Dangerous Good Safety Act 2007*.

4.9.3 Scalability

If there is a requirement to scale up to sustain substantial waste handling operations, the following steps will be taken:

- If required, a dedicated position in the IMT Logistics Section will be allocated to handle all waste operations. This role can be filled by one of SapuraOMV’s logistics personnel, or by a contractor with relevant skills (e.g. Waste Management Contractor).

- Liaison with Shire Councils by the waste service contractor to advise them of plans and to coordinate use for resources where appropriate and agreed.
- Advance notifications to final disposal sites that waste may be expected in days and weeks to come.

The IMT Logistics Section will also scale up the supply of transport in terms of both vessels and road transport, as well as support equipment and personnel.

4.9.4 Regulatory Approvals

Any temporary waste storage and treatment facilities will trigger the Category 61 thresholds within the *Environment Protection Act 1986*, a licence to operate will be required from the DWER (WA) for any storage or treatment of wastes. As Works Approvals and licences can only be prescribed to specific premises, and suitable premises may not be determined until a spill has eventuated, obtaining these formal approvals is not possible in advance.

DoT WA working in conjunction with DWER will ensure that any temporary facilities are approved in accordance with State legislation, where WA DoT's regulatory abilities through the *Emergency Management Act 2005* may be employed to ensure required approvals are obtained in an expeditious manner.

5. Forward Operations

5.1 Marine Operations Base

The IMT will be responsible for managing the marine, aerial and shoreline responses. In the event of a Level 3 incident, the Marine Operations Base for the drilling campaign, likely to be located at Dampier, will be expanded and adapted by SapuraOMV with assistance as necessary.

If instructed by the IMT, the Marine Operations Base contractor (see **Section 6.2**) will assist SapuraOMV in the establishment, maintenance and removal of the Marine Operations Base, and will subcontract services to provide required services (e.g. catering facilities, power, ablutions). A Waste Management Contractor (see **Section 6.2**) will set up the non-oily and oily waste management infrastructure, and associated logistics at the Marine Operations Base. Supplies to the Marine Operations Base will be provided by (or the responsibility of) the Marine Operations Base contractor (see **Section 6.2**).

5.2 Forward Operations Base(s)

Under instruction by the IMT, a Forward Operations Base contractor (see **Section 6.2**) will set up and maintain the Forward Operations Base(s) (location TBD with DoT at time of incident response) in proximity to response activities. A Waste Management contractor (see **Section 6.2**) will set up the non-oily and oily waste management infrastructure, and associated logistics at the Forward Operations Base. Supplies to the Forward Operations Base will be provided by (or the responsibility of) the Forward Operations Base contractor (see **Section 6.2**).

5.3 Shoreline Staging Area(s)

Under instruction by the IMT, a Shoreline Staging Area contractor (see **Section 6.2**) will set up and maintain the shoreline staging area(s) closer to response activities (location TBD with DoT at time of incident response) and supply the shoreline clean-up equipment. Shoreline clean-up equipment and other supplies to the Shoreline Staging Area(s) will be transported by the Shoreline Staging Area contractor. The Waste Management contractor will set up cold, warm and hot zones and control points between the zones established as per industry-standard Standard Operating Procedures (SOPs).

5.4 Oiled Wildlife Response Centre(s)

In addition to the AMOSC OWR container, OWR operations require significant space with freshwater supply, wastewater and solid waste handling, lighting, power, crib room and toilets. The OWR Centre will be established and maintained initially at the Forward Operations Base(s) (location TBD with DoT at time of incident response) as appropriate under instruction by the IMT to decrease transit times of oiled wildlife. The Pilbara Region Oiled Wildlife Response Plan identifies locations in Exmouth, Onslow and Karratha/Dampier that may be suitable for an OWR Centre. The OWR Centre(s) will be established and supported by AMOSC initially via OWR kits located in Exmouth and mobilisation of an OWR container from Fremantle. AMSA also have an OWR kit and container that could be mobilised by road and/or vessel to the Forward Operations Base.

5.5 Waste Transfer Station(s)

Ideally, waste material will be dispatched immediately to the final waste processing plants. Industry experience with previous spills has shown that delays in the establishment of waste handling supply chains and resultant secondary contamination can result in additional clean-up effort when waste is not handled properly and timely. Given the predicted potential for significant waste volumes to be generated (**Section 4.9.1**), the set-up of a proper fit-for-purpose waste handling supply chain is critical in the event of substantive response efforts in terms of shoreline clean-up, offshore containment and recovery, and protection and deflection measures. As mentioned previously, a waste transfer station will be established at the Marine Operations Base (likely at Dampier), and if required at the Forward Operations Base(s) (location TBD with DoT at time of incident response). Waste tansfer stations will also be established at Shoreline Staging Areas so that waste can be properly handled by the Waste Management Contractor.

5.6 Logistical Considerations

Logistical considerations of the Marine Supply Base, Forward Operations Base(s), OWR Centre(s) and Waste Transfer Station(s) are summarised in **Table 5-1**. Depending on the location of the Shoreline Staging Area(s) in terms of proximity to towns (e.g. Exmouth, Onslow, Dampier/Karratha) some of these services may be required, which will be set up by the Shoreline Staging Area(s) contractor.

Table 5-1 Logistical considerations for mainland Bases / Areas / Stations / Centres

Consideration	Possible Logistical Issues	Available Solutions	Dampier	Exmouth	Onslow
Power, IT and Location	- No mobile phone coverage - No available IT resources - VHF radios only useful over limited area	- Use of satellite phones - Provision of laptops, wireless internet hubs, routers, printers, generators - Use of a local high gain antenna with a mobile phone repeater station - Photographic equipment and data pads with geo-referencing capabilities - Use of a SPOT tracker to send instant coordinates	Yes	Yes	Yes
Office facilities	- Unavailable office area	- Operate from support vessels - Hire of local space on mainland - Converted accommodation or shipping containers	Yes	Yes	Yes
Accommodation	- Insufficient or no accommodation	- Accommodation on support vessels - Local facilities	Yes	Yes	Yes
Transportation	- Insufficient or absent transport to offshore or remote areas.	- Transport provided by vessel contractors and their tenders, fixed wing contractors and helicopter contractors where possible, (see **Section 6.2**) - Local providers of 4WD vehicles - Mainland transport contractor for freight	Yes	Yes	Yes

Estimated travel times between Perth, the Marine Operations Base (likely at Dampier) and potential Forward Operations Base locations (i.e. Exmouth, Onslow) are summarised in **Table 5-2**. **Figure 5-1** illustrates the distance from the well site to the potential locations of the Marine Operation Base and Forwards Operations Base(s).

Table 5-2 Estimated travel times between locations of Bases/Areas (hours)

Location 1	Location 2	Flight (~800 km/hr)	Road (~100 km/hr)	Vessel (~12 knots, ~22 km/hr)	Helicopter (~105, knots, ~195 km/hr)
Well site	Dampier	-	-	7	0.8
Perth	Dampier	2	16	-	-
Perth	Exmouth	2	13	60	-
Perth	Onslow	2	14	-	-
Dampier	Onslow	-	3.5	10	1
Dampier	Exmouth	-	6	15	1.5
Exmouth	Onslow	-	4	5	0.5

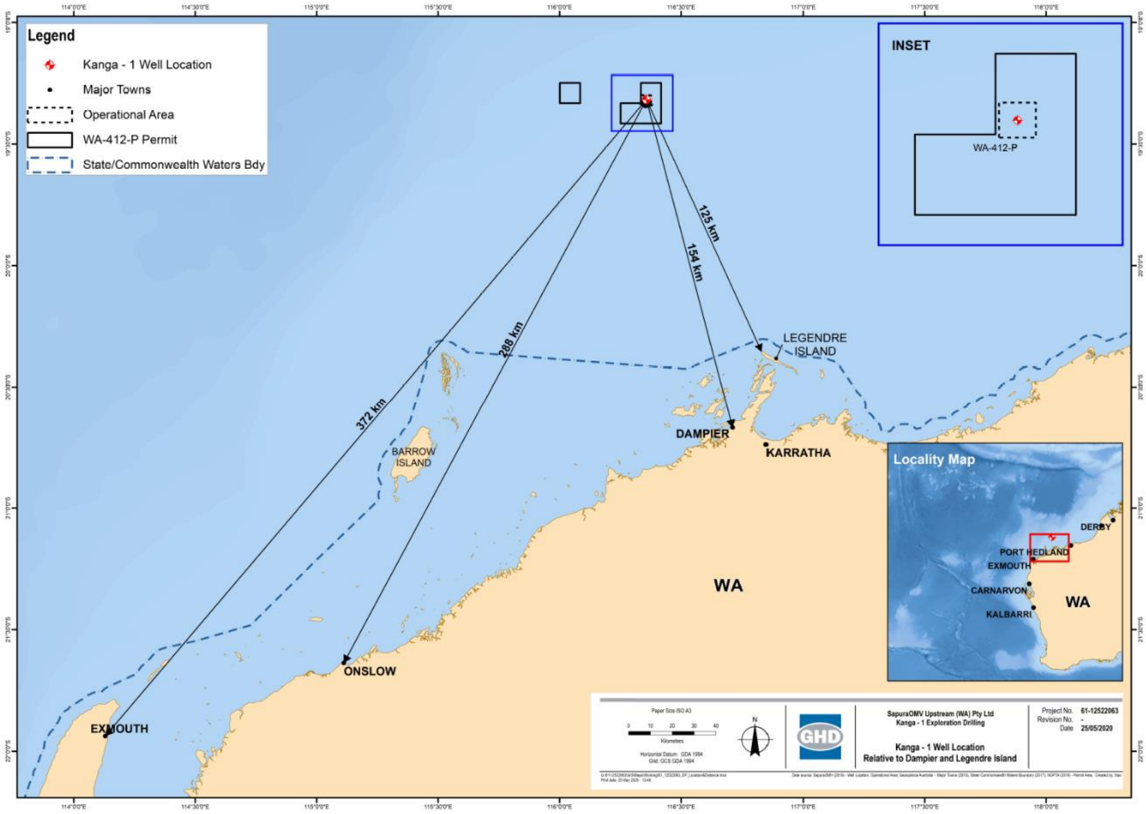

Figure 5-1 Distances between the well and likely locations of response bases

6. OPEP Resourcing

6.1 Incident Management Team

A response to a Level 2 or Level 3 spill will require specialist skills for an extended period of time. As per **Table 6-1** first response IMT manning will be fulfilled by personnel from SapuraOMV and other contracted organisations along with provision of additional support to provide full cover of IMT positions. The SapuraOMV duty roster is updated weekly.

The potential peak IMT resourcing requirements to manage the response in the event of a 'worst case discharge' scenario, and demonstration of the resourcing capacity available for SapuraOMV to meet those requirements, are described in **Appendix B**.

Table 6-1 IMT manning strategy

Role	First Response Fill	Surge	Provision of Additional Support
Incident Commander	SapuraOMV		AMOSC, OSRL, AMSA and DoT
Planning Section Chief	SapuraOMV		AMOSC, OSRL, AMSA and DoT
Operations Section Chief	SapuraOMV		AMOSC, OSRL, AMSA and DoT
Logistics Section Chief	SapuraOMV		AMOSC, OSRL, AMSA and DoT
Source Control Branch Director	SapuraOMV		Wild Well Control (WWC), Specialist Third Party providers
Liaison Officer	SapuraOMV	SapuraOMV, Specialist Third Party providers	AMOSC
Public Information Officer	SapuraOMV/ Direct Contractor	Direct Contractor	Specialist Third Party providers
Safety Officer	SapuraOMV		Specialist Third Party providers
Finance & Admin Section Chief	SapuraOMV	SapuraOMV, Specialist Third Party providers	Specialist Third Party providers
Environment Unit Lead	SapuraOMV	SapuraOMV, Specialist Third Party providers	Specialist Third Party providers

6.2 External Services Contracting Strategy

A large spill may require deployment of substantive spill response resources for an extended period of time. In addition to SapuraOMV resources, these resources will be obtained from third party contractors, industry support groups and government support agencies (collectively referred to as 'external services'). Key external services organisations, summary roles and service provision arrangements are provided in the external services contracting strategy in **Table 6-2**.

In the event of a Level 2 or Level 3 spill and activation of relevant external resources, the IMT will:

- Request and receive up to date equipment inventories from each contractor.
- Response personnel, equipment, plant and services will be resourced as per the external services contracting strategy in **Table 6-2**.
- An up-to-date contact list will be maintained by SapuraOMV on their network and in hardcopy in the emergency control centre (ECC) to rapidly mobilise OPEP resources in the event of a large spill incident.

Table 6-2 External services contracting strategy

Scope of Work	Supplier/s	Contract Type	Contract Timing	General Contract Specifications and Notes	Timeframes
- Capping stack - Debris clearance equipment and BOP intervention - Subsea dispersant application equipment - Associated personnel and technical services	WWC global call off agreement.	C	In-place.	The SapuraOMV Well Containment Plan will be prepared in conjunction with WWC 3 months prior to commencement of the Activity and will include logistics strategies to meet the required deployment timeframes as summarised in **Figure 3-3**. The logistics plan included in the WCP will also include timelines for mobilisation of personnel to provide operational support. Personnel will be available prior to arrival of capping stack and related equipment.	As per **Figure 3-3** of **Section 3.3** - Source Control Plan. Immediate activation of associated personnel and technical services and continued deployment until well control as per **Section 3.3** - Source Control Plan
Subsea dispersant delivery hoses	Industry specialist provider to meet the technical specifications (to be selected).	B	In-place 6 weeks prior to start of Activity.	Hose lengths (>150 m) and fittings as specified in the WCP with input from WWC.	As per **Figure 3-3** of **Section 3.3** – Source Control Plan
Initial hydrocarbon surveillance	Primary rig support vessels via Clarkson's.	A	In-place 6 weeks prior to start of Activity	Initial (immediate) hydrocarbon surveillance as per **Section 3.4.1**.	Immediate assessments as per **Section 3.4.1** – Monitor and Evaluate Plan (OS1: Hydrocarbon Surveillance and Tracking).
Well control/ installation vessels (Vessel Safety Case (VSC) may be required)	Vessel contractors via Clarkson's and/or APPEA MoU.	A or D	Contracted as required.	Vessels to support following well control efforts: • Relief well (refer to **Section 3.3)** • Emergency BOP activation (refer to **Section 3.3)** • Subsea dispersant application (refer to **Section 3.3** and **Section 4.4**) • Debris clearance (refer to **Section 3.3**) • Capping stack installation (refer to **Section 3.3**) Vessel specifications will be as per WCP with Capping stack installation requiring 250 tonne crane capacity	As per **Figure 3-3** of **Section 3.3** – Source Control Plan and **Section 4.4** – Subsea Dispersant Application Plan.
Well control personnel and technical services	WWC.	C	In-place.	The SapuraOMV Well Containment Plan will be prepared in conjunction with WWC 3 months prior to commencement of Activities and will include logistics strategies to meet the required deployment timeframes.	Immediate activation and continued deployment until well control as per **Figure 3-3** of **Section 3.3** - Source Control Plan.
Oil spill response vessels (large, no VSC)	Vessel contractors via Clarkson's.	A or B	Additional vessel call off option in place with primary vessel supplier prior to drilling or contracted when required via Mutual Aid MoU or vessel brokers / direct.	Vessels to support following spill response efforts: • Surface dispersant application (refer to **Section 4.2**) • Mechanical dispersion (refer to **Section 4.5)** • Containment and recovery (refer to **Section 4.7**) • Offshore waste management (refer to **Section 4.9**) Adequate vessels will be sourced to meet the plant requirements outlined in **Appendix D**.	As per **Section 4.2** – Shoreline Clean-Up, **Section 4.5** – Mechanical Dispersion, **Section 4.7** – Offshore Containment and Recovery and **Section 4.9** – Waste Management.
Oil spill response vessels (small, no VSC)	Vessel contractors via Clarkson's.	A or B	Additional vessel call off option in place with primary vessel supplier prior to drilling or contracted when required direct from local suppliers.	Vessels to support following spill response efforts: • OS3: Shoreline assessment (refer to **Section 3.4.3**) • Scientific monitoring plan (refer to **Section 3.5 and OSMIP**). • Oiled wildlife response (refer to **Section 4.8**) • Shoreline protection and deflection (refer to **Section 4.6**) • Shoreline clean-up (refer to **Section 4.2**) • Shoreline waste management (refer to **Section 4.9.2.2)** Transport personnel and equipment to/from remote locations, and response use in shallow, nearshore environments Adequate vessels can be sourced to meet the requirements outlined in **Appendix D**.	As per **Section 3.4.3** – OS3: Shoreline Assessment, **OSMIP** and **Section 3.5** – Scientific Monitoring, **Section 4.9** – Waste Management and **Section 4.9.2.2** – Shoreline Waste Collection, **Section 4.6** - Shoreline Protection and Deflection, **Section 4.2** – Shoreline Clean-up and **Section 4.8** – Oiled Wildlife Response.
Secondary MODU.	As available.	A or D	Contracted when required via APPEA Mutual Aid MoU or direct.	- NOPSEMA-accepted MODU Safety Case - Technical specification to meet requirements of relief well.	As per **Section 3.3** - Source Control Plan.
Casing and well head for relief well.	MITO - Casing Dril-Quip - Wellhead	A and B	In place and available 6 weeks prior to start of Activity.	Technical specification to meet requirements of relief well. The wellhead will be the same specification as the primary wellhead. The casing will meet the specifications of the dynamic well kill requirements as a minimum.	As per **Section 3.3** - Source Control Plan.
ROVs	Industry specialist provider to meet the technical specifications (to be selected).	A	Primary supplier in-place 6 weeks prior to start of Activity.	Technical specification to meet requirements of response role. ROV will be capable of performing BOP and capping stack interventions and subsea dispersant application.	As per **Section 3.3** - Source Control Plan and **Section 4.4** –

Scope of Work	Supplier/s	Contract Type	Contract Timing	General Contract Specifications and Notes	Timeframes
			Additional suppliers contracted as necessary.		Subsea Dispersant Application Plan.
- 2x Satellite tracking buoys to leave on MODU during Activity. - Further tracking buoys to call-off as necessary.	AMOSC service agreement	A and B	In-place 6 weeks prior to start of Activity.		As per **Section 3.4.1** – Monitor and Evaluate Plan (OS1: Hydrocarbon Surveillance and Tracking).
Oil Spill Observers	AMOSC service agreement	B	In-place	Trained observers and sampling of spilled oil and water column.	As per **Section 3.4.1** – Monitor and Evaluate Plan (OS1: Hydrocarbon Surveillance and Tracking).
Helicopter services for spill monitoring	Helicopter provider(s)	A	In-place 6 weeks prior to start of Activity.	Dedicated helicopter will be available if not otherwise required, for safety reasons.	As per **Section 3.4.1** – Monitor and Evaluate Plan (OS1: Hydrocarbon Surveillance and Tracking).
Fixed-wing aircraft services for spill monitoring	Aircraft from qualified contractors.	B	Call off/MoU arrangement via primary aerial services provider 6 weeks prior to start of activity.	Provision of fixed wing aircraft for aerial observation will meet Appendix D deployment timeline and number of aircraft.	As per **Section 3.4.1** – Monitor and Evaluate Plan (OS1: Hydrocarbon Surveillance and Tracking).
Satellite imagery	AMOSC service agreement OSRL membership	B C	In-place In-place	May be accessed direct or via AMOSC and/or OSRL.	As per **Section 3.4.1** – Monitor and Evaluate Plan (OS1: Hydrocarbon Surveillance and Tracking).
Oil Spill Trajectory Modelling	APASA via AMOSC	B	In-place	Provision of OSTM and 3D modelling during spill.	As per **Section 3.4.2** – Monitor and Evaluate Plan (OS2: Oil Spill Trajectory Modelling).
Shoreline Assessment Teams	Environmental consultants AMOSC service agreement OSRL membership WA DoT (via WA State Hazard Plan)	A B C E	In-place 6 weeks prior to start of Activity. In-place In-place N/A	Trained in beach profiling and shoreline assessment.	As per **Section 3.4.3** – Monitor and Evaluate Plan (OS3: Shoreline Assessment).
Land vehicles for shoreline response	Various car rental firms	E	Hired when required.	-	As per **Section 3.4.3** – Monitor and Evaluate Plan (OS3: Shoreline Assessment).
Scientific Monitoring personnel and equipment	Environmental consultancy	B	Access to trained personnel and equipment necessary for scientific monitoring via a dedicated scientific monitoring standby contract in-place 6 weeks prior to start of Activity.	Demonstrated capability and capacity to implement Scientific Monitoring Plan including: - nominated personnel with expertise in relevant disciplines that meet the minimum qualifications and experience requirements for key OSMIP roles - confirmed local (ie WA) resourcing (personnel and equipment) capacity sufficient to meet immediate OSMIP implementation requirements - experience coordinating and implementing scientific monitoring studies for oil and gas operators in WA.	As per **Section 3.5** – Scientific Monitoring Plan and the **OSMIP**.
- Oiled Wildlife Response (OWR) personnel - OWR kits - OWR container - OWR Centres	AMOSC service agreement OSRL membership WA DBCA (via WA State Hazard Plan) AMSA (via National Plan)	B C E E	In-place In-place N/A. N/A	Trained in the implementation of oiled wildlife response plan including long-term care, relocation and remediation of marine fauna.	As per **Section 4.8** – OWR Plan and **Section 5.4** - OWR Centre(s).
- Dispersant – surface and subsea stockpiles. - Trained personnel and equipment for dispersant operations. • Surface • Subsea	AMOSC service agreement OSRL GDS membership AMSA (via National Plan) AMOSC service agreement WWC global framework agreement	B C E B C	In-placeIn-place 2-3 months prior to start of activityN/A. In-place In place 6 weeks prior to start of activity	Dispersant stockpiles from AMOSC within Australia (>250m^3) and OSRL global stockpiles (~5,000m^3), supplemented by AMSA stockpiles from around Australia (>350m^3) meet the dispersant volume and availability requirements projected in Appendix D. AMOSC Core Group of trained responders in the IMT and field. WWC subsea dispersant operations/technical specialists forms part of the team mobilised for the Well Containment Plan.	As per **Section 4.3** - Surface Dispersant Application Plan and **Section 4.4** – Subsea Dispersant Application Plan.
Fixed-wing aircraft for dispersant application.	AMOSC service agreement OSRL membership	B C	In-place In-place	Adequate aircraft can be sourced to meet the requirements outlined in Appendix D.	As per **Section 4.3** Surface Dispersant Application Plan.

Scope of Work	Supplier/s	Contract Type	Contract Timing	General Contract Specifications and Notes	Timeframes
- Marine oil spill response equipment - Associated personnel and technical services	OSRL membership AMOSC service agreement AMSA (via National Plan) Equipment suppliers	C B E E	In-place In-place N/A. Sourced as required.	Includes equipment for offshore containment and recovery, and shoreline protection and deflection.	As per **Sections 4.6** Shoreline Protection and Deflection Plan and **4.7** Offshore Containment and Recovery Plan.
- Shoreline oil spill response equipment. - Associated personnel and technical services.	OSRL membership AMOSC service agreement WA DoT (via WA State Hazard Plan) AMSA (via National Plan) Equipment suppliers	C B E E E	In-place In-place N/A. N/A. Sourced as required.	Trained shoreline clean-up personnel, able to brief and lead shoreline clean-up teams provided. Experienced clean-up personnel to train clean-up labourers as required. Appropriate PPE to be provided as required.	As per **Section 4.2** - Shoreline Clean-Up Plan.
Waste Management equipment and services.	Licensed waste management contractor	A	In-place 6 weeks prior to start of Activity.	Set up secure temporary waste storage/laydown areas in proximity to clean-up operations, manage collection, transport and delivery of wastes to licensed facilities, and maintain all relevant waste documentation. Waste will include hazardous and non-hazardous solid and liquid wastes.	As per **Section 4.9** - Waste Management Plan and **Sections 4.2**, **4.6, 4.7 5.1** and **5.5**.
Shoreline Staging Area equipment and personnel.	AMOSC Equipment suppliers	B E	In-place Sourced when required.	Secure temporary areas for labour in proximity to shoreline clean-up operations (e.g. generators, accommodation, sewage/grey water facilities, catering)	As per **Section 4.2** - Shoreline Clean-Up Plan.
IMT support services	AMOSC service agreement OSRL membership WWC global framework agreement ICS Specialists Legal consultancy Media consultancy Environmental consultancy Agency hire	B B C B B B B B	In-place In-place In place 6 weeks prior to start of Activity In-place 6 weeks prior to start of Activity In place 6 weeks prior to start of Activity In place 6 weeks prior to start of Activity In place 6 weeks prior to start of Activity In place 6 weeks prior to start of Activity	Support services from specialist third party providers to support the IMT resourcing for a WCD scenario	Immediate
General labour hire.	Labor hire contractors	A	Sourced when required.	Primarily for shoreline clean-up, but also for other spill response activities (e.g. shoreline clean-up, protection and deflection deployment working under the guidance of team leaders) or other specialist workforce (e.g. forklift drivers, security).	As per **Section 4.2** - Shoreline Clean-Up Plan.
Mainland Transport Contractor.	Logistics and transport contractor	B	In-place 6 weeks prior to start of Activity.	Vehicles and drivers (with controlled waste licences), hotshot services, transport of personnel mobilised during response.	Immediate.
Marine Operations Base.	Toll	A	In-place 6 weeks prior to start of Activity.	Likely established at primary supply port (Dampier). Storage, laydown and biosecurity areas, forklifts, office space warehouses, lifting equipment, cleaning and servicing facilities.	Immediate.
Forward Operations Base.	Contractor to be selected	A	In-place 6 weeks prior to start of Activity.	If required, likely established at locations to be agreed with DoT depending on occurrence of substantive shoreline loadings. Storage, laydown and biosecurity areas, forklifts, office space warehouses, lifting equipment, cleaning and servicing facilities.	Immediate.
Contract Type					
A: SapuraOMV dedicated contract					
B: SapuraOMV call-off agreement					
C: SapuraOMV Global call-off agreement					
D: Assignment from other Titleholders/Operators					
E: No contract arrangement needed					
Notes:					
i) Contract scopes of work will match EP and OPEP commitments ii) Vessels conducting source control activities ("installation vessels") are likely to require a NOPSEMA-accepted Vessel Safety Case (VSC). Presence of such vessels in Australian waters is dependent on activities of other Titleholders at any given time. Installation vessels are likely to be active in the South East Asia region and can be mobilised to Australia, in which case close liaison with NOPSEMA (Safety Division) will be required. SapuraOMV receives regular broker reports that identify various classes of vessels active in the region so can be ready to contact vessel owners at short notice.					

6.3 Resources for Implementation of OPEP Responses (Worst-Case)

Estimates of spill response resources to implement the OPEP are summarised in **Appendix D** These OPEP resource requirements are based on likely response strategies to combat the predicted worst-case loading onto shorelines of ~1,000 m^3 for a Level 3 loss of well control incident (see **EP Section 8.1**). Estimates of first strike (week 1) and peak escalation resources from **Appendix D** are summarised in:

- **Table 6-3** for plant (aircraft and vessels);
- **Table 6-4** for personnel; and
- **Table 6-5** for key response implementation equipment and comparison with proximal first strike (Exmouth, Dampier) and escalation (other Australian locations, OSRL) stockpiles (see **Appendix E)** for detailed spill response equipment stockpile).

Table 6-3 First strike and peak escalation of spill response plant resources and dispersant volume estimates (worst-case)

Stage	Aircraft - Observation	Aircraft - Dispersant	Vessel - Dispersant	Vessel – C&R*	Vessel – P&D**	Dispersant (m^3/week)
First Strike Week 1	2	4	5	0	0	236
Peak Escalation	2	4	5	15	20	560

* Containment and Recovery (includes support vessels for oily waste transport)

** Protection and Deflection (includes support vessels for oily waste transport)

Table 6-4 First strike and peak escalation of spill response personnel resource estimates (worst-case)

Stage	Aerial Operations	Marine Operations	Shoreline Operations	Totals
First Strike Week 1	15	7	9	31
Peak Escalation	19	133	369	770

Table 6-5 First strike and peak escalation of spill response equipment resource estimates (worst-case)

Equipment	First Strike Estimate (Appendix D)	Peak Escalation Estimate (Appendix D)	First Strike Available Resources (Appendix E)	Peak Escalation Potential Resources Available (Appendix E)
Vessel Dispersant Spray Sets	5	5	6	45
Offshore Boom Length	0	1,200	3,700	21,770
Oil Recovery Devices	0	21	15	222
Stage 1 Nearshore/Shoreline Clean-up Boom (Inshore) Length (m)	0	3,200	2,225	31,875

Estimates of the volumes of oily water and solid waste generation from a worst-case response are summarised in **Table 6-6** (also in **Section 4.9.1**).

Table 6-6 Oily waste generation estimates (worst-case)

Type of Waste	Total (m^3)
Total oily water waste (Stage 1 shoreline clean-up, offshore containment and recovery)	19,775
Total oily solid waste (Stage 2 manual and stage 3 polishing shoreline clean-up, shoreline protection and deflection, PPE)	9,453

These estimates of plant, personnel, equipment, dispersant volumes and waste generation from a predicted worst-case oiling of shorelines serve as the basis to inform the development of the External Services Contracting Strategy (**Section 6.2**).

6.4 Confirmation of Availability and Mobilisation of Spill Response Plan, Personnel and Equipment

The availability of key spill response plant, equipment and personnel from external organisations (e.g. WWC, OSRL, AMOSC, OSRL) and mobilisation timeframes (first strike escalation) stipulated in this OPEP will be confirmed and related contracts/arrangements/agreements will be in place prior to the Kanga-1 well drilling campaign.

7. Termination Strategy

The decision to terminate the spill response is made in consultation with the relevant Controlling Agency, Jurisdictional Authorities and other Statutory Authorities that play an advisory role (e.g. DBCA). The decision to terminate spill response strategies will be made with consideration of the following:

- The effectiveness and environmental benefit of the current response activities.
- The potential for further spills/leaks.
- The potential for additional environmental damage caused by ongoing clean-up activities.
- An assessment of prevailing weather conditions, including the potential to cause increased risk to response teams or increase the efficacy in weathering hydrocarbons.

A NEBA will be conducted to inform the decision making process. Termination criteria are defined within each section of response strategies defined within this OPEP. Upon conclusion of the spill response activities, SapuraOMV will complete the following tasks:

- Prepare detailed reports and collate all documents;
- Report on the performance outcomes and standards of each individual spill response that was initiated;
- Undertake an inventory of consumables and prepare accounts;
- Arrange for the return of equipment;
- Arrange for the refurbishment of consumed equipment;
- Conduct an investigation into the cause of the incident and report to relevant authorities; and
- Assess any long-term environmental monitoring requirements.

8. OPEP Administration

8.1 OPEP Custodian

Name: Senior HSE Specialist, HSE Department

Address: SapuraOMV Upstream (WA) Pty Ltd
Level 2, 251 St Georges Terrace
Perth, WA 6000

Telephone: 08 6118 4990 (office)

Email: kanga.australia@sapura-omv.com

8.2 OPEP Custodian Responsibilities

The OPEP custodian is responsible for:

- Distribution and tracking copies of the OPEP.
- Monitoring associated response plans (i.e. National Plan for Maritime National Emergencies, WA State Hazard Plan for Maritime Environmental Emergencies, WA Oiled Wildlife Response Plans) and other related resources for material changes, and ensuring spill response activities meet requirements/guidelines.
- Accepting, assessing and collating any requests for revision of the OPEP.
- Making revisions to the OPEP.
- Maintaining an up-to-date digital version of the OPEP and a copy of the OPEP as currently issued (the 'master' copy).
- Issuing updates for revised sections of the OPEP.
- Submission of revisions of the OPEP to NOPSEMA in accordance with Regulation 14 (8AA) (refer to **Section 8.3** below).

8.3 OPEP Review and Update

This OPEP will be reviewed and updated as necessary in response to one or more of the following:

- When major changes occur that may affect the spill response coordination or capabilities.
- Changes to the Environment Plan that affect Oil Spill Response coordination or capabilities (e.g. a significant increase in spill risk).
- Following routine testing of the OPEP if improvements are identified.
- After an actual Level 3 or Level 2 spill incident.
- If not reviewed beforehand, 3-6 months prior to the Activity.

The extent of changes made to the OPEP and resultant requirements for regulatory resubmission will be informed by the relevant Commonwealth regulations, i.e. the OPGGS(E) Regulations. The OPEP custodian (or delegate) will review the OPEP in accordance with SapuraOMV HSE procedures and relevant statutory requirements.

8.4 Maintenance of the OPEP

SapuraOMV will submit a revised OPEP to NOPSEMA as soon as practicable where there are significant changes to the content of the OPEP or capability to respond to an incident. Any significant changes in the content of the OPEP or capability to respond to an incident will be captured through SapuraOMV's Management of Change (MoC) procedure (refer to **Section 9.4.4** of the EP for further information).

8.5 OPEP Training

All personnel onboard the MODU are trained (inducted) in the application of the relevant SOPEP. Regular SOPEP drills and exercises are carried out on the MODU in accordance with the SOPEP to maintain the crew's knowledge of response equipment and incident response procedures. This verifies emergency response efficiency, effectiveness of procedures and detects any failure in equipment. These drills include, but are not limited to, spill response, collision, grounding, fire and explosion. All drills are documented, debriefings held and corrective actions identified (including revisions to the SOPEP) and tracked to completion by the MODU OIM.

All nominated IMT personnel in this OPEP will be trained to an appropriate level to undertake their role in its implementation. SapuraOMV personnel and support resources that will fill IMT roles are outlined in **Table 6-1**. SapuraOMV staff receive spill response training commensurate with their nominated IMT roles as listed in **Table 8-1** where:

- IMO is the International Maritime Organisation ranking for oil spill response training.
- IPIECA is the Incident Command/Management System SapuraOMV has adopted.
- The relevant training levels/courses are aligned with the Australian PMA Chemical, Hydrocarbons and Refining Training.

Classroom training will be supported by exercises to ensure that competencies are maintained, as summarised in **Table 8-2**. This OPEP relies on the supply of trained response personnel from other response organisations (e.g. AMOSC, OSRL, AMSA, DoT) therefore SapuraOMV will not be responsible for their training. The minimum training requirements in **Table 8-1** will apply to IMT support personnel from external organisations to assure competencies. Further details are provided in **Appendix B**. Competency requirements for key roles associated with OSMP implementation are detailed in the OSMIP (Doc No AU-HSE-KG1-EX-PLN-038). Competency requirements for the Source Control Team will be specified in the Well Containment Plan and will be developed in conjunction with WWC.

A briefing on the Bonn Agreement oil appearance code (BAOAC) will be provided to relevant response personnel such as helicopter pilots that can assist with the initial assessment of a spill in the event of an incident.

Table 8-1 Minimum training requirements for Key IMT and ERT/SCT oil spill response personnel

Team	Oil Spill Response Position	Minimum Training Level Course
IMT	Incident Commander	IMO 3 / PMAOMIR418 or ICS300
	Operations Section Chief	PMAOMIR320/322 (or equivalent to ICS300), oil spill response training equivalent to IMO II and internal competency training[8]
	Logistics Section Chief	
	Finance Section Chief	
	Planning Section Chief	
	Safety Officer	
	Liaison Officer	
	Public Information Officer	

[8] Internal competency training includes but not necessarily limited to training and exercises outlined in Table 8-2.

Team	Oil Spill Response Position	Minimum Training Level Course
	Environmental Unit Lead	
	Source Control Branch Director	
	Source Control Team – Relief Well and Well Kill Group	IWCF Well Control Supervisor Certifications
ERT/SCT	SapuraOMV Offshore Representative – Reports to IMT	Campaign specific emergency response induction and participation in MODU emergency drills and exercises.
	Aerial Observers	Briefing on BAOAC

8.6 OPEP Testing

A number of desktop exercises to test this OPEP will occur prior to and during the commencement of drilling operations. This will include (but not be limited to) testing when the OPEP is introduced, not later than 12 months after the most recent test, or in the event that the OPEP is significantly amended. A Level 3 spill incident desktop exercise will be used to evaluate the effectiveness of oil spill incident response by simulating the first several hours of an incident. It is anticipated that local (Perth) and regional (Malaysia) SapuraOMV staff will partake in the exercise along with key external OPEP contractors. Any improvements identified during exercises will be incorporated into the OPEP.

Table 8-2 OPEP exercise and training schedule for oil spill response personnel

Timing	Training/ Exercise	Objectives Summary	Exercise Type	Duration	Team involved
Q1 2022	Training	Familiarisation sessions with AMOSC and OSRL oil spill response call-out, mobilisation and integration.	NA	~4.5 hrs	Perth Office, IMT Command and Section Chiefs
TBC[11]	Training	Crisis Communication Training focused on notifications and communications protocols. Test the call out and interface functionality between PIO and KL Crisis Communications Department.	NA	2 hours	IMT Command, CMT
4 months prior to spud date	Exercise	Check currency of emergency contact numbers. Test IMT Call-Out / Messaging Process for key contacts	Notification	30 mins	IMT (as appropriate)
3 months prior to spud date	Training and exercises	Incident Control System (ICS) foundations training and IMT duties related to Kanga-1 and/or associated emergency response training exercises as appropriate for IMT roles	Tabletop	0.5 day	IMT

[11] Training date yet to be confirmed.

Timing	Training/ Exercise	Objectives Summary	Exercise Type	Duration	Team involved
3 months prior to spud date	Training	Oil spill response training for IMT members to a level equivalent to IMO II (or IMO III for IC), where appropriate per Appendix B	NA	As required	IMT
3 months prior to spud date	Training	Oil Spill Preparedness & Response (OSPR) introduction for the Kanga-1 exploration well OPEP and campaign awareness training	NA	1-3 hrs	Perth Office, IMT Command, Section Chiefs and Branch Directors[12]
2 months prior to spud date	Training	Functional specific sessional training / workshops to validate IMT roles & responsibilities specific to oil spills.	NA	1-2 hours each	IMT Command, Section Chiefs and Branch Directors[12]
2 months prior to spud date	Exercise	Kanga-1 LOWC exercise with focus on initial reactive phase response actions. Test notifications of internal / external supports. Test of WCP logistics plans to confirm vessel and MODU availability and forecast of likely changes to this during the duration of the Activity. Equipment / personnel logistics plans and charters etc with regards to COVID19 to be tested if applicable. Validate familiarity with response procedures of personnel involved in the Activity.	Tabletop	0.5 day	IMT Command, Section Chiefs and Branch Directors, CMT
Pre-Spud	Exercise	Communication & notification to test call-out response from MODU, including internal and external support. Test availability timeframes (within COVID restrictions if applicable)	Tabletop	30 mins	IMT (as appropriate), ERT/SCT

[12] Other IMT members provided with relevant training at time of activation as per Appendix B.

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Appendices

Appendix A

Preliminary NEBA and ALARP Justification for OPEP Response Strategies

A-1 Source of Risk

The Kanga-1 Exploration Well EP has identified the worst case credible hydrocarbon spill scenario as a Level 3 loss of well control with total surface release of 345,014 m^3 of crude oil and 5,776,235 sm^3 of gas over a period of 77 days (**EP Section 8.1**, also refer to GHD (2020b)).

A-2 Strategic NEBA of Response Strategies

The overall aim of a spill response is to effectively mitigate damage to the environment. Though there are a number of potential spill response strategies, not all may be effective to protect the environment potentially affected by a particular spill. This section describes the strategic NEBA undertaken for the suite of potential spill response strategies identified for a Level 3 credible worst-case spill scenarios for the Activity (**Table A-1**). The NEBA assesses each potential spill response strategy on the basis of the following criteria: environmental benefit(s), environmental risk(s)/impact(s), and operational constraints. If a response strategy is considered applicable, then its appropriateness as a primary or secondary response strategy is evaluated. This strategic NEBA employed the following process:

- List the available response strategies.
- Identify the benefit, environmental impact(s)/risk(s) and operational constraints of each response strategy.
- Evaluate the applicability of each response strategy for Level 3 credible worst-case scenarios.
- Identify all the applicable strategies for Level 3 credible worst-case scenarios.

The response strategies are further delineated as:

- <u>Primary response strategies</u> to be used as soon as possible in the event of a spill.
- <u>Secondary response strategies</u> to be implemented as and if needed, and when practicable with net environmental benefit.
- Not applicable (N/A) response strategies.
- Rejected response strategies due to lack of net environmental benefit.

In the event of an oil spill, operational NEBAs will be undertaken by the Incident Management Team (IMT) during the Incident Action Plan (IAP) process to evaluate response options that have a net environmental benefit (**OPEP Section 4.1**). Hence, the combination of spill response strategies and their implementation may evolve over time as conditions change on the basis of these operational NEBAs.

Table A-1 Strategic NEBA of potential response strategies for a Level 3 spills

Spill Response Strategy	Overview of Environmental Benefits	Associated Environmental Risks	Operational Constraints	Response Applicability	Primary or Secondary Response	Justification Note
Source Control – Emergency BOP Intervention	Subsea Emergency Accumulator (or similar) used to enable emergency BOP intervention (i.e. where rig failure to close BOP) to prevent further Level 3 oil releases to environment.	Minor localised physical disturbance to the seabed. Risks from operation of vessel spread to support deployment of equipment (e.g. liquid waste, marine fauna interaction, interference with other users).	ROV equipped with hot stab capability. WWC intervention package available to mobilise from Singapore includes hydraulic power unit. Debris clearance package may need to clear debris prior to allow emergency BOP intervention (available from Singapore). Requirement for support vessels with suitable Vessel Safety Case(s) and functional work-class ROV to operate within incident area.	Yes	Primary	May completely or partially decrease the spill rate though complete or partial BOP closing.
Source Control – Capping Stack	Limits spill of oil at the seabed until a successful relief well drilled.	Minor localised physical disturbance to seabed. Risks from operation of vessel spread to support deployment of equipment (e.g. liquid waste, marine fauna interaction, interference with other users).	Capping stack available from WWC in Singapore, plus additional equipment available from WWC in Aberdeen (maintained in “ready-fly” status). Debris clearance tools may be needed to clear debris from wellhead prior to capping stack installation; these are available to fly from WWC in Singapore. Capping stack equipment configuration may need to be adjusted dependent on loss of containment scenario. Deployment is weather dependent. Safety (flammability) may prevent capping stack deployment from a vessel above the wellhead. Requirement for support vessels with suitable Vessel Safety	Yes	Primary	Well capping is supplementary to the drilling of a relief well and its deployment is dependent upon the wellhead condition and safety (flammability risk) above the wellhead.

Spill Response Strategy	Overview of Environmental Benefits	Associated Environmental Risks	Operational Constraints	Response Applicability	Primary or Secondary Response	Justification Note
			Case(s), crane capabilityand functional work-class ROV to operate within incident area, plus support vessels.			
Source Control – Relief Well	Limits spill of oil to environment. Successful drilling of relief well estimated as 77 days after loss of well control.	Discharges (e.g. liquid/solid wastes, drilling mud) and physical disturbance from relief well drilling. Risks from operation of vessel spread to support deployment of equipment (e.g. liquid waste, marine fauna interaction, interference with other users).	Unfavourable metocean conditions may cause delays in relief well completion (e.g. cyclones). Duration to source a MODU to drill a relief well. Equipment necessary to drill a relief well.	Yes	Primary	Most effective method to gain permanent control of the well and prevent further oil releases.
Source Control – Subsea Dispersant Application	Direct subsea application of dispersant at the wellhead decreasing volumes of dispersant required via aerial and/or vessel application. Reduced surface oil (concomitant increased entrained oil) above wellhead reduces safety hazard (volatile organic compounds [VOCs] and explosion risk) to allow use of other response strategies (e.g. install capping stack). Oil spill modelling of this response strategy predicted subsea dispersant application to	Minor localised physical disturbance to the seabed. Risks/impacts from operation of vessel spread to support deployment of equipment (e.g. liquid waste, marine fauna interaction, interference with other users, etc.). Discharge of dispersant into environment. No removal of hydrocarbons from environment. Increased concentration of subsurface hydrocarbons in the water column.	Uncertain amenability of oil to dispersant. Deployment is weather dependent. Supply chain of dispersant to vessel could limit productivity if continuously injected. Requires clear area; restricts simultaneous operations. Water depth at location (~147 m) may limit support vessel operability due to lower explosive limit (LEL) presence (IPIECA-IOGP, 2015 [13]). Requirement for support vessels with suitable Vessel Safety Case(s) and functional work-class ROV to operate within incident area. Requirement for hoses to pump dispersant to subsea environment.	Yes	Secondary	May be suitable depending on dispersant efficacy of spilled oil. Further, if there is substantially greater gas in the well than the oil spill modelling release characteristics, then a more energetic release will yield smaller droplet sizes that are favourable for greater effectiveness of subsea dispersant application relative to the large droplet sizes from the relatively low gas release simulated by GHD (2020b). If subsea dispersant application is effective, then targeted injection

13 IPIECA-IOGP (2015). Dispersants: Subsea Application. Good Practice Guidelines for Incident Management and Emergency Response Personnel. IOG Report 533.

Spill Response Strategy	Overview of Environmental Benefits	Associated Environmental Risks	Operational Constraints	Response Applicability	Primary or Secondary Response	Justification Note
	not be effective because of low gas rates and thereby large droplets sizes (GHD, 2020b)					during periods of high shoreline oiling risk as identified by forecast modelling (OS2) will be carried out.
Monitor and Evaluate (Operational Monitoring)	Monitoring of spill required for real-time decision to identify emerging environmental risks, to plan spill response, and to assess response effectiveness.	Risks from operations of monitoring vessels and aircraft (e.g. liquid waste, marine fauna interaction, interference with other users).	Visual observations at night or during poor weather restricted. Stringent safety requirements for aerial and marine operations. Coordination of multiple vessels/ aircraft in limited area (SIMOPS).	Yes	Primary	Surveillance activities ensure constant monitoring and evaluation of the spill.
***In-situ* Burning**	Combustion of oil on sea surface reduces the volume remaining on the surface. Generates modest waste products for recovery and disposal.	Generates highly visible black smoke, particulates and atmospheric emissions including greenhouse gases. Incomplete combustion residues may be toxicologically damaging and could be ingested by marine life. Burn residues can also physically impact marine fauna and flora through coating of gills, feathers and fur, etc. Particulates (smoke) in air with associated health risks. Risks from operation of vessel-based *in-situ* burning activities (e.g. liquid waste, marine fauna interaction, interference with other users).	Need thick hydrocarbon film for ignition/ combustion (5-10 mm). Availability of fireproof booms. Never carried out in Australia; limited experience nationally. Ignition of hydrocarbon requires specialist training and equipment. Wind conditions a key constraint as calm conditions required for safe and controlled burning [wind limited to 10 kts, and wave height <1 m (IPIECA-IOGP, 2015) [14]].	No	Reject	Operational constraints from *in-situ* burning outweighs benefits.

14 IPIECA-IOGP (2015). Dispersants: Subsea Application. Good Practice Guidelines for Incident Management and Emergency Response Personnel. IOG Report 533.

Spill Response Strategy	Overview of Environmental Benefits	Associated Environmental Risks	Operational Constraints	Response Applicability	Primary or Secondary Response	Justification Note
Surface Dispersant Application – Vessel	Accelerates breakup of surface oil by reducing oil-water interfacial tension to increase entrained oil and its subsurface dispersal, thereby reducing potential impacts to surface (e.g. seabirds) and shoreline (e.g. mangroves) receptors. Trajectory of subsurface dispersed hydrocarbons driven primarily by ocean currents, rather than winds. Reduction in onshore hydrocarbon waste disposal. Oil spill modelling deterministic assessment with this response strategy simulated a 6-17% reduction in peak surface oil and a 35-50% reduction in shoreline loads (GHD, 2020b)	Discharge of dispersant into environment. Adds chemical to environment when spill may not greatly impact environmental receptors. Risks from operation of vessel to support application of dispersant (e.g. liquid waste, marine fauna interaction, interference with other users). No removal of hydrocarbons from environment. Increased concentration of subsurface hydrocarbons in the water column.	Uncertain amenability of oil to dispersant. Aerial application only possible with wind less than 35 knots, and wave height less than 5 m (IPIECA-IOGP, 2015)[14]. Vessel application may have a wider range of suitable weather conditions compared to aerial application. Supply chain of dispersant could potentially limit response implementation, but a supply chain analysis of available stockpiles demonstrates that needs can be met (Appendix D). Requires clear area with no (or limited) simultaneous operations. Limits SIMOPs in areas of aerial application. Oil spill modelling deterministic assessment with this response strategy simulated most dispersant application by aircraft and vessel within 80 km of the well where thick fresh oil was most prevalent (GHD, 2020b)	Yes	Secondary	May not be suitable for Level 3 oil spill due to uncertain dispersant efficacy. Secondary strategy with implementation dependent on dispersant efficacy. If efficacy favourable, GHD (2020b) deterministic simulations indicate a sizeable reduction in shoreline loading of ~30%. Requires careful consideration of possible increased toxicity of dispersed oil to subtidal environmental values (e.g. corals).
Surface Dispersant Application – Aerial				Yes	Secondary	
Mechanical Dispersion	Enhances dispersion and break-up of surface hydrocarbons to facilitate natural degradation processes.	Increased subsurface oil concentrations. Risks from operation of vessel mechanical dispersion activities (e.g. liquid waste, marine fauna interaction, interference with other users).	Vessels not designed to cavitate, not efficient at breaking up slicks. Potential OHS risks through ignition or inhalation of vapours. Small oil droplet size required otherwise resurfaces, hence for some oil types limited benefit	Yes	Secondary	Secondary response strategy if risk to sensitive receptors.

Spill Response Strategy	Overview of Environmental Benefits	Associated Environmental Risks	Operational Constraints	Response Applicability	Primary or Secondary Response	Justification Note
			unless combined with dispersant application. Wind speeds above 20 knots provide natural dispersion, making this method redundant.			
Containment & Recovery	Contain spill as close as possible to the source. Recovery reduces spread of surface oil and thereby risks to sensitive receptors. Removal of oil from the environment.	Risks from vessel-based containment and recovery activities (e.g. liquid waste, marine fauna interaction). Equipment and labour intensive. Waste disposal of recovered oil. Cleaning and disposal of contamination from booms and response vessels.	This strategy requires relatively low currents (currents <0.5 m/s or <~1 knot) and wave climate that are not common in the wellhead vicinity. Hence, limited operability given typical tidal conditions. Requires minimum slick concentrations >10 g/m^2. Operationally challenged due to distance from shore and sea state. Consider SIMOPS in the area.	Yes	Secondary	Weather and tidal conditions unlikely to permit efficient offshore containment in proximity to the wellhead with booms, weirs and skimmers for Level 3 oil spill. High spill rate and many vessels for meaningful recovery of spilled oil. Strategy may be effective to protect high priority sensitive receptors.
Shoreline Protection & Deflection	Near-shoreline deployment of booming equipment to protect target receptors and to deflect to lower priority areas.	Risks from operation of vessel-based protection and deflection activities (e.g. liquid waste, marine fauna interaction, interference with other users). Risks from securing booms on shallow nearshore benthic environments. Generation of waste from booms and disposal of recovered oil and water. Potential impacts to shorelines that oil is deflected towards.	Wind, waves and surface currents are key constraint in the deployment and operations of booms in nearshore coastal environments. Considerable resources and logistics support needed (i.e. equipment and labour intensive). Site constraints (e.g. breaking waves). Minimum shoreline proximal slicks concentrations >10 g/m^2.	Yes	Secondary	Sensitive areas (e.g. mangroves, turtle nesting shorelines) may be targeted for protection by the IMT (via information from operational monitoring and forecast shoreline oiling).

Spill Response Strategy	Overview of Environmental Benefits	Associated Environmental Risks	Operational Constraints	Response Applicability	Primary or Secondary Response	Justification Note
Shoreline Clean-up	Oil removal from shorelines to reduce environmental risks to sensitive receptors. Reduce visual impact. Reduce risk of oil re-entrainment from shoreline into marine environment.	Potential shoreline disturbance to sensitive habitats (e.g. turtle nesting beaches) from clean-up operations (e.g. trampling by response personnel and equipment) may outweigh environmental benefits in some circumstances and natural passive reduction in shoreline oiling via biodegradation, photo-oxidation and volatilisation. Waste from removal of contaminated sediment from beaches and risks to associated flora and fauna during removal activities. Temporary storage of waste has the potential to cause contamination to areas not contacted by the spill. Presence of response personnel, equipment and facilities increase the risk of hydrocarbon cross contamination from impacted to non-impacted sites.	Labour intensive, significant logistics including waste management considerations required. Personnel management and coordination to reduce environmental and safety risks/impacts. Applicability influenced by shoreline characteristics (e.g. substrate type, beach type, exposure to wave action, biological, social, heritage or economic resources, amount of hydrocarbon present) and access to site for vessel/s and vehicle/s.	Yes	Secondary	This is a secondary response that may be implemented as the maximum predicted shoreline loading is ~1,000 tonnes mostly at Barrow Island and Montebello Islands (see **EP Section 8.1, Appendix D)**.

Spill Response Strategy	Overview of Environmental Benefits	Associated Environmental Risks	Operational Constraints	Response Applicability	Primary or Secondary Response	Justification Note
Oiled Wildlife Response	Reduce impacts to wildlife (e.g. onshore exclusion barriers, hazing, pre-emptive capture). Collection and rehabilitation to treat oiled fauna and return to similar suitable habitat.	Risks from operation of vessel-based oiled wildlife response activities (e.g. liquid waste, marine fauna interaction, interference with other users). During hazing could accidentally drive wildlife into spills or separate groups/individuals (e.g. parents/ offspring pairs). Potential risk of fauna injury and inappropriate field collection/ handling during pre-emptive capture and post-oiled collection. Rehabilitation activities could result in inadequate/ inappropriate animal handling leading to stress/ injury/ death. Inappropriate fauna relocation points leading to disorientation/ stress.	Labour intensive and significant logistics considerations. Wind a key constraint, calm seas and ideal conditions 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 to handle rehabilitation and fauna treatment. Utilisation of skilled veterinarians for treatment of oiled wildlife.	Yes	Secondary	Applicable as a secondary response strategy for oiling of marine fauna.
Scientific Monitoring	Determine extent, severity and persistence of environmental impacts and subsequent recovery from oil spills.	Risks from operation of vessel and aerially based scientific monitoring activities (e.g. liquid waste, air emissions from fuel usage, noise, marine fauna interaction, interference with other users, collisions).	Weather constraints.	Yes	Primary	Applicable as a primary response strategy to characterise impacts from oil spill and response activities, and subsequent recovery.

A-3 ALARP Demonstration for Control Measures of Selected Response Strategies

The ALARP principle (**EP Section 6.6**) is applied to potential control measures of the selected spill response strategies from the preliminary NEBA in **Section A-2**. An overview of the ALARP demonstration process of each potential response strategy's control measure is outlined in **Table A-2**, and a summary of the assessment is provided in **Table A-3**. Rationale for low effectiveness rankings of potential criteria are provided in **Table A-3**.

Table A-2 Overview of ALARP demonstration for potential control measures associatd with response strategies

<table>
<tr><th>Column Title</th><th colspan="3">Description</th></tr>
<tr><td>Control Measures</td><td colspan="3">A potential control measure of the response strategy.</td></tr>
<tr><td>Hierarchy of Control (HOC)</td><td colspan="3">Hierarchy of control category of the control measure.</td></tr>
<tr><td>Rationale</td><td colspan="3">Why is the control measure for the response strategy under consideration?</td></tr>
<tr><td>Environmental Benefit</td><td colspan="3">What environmental benefit is derived from the control measure?</td></tr>
<tr><td rowspan="9">Effectiveness</td><td colspan="3">What is the effectiveness of the control measure in terms of functionality, availability, reliability, survivability, independence and compatibility?</td></tr>
<tr><td rowspan="2">Criteria</td><td colspan="2">Effectiveness Ranking</td></tr>
<tr><td>Low</td><td>High</td></tr>
<tr><td>Availability</td><td>Equipment/resources not readily available and SapuraOMV has no external arrangement or internal processes in place to expedite timely provision of equipment/ resources.</td><td>Equipment/resources readily available or SapuraOMV has equipment/resources on standby, and/or contracts, arrangements, or MOU's in place for provision of equipment/resources.</td></tr>
<tr><td>Functionality</td><td>Control measure does not materially reduce risk/ impact.</td><td>Control measure does materially reduce risk/ impact.</td></tr>
<tr><td>Reliability</td><td>Control measure not tested in Australian waters and/or low assurance assigned to success rate.</td><td>Control measure has been tested in Australian waters and/or high assurance assigned to success rate.</td></tr>
<tr><td>Survivability</td><td>Control measure has low operational timeframe and will need to be replaced regularly to maintain effectiveness.</td><td>Control measure has a high operational timeframe and will not need to be replaced regularly to main effectiveness.</td></tr>
<tr><td>Independence/ Compatibility</td><td>Control measure is reliant on other control measures in place and/or is not compatible with other control measures in place.</td><td>Control measure is not reliant on other control measures in place and/or can be implemented with other control measures.</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td>Implement Time</td><td colspan="3">How soon could the control measure be implemented?</td></tr>
<tr><td>Cost/ Effort</td><td colspan="3">What is the cost to implement the control measure during the Activity?</td></tr>
<tr><td>ALARP Summary</td><td colspan="3">Accept or reject control measure on basis of ALARP.</td></tr>
</table>

Table A-3 ALARP demonstration of potential control measures for selected response strategies of the strategic NEBA

Key: A: Availability; F = Functionality, R: Reliability; S = Survivability; IC: Independence/Capability.

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
Source Control – Secondary Well Control Preventative Measures (Primary Strategy)							
No emergency BOP intervention source control.	N/A	Do nothing option.	None	N/A	N/A	Nil	**Reject** – An emergency BOP intervention source control strategy for Level 3 spill required.
Emergency BOP operations managed in accordance with IAP, WCP and third-party contractor requirements.	Administrative	Rapidly initiate emergency BOP intervention planning and pre-identification of equipment requirements.	Reduced wellhead release period.	**A, F, S, IC**: High. **R**: Low (dependent on safe operating conditions [LEL, metocean] over wellhead)	Immediate and ongoing.	Minor	**Accept** –Control measure effective and minor cost implications.
Arrangements for Subsea Emergency Accumulator (or similar) on standby to enable BOP intervention.	Administrative	Rapid mobilisation of equipment and emergency BOP intervention.	Reduce wellhead release period.	**A, R, F, S, IC**: High.	<1 day to mobilise, onsite ~7 days.	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.
Source Control – Capping Stack (Primary Strategy)							
No capping stack source control.	N/A	Do nothing option.	None	N/A	N/A	Nil	**Reject** – Capping stack source control strategy for Level 3 spill required.
Capping stack operations managed in accordance with IAP, Well Containment Plan (WCP) and third-party contractor requirements.	Administrative	Rapidly initiate capping stack planning and pre-identification of equipment requirements.	Reduced wellhead release period.	**A, F, S**: High. **IC**: Low (potentially dependent on debris clearance around well). **R**: Low (dependent on safe operating conditions [LEL,	Immediate and ongoing.	Minor	**Accept** –Control measure effective and minor cost implications.

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
				metocean] over wellhead).			
Capping stack equipment maintained in 'ready deploy status' by WWC.	Administrative	Rapid mobilisation of capping stack.	Reduced wellhead release period.	**A, R, S, F, IC**: High	N/A	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.
Support vessel(s) with ROVs to be sourced via Mutual Aid MoU.	Administrative	Rapid identification and sourcing of suitable vessels for capping stack deployment	Reduced wellhead release period.	**A, R, S, F, IC**: High	N/A	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.
Support vessel(s) with ROVs on standby.	Administrative	Rapid deployment of capping stack.	Reduced wellhead release period.	**A, R, S, F, IC**: High.	N/A	~$5-10 million	**Reject** – High costs disproportionate to environmental benefit from potential to have debris cleared prior to capping stack arrival at site.
Debris Clearance Tools on WWC shared standby for preparation of site (if needed) prior to installing capping stack.	Administrative	Rapid mobilisation of equipment to prepare site prior to potential installation of capping stack.	Reduce wellhead release period.	**A, F, S, IC**: High. **R**: Low (dependent on safe operating conditions [LEL, metocean] over wellhead).	<1 day to mobilise, onsite ~16 days.	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.
Purchase and pre-position capping stack and equipment.	Administrative	Capping stack immediately available.	Marginally reduce wellhead release period.	**A, R, S, F, IC**: High	~1 day	~$10-20 million	**Reject** – High costs disproportionate to environmental benefit from small reduction in time from transporting capping stack from Singapore given the likely time required for debris clearance.

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
Pre hire of capping stack deployment vessel on standby in Singapore	Administrative	Rapid mobilisation and deployment of capping stack.	Reduced wellhead release period.	**A, R, S, F, IC**: High.	N/A	~$8-10 million	**Reject** – High costs disproportionate to environmental benefit from small reduction in time from transporting capping stack from Singapore given the likely time required for debris clearance.
Pre hire of suitable Capping Stack transport vessels on standby in Singapore	Administrative	Rapid mobilisation of capping stack to Dampier	Reduced wellhead release period.	**A, R, S, F, IC**: High.	N/A	~$1.5-2 million	**Reject** – High costs disproportionate to environmental benefit from small reduction in time from transporting capping stack from Singapore given the likely time required for debris clearance and capping deployment vessel.
Pre hire of suitable debris clearance support vessel(s) on standby in Singapore	Administrative	Rapid mobilisation and implementation of debris clearance package.	Reduced wellhead release period.	**A, R, S, F, IC**: High.	N/A	~$8-10 million	**Reject** – High costs disproportionate to environmental benefit from negligible reduction in time from transporting debris clearance tools.
Vessel Brokerage weekly vessel updates.	Administrative	Weekly update on vessel availability and forecasts.	Reduced wellhead release period – improved identification of potential vessels prior to commencement of Activity.	**A, R, F, S, IC**: High.	4 months prior to commencement of the Activity, through to the end of the Activity.	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
Subscription to realtime vessel tracking and brokerage service.	Administrative	Rapid identification and selection of appropriate vessels for all Capping and Debris clearance activities.	Reduced wellhead release period – improved mobilisation of all required vessels.	**A, R, F, S, IC**: High.	In place 1 month prior to commencement of the Activity, through to the end of the Activity.	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.
Invasive Marine Species (IMS) clearance of Capping/Debris vessels.	Administrative	Vessels cleared from IMS are able to mobilise directly to the wellsite in event of emergency.	Reduced wellhead release period – improved mobilisation of all required vessels.	**A, R, F**: High **S, IC:** Low	Prior to commencement of the Activity.	Moderate to Significant	**Reject** – This control relies on contracting the vessels required, High cost disproportionate to environmental benefit, also, by being on standby in Singapore for extended duration vessel preclearance would expire.
Invasive Marine Species (IMS) Risk Assessment (RA) of Potential Capping/Debris vessels.	Administrative	RA based on past and prospective vessel movements informs choice of capping/debris clearance vessels.	Reduced wellhead release period – improved mobilisation of all required vessels	**A, R, F, S, IC**: High.	In place 1 month prior to commencement of the Activity, through to the end of the Activity.	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.
Pre-Mobilisation of Source Control Personnel	Administrative	Having Source Control Team in place at the start of the Activity leads to elimination of the mobilisation time for Source Control Team.	Negligable – Source Control Team can work remotely during initial phase and then mobilise over time.	**A, R, S, IC**: High. **F:** Low	In place at the start of the Activity	~$1.5 million	**Reject** – High costs disproportionate to negligible environmental benefit from reduction in mobilisation times (Source Control Team able to operate remotely).
Source Control personnel resourcing plan in place.	Administrative	Source Control team Positions and provider identified for all positions. Contracts/Arrangements in place for all positions, means	Reduced wellhead release period – Source Control Team in place.	**A, R, F, S, IC**: High	In place 2 months prior to commencement of the Activity,	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
		Source Control Team can be fully manned ASAP.					
Safety Case preparatory works for debris clearance and capping stack deployment addressing any relevant learnings from the DISC and industry knowledge on comparable activities, are completed prior to entering the reservoir.	Administrative	Preparation works to assist completion of Safety Case for deployment of capping stack, reduces response time to complete preparation for deployment.	Reduced wellhead release period – improved Safety Case acceptance reliability.	**A, R, F, S, IC**: High	Completed subsequent to primary MODU safety case Acceptance and prior to entering reservoir.	Moderate	**Accept** – Control measure practicable and effective, cost not disproportionate to environmental benefit.
Source Control – Relief Well (Primary Strategy)							
No relief well source control.	N/A	Do nothing option.	None	N/A	N/A	Nil	**Reject** – Relief well source control strategy required.
Relief well operations managed in accordance with the Incident Action Plan (IAP), Well Containment Plan (WCP) and third-party requirements.	Administrative	Rapidly initiate relief well planning and pre-identification of equipment requirements.	Reduced spill period.	**A, F, R, S, IC:** High.	Immediate and ongoing.	Minor	**Accept** – Control measure is effective and has minor cost implications.
NOPSEMA-accepted Well Operation Management Plan (WOMP) and Safety Case(s) specific to the Activity.	Administrative	Based on legislative requirement.	Legislative requirement.	**A, F, R, S, IC:** High.	Immediate and ongoing.	Minor	**Accept** – Control measure is effective and has minor cost implications.
Purchase casing, casing accessories and wellhead for relief well.	Administrative	Reduces delays in equipment availability.	Reduced wellhead release period and volume.	**A, F, R, S, IC:** High.	Implement prior to drilling operations.	>$2M, Contracting and logistics effort	**Reject** – High costs, grossly disproportionate to environmental benefit.
Supply arrangement in place for casing, casing accessories and wellhead for relief well.	Administrative	Reduces delays in equipment availability.	Reduced wellhead release period and volume.	**A, F, R, S, IC:** High.	Implement prior to drilling operations.	Contracting and logistics effort	**Accept** – Control measure is effective and has minor cost implications.

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
Necessary casing widely used by Australian Titleholders with stockpiles in Australia accessible via APPEA MoU provisions.	Administrative	Reduces delays in equipment availability	Reduced wellhead release period.	**A, F, R, S, IC**: High	Implement prior to drilling operations	Minor	**Accept** – Control measure practicable and effective, not disproportionate to environmental benefit.
Pre-drill top hole of relief well.	Administrative	Reduces duration to drill relief well.	Reduced wellhead release period.	**F, S, IC:** High. **A:** Low (difficult to contract rig). **R:** Low (prevailing weather conditions could render pre-drill site inoperable).	Up to a year.	~$10-15 million	**Reject** – High costs, second operation risk exposure, and plug and abandon liability grossly disproportionate to environmental benefit.
Mutual Aid MoU in place with other operators to release MODU for relief well.	Administrative	Allow rapid mobilisation of MODU.	Reduced wellhead release period and volume.	**A, F, S, IC:** High. **R:** Low (MoU has not been tested).	N/A	Minor	**Accept** – Control measure practicable and effective, not disproportionate to environmental benefit.
Prepare outline relief well safety case (MoU MODU)	Administrative	Reduces delays in preparation of safety case for relief well.	Reduced wellhead release period and volume.	**A, F, R, S, IC**: High	Implement post primary MODU safety case prior to entering reservoir.	~$100 k	**Reject –** Minimal time saving benefit due to unknown parameters, and existing safety case(s) of MoU MODU's. Cost disproportionate to environmental benefit.
MODU contract tracking and forecasting.	Administrative	Improves visibility of likely locations of relief well MODU during the Activity.	Reduced wellhead release period and volume.	**A, F, R, S, IC**: High	Ongoing	Minor	**Accept** – Control measure practicable and effective, not disproportionate to environmental benefit.
Prepare mobilisation plan for Operator with appropriate Australian Safety Case MODU (SEA - MODU) if no MoU MODU in Australia 3 months prior to	Administrative	Reduces delays in preparation of safety case for relief well – in the case of requiring a MODU to be mobilised from Souteast Asia.	Reduced wellhead release period and volume.	**A, F, R, S, IC**: High	Implement with primary MODU provider (or other with Australian Safety Case experience) if no MoU MODU in	Moderate	**Accept –** If no MoU MODU in Australia - Control measure practicable and effective, not disproportionate to environmental benefit.

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
commencement of Activity.					Australia 3 months prior to commencement of the Activity.		
Invasive Marine Species (IMS) clearance of Southeast Asia (SEA) MODU.	Administrative	MODU cleared from IMS are able to mobilise directly to the wellsite in event of emergency.	Reduced wellhead release period – improved mobilisation of MODU.	**A, R, F**: High **S, IC:** Low	Prior to commencement of the Activity.	Moderate	**Reject** – This control relies on contracting the MODU required, High cost then disproportionate to environmental benefit, also, by being on standby in SEA for extended duration MODU preclearance would expire.
Invasive Marine Species (IMS) Risk Assessment (RA) of Potential SEA MODU.	Administrative	RA based on past and prospective MODU movements informs choice of available MODU.	Reduced wellhead release period – improved mobilisation of MODU.	**A, R, F, S, IC**: High.	Implement if no MoU MODU in Australia concurrent with mobilisation plan.	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.
Vessel Brokerage weekly vessel updates.	Administrative	Weekly update on appropriate heavy lift vessels for SEA MODU IMS RA/ cleaning/ mobilisation.	Reduced wellhead release period – improved identification of potential vessels prior to commencement of Activity.	**A, R, F, S, IC**: High.	4 months prior to commencement of the Activity, through to the end of the Activity.	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.
Subscription to realtime vessel tracking and brokerage service.	Administrative	Rapid identification and selection of appropriate heavy lift vessels for SEA MODU IMS RA/cleaning/mobilisation.	Reduced wellhead release period – improved mobilisation of SEA MODU.	**A, R, F, S, IC**: High.	In place 1 month prior to commencement of the Activity, through to the end of the Activity.	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
MODU on standby in case relief well needed.	Administrative	MODU immediately available to drill relief well.	Reduced wellhead release period and volume.	**F, R, S, IC:** High. **A:** Low (difficult to get rig on standby).	~7 days to mob standby MODU to drill relief well	~$40-50 million	**Reject** – High costs grossly disproportionate to environmental benefit.
Pre-Mobilisation of Relief Well (Source Control) Personnel	Administrative	Having Source Control Team in place at the start of the Activity leads to elimination of the mobilisation time for Source Control Team.	Negligable – Source Control Team can work remotely during initial phase and then mobilise over time.	**A, R, S, IC**: High. **F:** Low	In place at the start of the Activity	~$1.5 million	**Reject** – High costs disproportionate to negligible environmental benefit from reduction in mobilisation times (Source Control Team able to operate remotely initially).
Aircraft on standby for Source Control personnel mobilisation	Administrative	Allows for Source Control team to be mobilsied in one flight.	Negligable – Source Control Team not in one location and can work remotely during initial phase and then mobilise over time.	**A, R, S, IC**: High. **F:** Low	In place at the start of the Activity	$10-15 million	**Reject** – High costs disproportionate to negligible environmental benefit from reduction in mobilisation times (Source Control Team able to operate remotely initially).
Relief Well (Source Control) personnel resourcing plan in place.	Administrative	Source Control team Positions and provider identified for all positions. Contracts/Arrangements in place for all positions, means Source Control Team can be fully manned ASAP.	Reduced wellhead release period – Source Control Team in place.	**A, R, F, S, IC**: High	In place 2 months prior to commencement of the Activity,	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.
Relief Well MODU Conductor validation	Administrative	Provide assurance that any relief well MODU will be able to utilise existing conductor design.	Reduced wellhead release period.	**A, R, F, S, IC**: High	In place 4 months prior to Activity.	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit Worst case MoU or

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
							SEA MODU utilised for analysis.
Site survey conducted for relief well location.	Administrative	Provide assurance that primary and secondary relief well location(s) is/are suitable for use and provide information to complete mooring analysis.	Reduced wellhead release period.	**A, R, F, S, IC**: High	In place 12 months prior to Activity.	Minor	**Accept –** Control measure practicable and effective, minor cost not disproportionate to environmental benefit.
Mooring analysis for relief well MODU(s).	Administrative	Provide assurance that any relief well MODU can be moored at the relief well location.	Reduced wellhead release period.	**A, R, F, S, IC**: High	In place 4 months prior to Activity.	Minor	**Accept –** Control measure practicable and effective, minor cost not disproportionate to environmental benefit Worst case MoU or SEA MODU utilised for analysis.
Pre lay of relief well MODU moorings.	Administrative	Reduce time to moor relief well MODU on location.	Reduced wellhead release period.	**A, R, F, S**: High **IC:** Low	In place prior to Activity.	~$4.5 million	**Reject** – High costs disproportionate to environmental benefit. Potential that pre lay becomes redundant with small change in suitability of relief well location.
Pre lay equipment on standby at base.	Administrative	Reduce time to moor relief well MODU on location.	Reduced wellhead release period.	**A, R, F, S, IC**: High	In place prior to Activity.	~$2.5 million	**Reject** – High costs disproportionate to environmental benefit. No mobilisation provides no significant reduction in mooring time.
Mooring and pre lay contract in place.	Administrative	Reduce time to contract relief well mooring components.	Reduced wellhead release period.	**A, R, F, S, IC**: High	In place prior to Activity.	Minor	**Accept –** Control measure practicable and effective, minor cost not

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
							disproportionate to environmental benefit.
Source Control – Subsea Dispersant Application (Secondary Strategy)							
No subsea dispersant system source control.	N/A	Do nothing option.	None	N/A	N/A	Nil	**Reject** – The option to apply a subsea dispersant system under appropriate conditions during a Level 3 spill is retained.
Only subsea dispersants with low(est) toxicity used.	Substitute	Reduce environmental effects by only selecting dispersants with low(est) toxicity.	Reduce wellhead release period if capping stack can be placed due to lower LEL from subsea dispersant. Reduced surface concentrations and shoreline loading.	**S, IC**: High. **A**: Low (stocks potentially limited). **F, R**: Low (tend not to be as effective as higher toxicity dispersants).	N/A	Minor	**Reject** – Control measure not effective due to limited stocks and potentially lower effectiveness. Dispersants listed on the Australian OSCA register to be used which consider toxicity effects.
Temporal windows of environmental sensitivity considered in operational NEBA.	Separate	Subsea dispersant application during temporal windows of environmental sensitivity (e.g. coral spawning, turtle nesting, shorebird & EPBC listed species migrations) a key consideration in operational NEBAs.	Reducing potential impacts during subsea dispersant application.	**A, F, R, S, IC**: High.	N/A	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.
Subsea dispersant operations managed in accordance with IAP, WCP and third-party contractor requirements.	Administrative	Rapidly initiate subsea dispersant planning and pre-identification of equipment requirements.	Identification of most effective response strategies with the least	**A, F, R, S, IC**: High.	Immediate and ongoing.	Minor	**Accept** – Control measure effective and minor cost implications.

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
			practicable impacts.				
Arrangements in place with WWC, AMOSC, OSRL and other third parties for plant, equipment, dispersants and service provision of subsea dispersant application.	Administrative	Rapid mobilisation of subsea dispersant system to reduce surface oil (environmental) and safety at surface via reduction in LEL potentially allowing other source controls measures to be implemented (e.g. capping stack).	Arrangements in place for rapid initialisation of subsea dispersant application resources that may reduce spill duration and decrease surface and shoreline oiling impacts.	**A, R, S, F, IC**: High.	<2 hours to initiate.	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.
OSRL GDS membership.	Administrative	Access to global stockpiles of dispersant. Supply chain analysis confirms that sufficient stockpiles exist to meet volume needs for this strategy (**Appendix D**).	Global stockpile access provides sufficient volumes for SSDA response to treat all predicted released oil that may reduce surface and shoreline oiling impacts.	**A, R, S, F, IC**: High.	<2 hours to initiate.	Moderate (~$100,000)	**Accept** – Control measure practicable and effective, moderate cost not disproportionate to environmental benefit.
Rapid dispersant efficacy assessment via trial surface slick application.	Administrative	Rapid onsite dispersant effectiveness trial spray prior to subsea application.	Determination of dispersant effectiveness at/near the spill site.	**A, R, S, F**: High **IC**: Low (SIMOPs during initial period after incident could conflict).	<2 days to initiate.	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.
Laboratory dispersant efficacy assessment.	Administrative	Detailed dispersant effectiveness evaluation to inform selection of priority of dispersant types for subsea application	Determination of effectiveness of the range of dispersants with greater certainty than the rapid assessment.	**A, R, S, F**: High **IC**: Low (ability to acquire oil sample of sufficient volume and 'freshness').	<2 days to initiate.	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
Chemical dispersants acceptable for use in marine environment.	Administrative	Only approved dispersants under NatPlan arrangement on the Oil Spill Control Agents (OSCA) Register or Transitional lists.	Use of approved chemical dispersants for Australian marine waters and conditions.	**A, R, S, F, IC**: High.	N/A	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.
Subscription to realtime vessel tracking and brokerage service.	Administrative	Rapid identification and selection of appropriate vessels for SSDI transport/deploymen t vessels	Faster deployment of subsea dispersant.	**A, R, F, S, IC**: High.	In place 1 month prior to commencement of the Activity, through to the end of the Activity.	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.
Invasive Marine Species (IMS) Risk Assessment (RA) of a likely primary potential mobilisation/deployment vessel.	Administrative	RA based on past and prospective selected vessel movements informs choice of available vessels.	Faster deployment of subsea dispersant.	**A, R, F, S, IC**: High.	In place 1 month prior to commencement of the Activity,	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.
Invasive Marine Species (IMS) clearance of potential vessels.	Administrative	RA based on past and prospective MODU movements informs choice of available MODU.	Faster deployment of subsea dispersant.	**A, R, F, S:** High. **IC**: Low	In place 1 month prior to commencement of the Activity,	Minor	**Reject** – Requires high-cost hire of prospective vessels and during waiting period vessels will lose their IMS clean status.
Pre hire of suitable SSDI/deployment vessel(s) on standby in Singapore	Administrative	Rapid deployment of SSDI system.	Faster deployment of subsea dispersant.	**A, R, F, S, IC**: High.	In place prior to commencement of the Activity,	Minor	**Reject** – High costs disproportionate to environmental benefit.
Dedicated support vessel with subsea dispersant system spread on standby.	Administrative	On standby 24/7 during Activity to rapidly initiated subsea dispersant system application in the event of a Level 3 spill	Reduce wellhead release period if capping stack can be placed due to lower LEL from subsea dispersant.	**A, R, S, F, IC**: High.	<1 day to initiate.	Significant support vessel standby costs >~$1 million.	**Reject** – High costs disproportionate to environmental benefit.

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
			Allow immediate response to potentially reduce surface concentrations and shoreline loading.				
Dedicated personnel on standby for implementation of subsea dispersant application response strategy.	Administrative	On standby 24/7 during Activity to rapidly initiate subsea dispersant system application in the event of a Level 3 spill.	Allow immediate response to potentially reduce surface concentrations and shoreline loading.	**A, R, S, F, IC:** High.	<1 day to initiate.	Significant personnel standby costs ~$1 million.	**Reject** – High costs to immediately initiate this secondary response strategy disproportionate to environmental benefit.
Dispersant premolisation to Dampier to support subsea dispersant application response strategy.	Administrative	Sufficient dispersant stockpiles immediately available at Dampier (port) / Karratha (airport) to carry out response strategy.	Allow immediate response to potentially reduce surface concentrations and shoreline loading.	**A, R, S, F, IC:** High.	<1 day to initiate.	Mobilisation of existing national and global stockpiles to Dampier not possible.	**Reject** – High costs to immediately initiate this secondary response strategy is disproportionate to environmental benefit.
Engage suppliers to manufacture dispersant and store at Dampier for subsea dispersant application response stragegy.	Administrative	Sufficient dispersant stockpiles immediately available at Dampier (port) / Karratha (airport) to carry out response strategy.	Allow immediate response to potentially reduce surface concentrations and shoreline loading.	**A, R, S, F, IC:** High.	<1 day to initiate.	Manufacture and storage costs of sufficient dispersant volumes >$1 million.	**Reject** – High costs to immediately initiate this secondary response strategy is disproportionate to environmental benefit.
Monitor and Evaluate (Operational Monitoring) (Primary Strategy)							
No monitoring and evaluation of the spill	N/A	Do nothing option.	None	N/A	N/A	Nil	**Reject** – Monitor and evaluate (operational monitoring) strategy required to inform response planning and to assess response effectiveness.

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
Monitor and evaluate operations managed by IMT through IAP process and guided by Operational and Scientific Monitoring Plan (OSMP).	Administrative	Information to plan and to monitor spill and response measures.	Knowledge of spill and evaluation of response measures to inform spill response.	**A, F, R, S, IC:** High.	Immediate and ongoing.	Minor	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.
Quasi-real-time Oil Spill Modelling (OSM) predictions to support operational NEBA during IAP process.	Administrative	Predicted spill trajectory, effectiveness of response and risks to environmental receptors inform IMT.	Forecasted spill behaviour to respond and to manage spill, and to identify sensitive receptors at risk.	**A, F, R, S, IC:** High.	<2 hours to initiate.	Minor	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.
Initial observations and reporting by MODU, vessel(s) and/or contracted helicopter(s).	Administrative	Vessels and helicopters/aircraft provide basic information (location, weather and spill character) to inform initial response.	Early indication of direction of spill to target immediate response and to establish situational awareness.	**A, F, R, S:** High. **IC:** Low (dependent on safety considerations and tasks of available on-/near- site vessels and/or contracted helicopters).	Immediate for vessel and/or MODU crew. Aircraft - ~6 hours.	Minor	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.
Oil Spill Tracking Buoys (OSTBs) located on MODU.	Administrative	OSTBs deployed in event of Level 3 spill to track spill movement and gain situational awareness.	Early indication of direction of spill to target immediate response and to establish situational awareness.	**A, F, R, S, IC:** High	Immediate	Minor	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.
Provision of satellite imagery.	Administrative	Quasi-real-time monitoring required to inform IMT of spill distribution, expedited acquisition.	Inform IMT IAP process to target response to yield greatest environmental benefit.	**A, F, R, S, IC:** High.	<24 hours for acquisition of first image.	Minor	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
Aerial monitoring by trained observers (AMOSC) in fixed-wing aircraft via AMSA Nat Plan.	Administrative	Fixed-wing aircraft and trained observers improve spill surveillance.	Ongoing spill surveillance to inform spill response.	**A, F, R, S, IC:** High.	Subject to aircraft and personnel availability, but ~24 hours.	Minor	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.
Dedicated monitoring plant, equipment and personnel on call-off arrangement.	Administrative	Dedicated monitoring resources improve spill monitoring.	Ongoing spill monitoring to inform spill response.	**A, F, R, S, IC:** High.	Subject to vessel and personnel availability, but <2 days from call-off.	Minor	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.
Trained observers, and dedicated equipment and plant on standby for aerial- and/or vessel-based surveillance.	Administrative	Decrease response time for plant (aircraft, vessels) and trained observers improve spill surveillance.	Ongoing spill monitoring to inform spill response.	**F, R, S, IC:** High. **A:** Low (trained observers [AMOSC] typically have fulltime jobs and may not be released for standby).	24 hours to get airborne or depart port with standby observers.	Standby costs of ~>$1M to maintain plant and trained observers.	**Reject** – Control measure costs grossly disproportionate to the limited environmental benefit.
***In Situ* Burning**							
No in situ burning response.	N/A	Do nothing option.	None	N/A	N/A	Nil	**Accept** – In situ burning response strategy not effective with debatable environmental benefit.
Surface Dispersant Application – Vessel and Aerial (Secondary Strategy)							
No surface dispersant system response strategy.	N/A	Do nothing option.	None	N/A	N/A	Nil	**Reject** – The option to apply a surface dispersant system under appropriate conditions during a Level 3 spill is retained.
Only surface dispersants with low(est) toxicity used.	Substitute	Reduce environmental effects by only selecting dispersants with low(est) toxicity.	Reduced surface concentrations and shoreline loading.	**S, IC**: High. **A**: Low (stocks potentially limited). **F, R**: Low (may not to be as effective as	N/A	Minor	**Reject** – Control measure not effective due to limited stocks and potentially lower effectiveness. Dispersants listed on

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
				higher toxicity dispersants).			the Australian OSCA register to be used which consider toxicity effects.
Temporal windows of environmental sensitivity considered in operational NEBA.	Separate	Surface dispersant application during temporal windows of environmental sensitivity (e.g. coral spawning, turtle nesting, shorebird & EPBC listed species migrations) a key consideration in operational NEBAs.	Reducing potential impacts during surface dispersant application.	**A, F, R, S, IC:** High.	N/A	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.
Operational control to prevent impacts on EPBC Listed migratory species.	Separate	Sightings of EPBC Listed migratory species (e.g. humpback whales) in the immediate vicinity of any surface dispersant operations will trigger cessation of response until animal has moved and not been sighted for 30 minutes, unless otherwise advised by DoT.	Reduced impact on EPBC Listed migratory species.	**A, F, R, S, IC:** High.	N/A	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.
Dispersant not applied in water depths <20 m, within 10 km of waters depths <20 m (unless OSTM has demonstrated no/minimal exposure risk to sensitive areas), within exclusion zones for	Separate	Restrictions on dispersant use that consider likely exposure to dispersant/ dispersed oil in sensitive areas is	Reduced impact from dispersant and dispersed oil on sensitive receptors (e.g. shallow water habitats and near coastal habitats).	**A, F, R, S, IC:** High.	N/A	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
offshore facilities, within a Habitat Protection Zone or National Park Zone of an Australian Marine Park (application considered in the Multiple Use Zone), and within State waters,		recognised good practice.					
Surface dispersant operations managed in accordance with IAP and third party contractor requirements.	Administrative	Rapidly initiate surface dispersant planning and pre-identification of equipment requirements.	Identification of most effective response strategies with the least practicable impacts.	**A, F, R, S, IC:** High.	Immediate and ongoing	Minor	**Accept** –Control measure effective and minor cost implications.
Arrangements in place with AMOSC, OSRL and other third parties for plant, equipment, dispersants and service provision of surface dispersant application.	Administrative	Rapid mobilisation of surface dispersant system to reduce surface oil (environmental) and the potential/degree of shoreline oiling. Plant, equipment and personnel to implement surface dispersant response strategy can be mobilised for first strike, escalation, and peak volume needs (**Appendix D**).	Arrangements in place for rapid initialisation of surface dispersant application resources that may reduce surface and shoreline oiling impacts. Mobilisation time frames for plant, equipment and personnel can meet first strike, escalation, and peak volume needs and thereby do not limit response strategy implementation.	**A, R, S, F, IC:** High.	<2 hours to initiate	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
OSRL GDS membership.	Administrative	Access to global stockpiles of dispersant. Supply chain analysis confirms that sufficient dispersant stockpiles exist to meet volume and temporal needs for this strategy (**Appendix D**).	Global stockpile access provides sufficient volumes for SDA response to treat minimum oil thickness (>50 um) that may reduce surface and shoreline oiling impacts.	**A, R, S, F, IC**: High.	<2 hours to initiate.	Moderate (~$100,000)	**Accept** – Control measure practicable and effective, moderate cost not disproportionate to environmental benefit.
Rapid dispersant efficacy assessment.	Administrative	Rapid onsite effectiveness trial of available dispersants prior to surface application.	Determination of effectiveness of dispersants available at/near the spill site.	**A, R, S, F, IC:** High.	<2 days to initiate	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.
Laboratory dispersant efficacy assessment.	Administrative	Detailed dispersant effectiveness evaluation to inform selection of priority of dispersant types for surface application	Determination of effectiveness of the range of dispersants with greater certainty than the rapid assessment.	**A, R, S, F**: High **IC**: Low (ability to acquire oil sample of sufficient volume and 'freshness').	<2 days to initiate.	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.
Chemical dispersants acceptable for use in marine environment.	Administrative	Only approved dispersants under NatPlan arrangement on the Oil Spill Control Agents (OSCA) Register or Transitional lists.	Use of approved chemical dispersants for Australian marine waters and conditions.	**A, R, S, F, IC:** High.	N/A	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.
Permission for dispersant application in or in proximity to WA waters obtained prior to application.	Administrative	Chemical dispersant cannot be applied without permission from HMA(s) (DoT).	HMA(s) requirement.	**A, R, S, F, IC:** High.	N/A	Minor	**Accept** – Control measure practicable and effective, minor cost not

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
							disproportionate to environmental benefit.
Dedicated response vessel(s) and/or fixed wing aircraft with surface dispersant system spread(s).	Administrative	On standby 24/7 during Activity to rapidly initiate surface dispersant system application in the event of a Level 3 spill.	Potentially reduce surface concentrations and shoreline loading.	**A, R, S, F, IC:** High.	<1 day to initiate.	Significant vessel and aircraft standby costs >~$1-5 million.	**Reject** – High costs to immediately initiate this secondary response strategy disproportionate to environmental benefit.
Dedicated personnel and equipment on standby implementation of surface dispersant application response strategy.	Administrative	On standby 24/7 during Activity to rapidly initiate surface dispersant system application in the event of a Level 3 spill.	Allow immediate response to potentially reduce surface concentrations and shoreline loading.	**A, R, S, F, IC:** High.	<1 day to initiate.	Significant personnel standby costs ~$1 million.	**Reject** – High costs to immediately initiate this secondary response strategy disproportionate to environmental benefit.
Dispersant premolisation to Dampier to support surface dispersant application response strategy.	Administrative	Sufficient dispersant stockpiles immediately available at Dampier (port) / Karratha (airport) to carry out response strategy.	Allow immediate response to potentially reduce surface concentrations and shoreline loading.	**A, R, S, F, IC:** High.	<1 day to initiate.	Mobilisation of existing national and global stockpiles to Dampier not possible.	**Reject** – High costs to immediately initiate this secondary response strategy is disproportionate to environmental benefit. Supply chain analysis in **Appendix D** shows that current spatial distribution of stockpiles can be managed to meet needs.
Engage suppliers to manufacture dispersant and store at Dampier for surface dispersant application response stragegy.	Administrative	Sufficient dispersant stockpiles immediately available at Dampier (port) / Karratha (airport) to carry out response strategy.	Allow immediate response to potentially reduce surface concentrations and shoreline loading.	**A, R, S, F, IC:** High.	<1 day to initiate.	Manufacture and storage costs of sufficient dispersant volumes >$1 million.	**Reject** – High costs to immediately initiate this secondary response strategy is disproportionate to environmental benefit. Supply chain analysis in **Appendix D** shows that current spatial distribution of

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
							stockpiles can be managed to meet needs.
Mechanical Dispersion (Secondary Strategy)							
No mechanical dispersion response.	N/A	Do nothing option.	None	N/A	N/A	Nil	**Reject** – Mechanical dispersion strategy may mitigate impacts/risks from surface slicks on sensitive environmental receptors.
Mechanical dispersion response.	Administrative	Rapid strategy to implement that may ameliorate impacts of a slick to sensitive shorelines.	Enhance natural degradation. Accelerates breakup of surface oil reducing impacts on receptors.	**A, S, IC:** High. **F:** Low (may be suitable if shoreline impact probable and waters too shallow for dispersant application). **R:** Low (vessels may not be effective in dispersing oil effectively, lack of cavitation at propellers to generate small droplets).	Rapid	Minor	**Accept** – Control measure may be practicable and effective, and not disproportionate to the potential environmental benefit.
Containment and Recovery (Secondary Strategy)							
No containment and recovery response.	N/A	Do nothing option.	None	N/A	N/A	Nil	**Reject** – The option to apply a containment and recovery under appropriate conditions during a Level 3 spill is retained.
Implement offshore containment and recovery operations near well.	Administrative	Recovery of oil offshore near the	Removal of surface oil primarily in the	**A:** High. **S:** Low (booms will require frequent	N/A	Major	**Accept** – Control measure may be practicable and

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
		source with thicker surface oil levels.	proximal waters to the well blowout with sufficient concentrations for response strategy to be effective.	maintenance and replacement). **F:** Low (will not materially decrease oil from marine environment, long distances to transport oil to waste transfer stations). **R:** Low (limited effectiveness in typical offshore metocean conditions). **IC:** Low (dependent on waste management capacity).			effective, and not disproportionate to the potential environmental benefit for collection of surface oil of sufficient thickness near the well.
Implement nearshore containment and recovery operations near sensitive receptors from surface/shoreline oiling.	Administrative	Recovery of oil offshore near key sensitive receptors with a sufficient probability of contact by a slick.	Removal of surface oil primarily in the proximal waters of key environmental receptors that may be impacted by shoreline oiling (preventative).	**A:** High. **S:** Low (booms will require frequent maintenance and replacement). **F:** Low (will not materially decrease oil from marine environment, long distances to transport oil to waste transfer stations for most key sensitive receptors). **R:** Low (limited effectiveness in typical nearshore metocean conditions and low surface oil thickness).	N/A	Major	**Reject** – Control measure will provide limited environmental benefit due to the insufficient thickness of the oil near proximal shorelines (~150 km).

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
				IC: Low (dependent on waste management capacity).			
Temporal windows of environmental sensitivity considered in operational NEBA.	Separate	Response strategy during temporal windows of environmental sensitivity (e.g. turtle nesting, shorebird & EPBC listed species migrations) a key consideration in operational NEBAs.	Reducing potential impacts during containment and recovery response strategy.	**A, F, R, S, IC:** High.	N/A	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.
Operational control to prevent impacts on EPBC Listed migratory species.	Separate	Sightings of EPBC Listed migratory species (e.g. humpback whales) in the immediate vicinity of any containment and recovery operations will trigger cessation of response until animal has moved and not been sighted for 30 minutes, unless otherwise advised by DoT.	Reduced impact on EPBC Listed migratory species.	**A, F, R, S, IC:** High.	N/A	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.
Containment and recovery operations managed in accordance with IAP and third party contractor requirements.	Administrative	Rapidly initiate containment and recovery planning and pre-identification of equipment requirements.	Identification of most effective response strategies with the least practicable impacts.	**A, F, R, S, IC:** High.	Immediate and ongoing.	Minor	**Accept** –Control measure effective and minor cost implications.
OSRL and AMOSC membership, Mutual Aid	Administrative	Ready access to a wide range and	Potential limited reduction of oiling	**A, F, R, S, IC:** High.	Mobilised within <24 hours for	Moderate	**Accept** – Control measure potentially

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
MoU for containment and recovery response resources.		large quantity of spill response equipment and trained personnel with rapid mobilisation.	impact on sensitive shorelines.		AMOSC equipment. <3 days for OSRL equipment. Functional <7 days.		practicable and effective for targeted key sensitive receptors and may not be disproportionate to potential environmental benefit.
Suitable response vessels sourced through external services contracting strategy.	Administrative	Enable deployment for containment and recovery operations at high priority sites with appropriate vessels.	Protection of very high sensitivity site(s) may be possible.	**A, F, R, S, IC:** High.	Mobilised within 7 days.	Minor	Accept – Control measure potentially practicable and effective, and not disproportionate to potential environmental benefit.
Containmnent and recovery equipment and vessels with trained personnel on standby at/near key sensitive receptors.	Administrative	Enable rapid deployment to protect high priority sites.	Protection of very high sensitivity site(s) may be possible.	**A, F, R:** High. **S:** Low (regular inspection and maintenance of booms required at pre-positioned sites). **IC:** Low (dependent on waste management capacity).	Mobilisation <1 day, functional within 7 days	Standby cost of vessel(s), personnel and equipment >$1M	**Reject** – Control measure grossly disproportionate compared to limited environmental benefit due to low probability of shoreline contact at pre-positioned sites.
Shoreline Protection and Deflection (Secondary Strategy)							
No shoreline protection and deflection response.	N/A	Do nothing option.	None	N/A	N/A	Nil	**Reject** – The shoreline protection and deflection strategy may potentially mitigate impacts/risks to key sensitive shoreline environmental receptors.
Temporal windows of environmental sensitivity	Separate	Response strategy during temporal	Reducing potential impacts	**A, F, R, S, IC:** High.	N/A	Minor	**Accept** – Control measure practicable

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
considered in operational NEBA.		windows of environmental sensitivity (e.g. turtle nesting, shorebird & EPBC listed species migrations) a key consideration in operational NEBAs.	during protection and deflection response strategy.				and effective, minor cost not disproportionate to environmental benefit.
Operational control to prevent impacts on EPBC Listed migratory species.	Separate	Sightings of EPBC Listed migratory species (e.g. humpback whales) in the immediate vicinity of any protection and deflection operations will trigger cessation of response until animal has moved and not been sighted for 30 minutes, unless otherwise advised by DoT.	Reduced impact on EPBC Listed migratory species.	**A, F, R, S, IC:** High.	N/A	Minor	**Accept** – Control measure practicable and effective, minor cost not disproportionate to environmental benefit.
Protection and deflection operations managed in accordance with IAP and third party contractor requirements.	Administrative	Rapidly initiate protection and deflection planning and pre-identification of equipment requirements.	Identification of most effective response strategies with the least practicable impacts.	**A, F, R, S, IC:** High.	Immediate and ongoing.	Minor	**Accept** –Control measure effective and minor cost implications.
OSRL and AMOSC membership, Mutual Aid MoU for shoreline protection and deflection response resources.	Administrative	Ready access to a wide range and large quantity of spill response equipment and trained personnel with rapid mobilisation.	Potential limited reduction of oiling impact on sensitive shorelines.	**A, F, R, S, IC:** High.	Mobilised within <24 hours for AMOSC equipment. <3 days for OSRL equipment.	Moderate	**Accept** – Control measure potentially practicable and effective for targeted key sensitive receptors and may not be

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
					Functional <7 days.		disproportionate to potential environmental benefit.
Suitable response vessels sourced through external services contracting strategy.	Administrative	Enable deployment to protect high priority sites with appropriate mix of small to larger vessels.	Protection of very high sensitivity site(s) possible.	**A, F, R, S, IC:** High.	Mobilised within 7 days.	Minor	**Accept** – Control measure potentially practicable and effective, and not disproportionate to potential environmental benefit.
Shoreline booms and associated equipment and vessels with trained personnel on standby at/near key sensitive receptors.	Administrative	Enable rapid deployment to protect high priority site.	Protection of very high sensitivity site(s) possible.	**A, IC:** High. **F:** Low (predicted surface oil concentrations low [<10 g/m^2] when arrive at shorelines). **R:** Low (potential minimal arrival time and location after release from wellhead difficult to predict). **S:** Low (regular inspection and maintenance required).	Mobilisation <1 day, functional within 7 days	Standby cost of vessel(s), personnel and equipment >$1-5 M	**Reject** – Control measure grossly disproportionate compared to limited environmental benefit due to low probability of shoreline contact at pre-positioned sites.
Shoreline Clean-up (Secondary Strategy)							
No shoreline clean-up response.	N/A	Do nothing option.	None	N/A	N/A	Nil	**Reject** – The shoreline clean-up strategy is mandatory to mitigate impacts/risks to sensitive shoreline environmental receptors.
No machinery to be used in mangroves or within 20	Separate	Separate potential impacts of	If required, arrangements in place for	**A, F, R, S, IC:** High.	Immediate and ongoing	Minor	**Accept** – Control measure practicable and effective, and not

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
m of an identified turtle nest.		machinery on sensitive receptors.	mobilisation for clean-up of oiled shorelines.				disproportionate to environmental benefit.
Shoreline clean-up operations managed in accordance with IAP and third party contractor requirements.	Administrative	Rapidly initiate shoreline clean-up planning and pre-identification of equipment requirements.	Identification of most effective response strategies with the least practicable impacts.	**A, F, R, S, IC:** High.	Immediate and ongoing	Minor	**Accept** –Control measure effective and minor cost implications.
Call-off arrangements in place for resources to implement shoreline clean-up response.	Administrative	Access to shoreline clean-up equipment, personnel, support logistics. Effective implementation if required.	Arrangements in place for mobilisation for clean-up of oiled shorelines, if required.	**A, F, R, S, IC:** High.	<2 weeks	Minor	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.
Standby arrangements in place for shoreline clean-up.	Administrative	Rapid access to shoreline clean-up equipment, personnel, and support logistics.	Rapid commencement of shoreline clean-up.	**A, F, R, S, IC:** High.	<1 week	Standby costs >$1M	**Reject** – Control measure grossly disproportionate to environmental benefit as equipment and personnel are rapidly available via call-off arrangements.
Contract with regulated and licenced waste management provider.	Administrative	Waste management services to remove shoreline clean-up waste.	Appropriate handling, storage and disposal of shoreline clean-up waste.	**A, F, R, S, IC:** High.	Immediate and ongoing	Minor	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.
Oiled Wildlife Response (Secondary Strategy)							
No oiled wildlife response (OWR).	N/A	Do nothing option.	None.	N/A	N/A	Nil	**Reject** – The OWR strategy is mandatory to mitigate impacts/risks to marine fauna.

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
OWR operations managed by IMT through IAP process.	Administrative	OWR operations directed to situations with a net environmental benefit.	Positive (greatest) environmental benefit from OWR to be based upon information (situational awareness) to inform wildlife collection.	**A, F, R, S, IC:** High.	Immediate and ongoing.	Minor	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.
AMOSC and OSRL membership for OWR personnel.	Administrative	Access to range of oiled wildlife response personnel from AMOSC and OSRL.	Ability to treat oiled wildlife with appropriate personnel and equipment.	**A, F, R, S, IC:** High.	<2 days	Moderate	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.
Equipment for OWR available Perth, Geelong and Broome via AMOSC.	Administrative	Wildlife treated on mainland or other site(s) where mobilised container(s) resides.	Ability to treat oiled wildlife, and triage when appropriate.	**A, F, R, S, IC:** High.	<24 hours for triage equipment. <2 days for Perth container with mobilisation.	Moderate	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.
OWR implementation (e.g. establishing work areas) to follow pre-designated plans of Western Australian Wildlife Response Plan (WAOWRP) and Pilbara Region Oiled Wildlife Response Plan (PROWRP).	Administrative	Reduce potential impacts to sensitive receptors be avoiding areas of environmental sensitivity.	Ability to treat oiled wildlife, and triage when appropriate.	**A, F, R, S, IC:** High.	Immediate and ongoing.	Minor	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.
Equipment for OWR (and triage) available (pre-positioned) at strategic locations.	Administrative	Wildlife treated at strategic locations where standby container(s) resides.	Ability to treat oiled wildlife in proximity to pre-positioned sites rapidly.	**F, R, S, IC:** High. **A:** Low (AMOSC cannot provide container on standby, must purchase with long lead times).	<1 day for equipment and personnel.	Not available through AMOSC. Procurement and maintenance	**Reject** – Control measure grossly disproportionate to the limited environmental benefit.

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
						of container >$50,000.	
Scientific Monitoring (Primary Strategy)							
No scientific monitoring of the spill.	N/A	Do nothing option.	None	N/A	N/A	Nil	**Reject** – Scientific monitoring response strategy required to quantify spill impacts and subsequent recovery.
Scientific monitoring managed by IMT through IAP process, guided by Operational and Scientific Monitoring Plan (OSMP) and the Scientific Advisory Group (SAG).	Administrative	Ensure monitoring information acquired to plan and monitor effectiveness of spill response. Ensure scientific objectives (characterise impacts and subsequent recovery) are met.	Understanding impacts to sensitive environmental receptors from the spill and response strategies, and subsequent recovery after the spill and response strategies. Inform IMT of effective spill response tactics to mitigate/reduce impacts from spill and responses.	**A, F, R, S, IC:** High.	Immediate and ongoing.	Minor	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.
Call-off arrangements in place for scientific monitoring.	Administrative	Readiness to implement scientific monitoring.	Ability to monitor spill impacts and recovery of sensitive receptors.	**A, F, R, S, IC**: High.	<1 day for IMT to initiate mobilisation. <7 days for initial monitoring implement-ation.	Minor	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.
Scientific monitoring personnel, plant and equipment on standby.	Administrative	Reduce response time to initiate scientific monitoring.	Marginal increase in ability to monitor sensitive	**A, F, R, S, IC:** High.	<6 hours to initiate mobilisation.	>$1M	**Reject** – Control measure is grossly disproportionate

Control Measures	HOC	Rationale	Environmental Benefit	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
			receptors prior to hydrocarbon contact relative to non-standby arrangement.		<3 days for initial monitoring implementation		compared to limited environmental benefit.

A-4 Spill Response Capability and Scalability

The required level of capability and escalation by SapuraOMV to respond to a Level 3 spill from a loss of well control considered the potentially impacted sensitive receptors, the protection priorities for Immediate Actions and resource estimates of an escalated response. Deterministic oil spill modelling of the worst-case loss of well control was used to estimate spill response mobilisation times and resource needs (equipment, plant, personnel) in the External Services Contracting Strategy in **OPEP Section 6.2**.

The Exernal Services Contracting Strategy to meet the capability and scalability needs for spill response (see **OPEP Section 6.2**) outlines the spill response arrangements that will be in place prior to the commencement of drilling for this Activity, and further resources for escalation of the response. Escalation of a spill response relies on membership with AMOSC and OSRL, and the resources of other contracted service providers.

SapuraOMV is satisfied that the External Services Contracting Strategy includes the spill response resources to implement the OPEP and to meet the associated environmental performance outcomes.

A-5 Prioritisation of Sensitive Locations

As part of oil spill response planning, it is necessary to identify environmental priorities for protection in the event of an oil pollution incident.

Based on the stochastic oil spill modelling results and the environmental impact and risk assessment for the worst-case spills, sensitive receptors were identified and prioritised in the following order:

- Environmentally sensitive locations (habitat, cultural, fauna/flora).
- Commercial/ industrial resources/ properties/ and assets.
- Recreational and human amenity resources.

The most sensitive receptors are deemed to be:

- Foraging/nesting/ breeding seabird/ shorebird habitat.
- Sandy beaches that provide nesting habitat for marine turtles.
- Emergent reefs.
- Breeding mammals.
- Tourism and fisheries.

Those most sensitive locations at highest risk (vulnerability) to oiling impacts from shoreline loading were identified as:

- Barrow Island (68.3% contact probability above 100 g/m^2, maximum of ~500 tonnes).
- Montebello Islands (60% contact probability above 100 g/m^2, maximum of ~400 tonnes).
- Imperieuse Reef (36.7% contact probability above 100 g/m^2, maximum of ~365 tonnes).
- Ningaloo Region (69.2% contact probability above 100 g/m^2, maximum of ~75 tonnes).
- Muiron Islands (57.5% contact probability above 100 g/m^2, maximum of ~50 tonnes).

A number of other offshore islands and mainland locations could receive shoreline loadings (e.g. Bernier Island, Carnarvon Region), but the probability of contact and/or maximum shoreline loads does not warrant identification as priority locations. In the event of a large spill incident, these protection priorities may change based on the nature and scale of the spill and through informed discussions with the relevant HMA(s)/Jurisdictional Authorities.

The following ratings are used to allocate a consequence assessment of hydrocarbons making contact with priority sensitivities:

C4: a high volume of hydrocarbons is predicted to make contact with a highly sensitive location.

C3: a low volume of hydrocarbons is predicted to make contact with a highly sensitive location.

C2: a high volume of hydrocarbons is predicted to make contact with a less sensitive location.

C1: a low volume of hydrocarbons is predicted to make contact with a less sensitive location.

Locations were then prioritised in order of response effort taking into account the impact consequence and the time to contact as follows:

P1: Contact with spill hydrocarbons at highly sensitive locations is predicted to occur within a very short time scale. Resources should be preferentially deployed to reduce potential contact as quickly as possible.

P2: Contact with spilled hydrocarbon at highly sensitive locations is predicted to occur over a longer time scale than for P1 locations. This may provide time to address issues with P3 locations before needing to preferentially deploy resources to the P2 locations.

P3: Contact with spilled hydrocarbons at locations with less sensitivity is predicted to occur within a very short time scale. This does not mean those locations are not important but this prioritisation provides guidance in balancing the deployment of limited resources between competing priorities.

P4: Contact with spilled hydrocarbons at locations with least relative sensitivity is predicted to occur over longer time scales. This does not mean those locations are not important but this prioritisation provides guidance in balancing the deployment of limited resources between competing priorities.

Table A-4 summarises the locations and receptors in order of priority based on stochastic oil spill modelling predictions of shoreling loading, probability of shoreline loading >100 g/m^2 (impact threshold, see **EP Section 8.1**) and the minimum time to shoreline loading of >100 g/m^2 for this preliminary NEBA assessment. The information in **Table A-4** was used to evaluate the potential impacts of an oil spill on receptors at these sensitive locations and whether response strategies will provide benefit, which is summarised in **Table A-5**.

Table A-4 Sensitive locations and the priority ranking and order of priority for response based on amount of accumulated hydrocarbons, time to contact, sensitive receptors present and consequence ranking for a Level 3 spill

<table>
<tr><th>Sensitive Location</th><th>Sensitive Receptors/ Values</th><th colspan="2">Stochastic Oil Spill Modelling Outputs</th><th>Consequence Ranking</th><th>Priority Ranking</th><th>Order of Priority</th></tr>
<tr><td rowspan="3">Barrow Island</td><td rowspan="3">Marine reptiles: nesting and foraging areas for marine turtles.
Birds: migratory route and feeding grounds for migratory seabirds.
Coral reefs.
Macroalgae and seagrass communities.
Mangroves
Marine Park and Marine Management Area (WA).</td><td>Probability of Shoreline Contact >100 g/m^2</td><td>68.3%</td><td rowspan="3">C4</td><td rowspan="3">P1</td><td rowspan="3">1</td></tr>
<tr><td>Minimum Time to Shoreline Loading >100 g/m^2</td><td>~8 days</td></tr>
<tr><td>Maximum Shoreline Loading >100 g/m^2</td><td>~500 tonnes</td></tr>
<tr><td rowspan="3">Montebello Islands</td><td rowspan="3">Marine reptiles: nesting and foraging areas for marine turtles.
Birds: migratory route/feeding grounds for migratory seabirds.
Coral reefs
Macroalgae and seagrass communities.
Mangroves.
Sandy beaches.
Marine Park (WA).
Tourism and recreational fishing.</td><td>Probability of Shoreline Contact >100 g/m^2</td><td>60.0%</td><td rowspan="3">C4</td><td rowspan="3">P1</td><td rowspan="3">2</td></tr>
<tr><td>Minimum Time to Shoreline Loading >100 g/m^2</td><td>~8 days</td></tr>
<tr><td>Maximum Shoreline Loading >100 g/m^2</td><td>~400 tonnes</td></tr>
<tr><td rowspan="3">Imperieuse Reef</td><td rowspan="3">Whales –migratory pathway for for pygmy blue whales.
Seabirds – breeding colonies, resting area for migratory species.
Seagrass communities.
Coral reefs – ecologically significant.
Sandy cay.
Marine Park (WA).
Tourism and recreational fishing.</td><td>Probability of Shoreline Contact >100 g/m^2</td><td>36.7%</td><td rowspan="3">C4</td><td rowspan="3">P2</td><td rowspan="3">3</td></tr>
<tr><td>Minimum Time to Shoreline Loading >100 g/m^2</td><td>~11 days</td></tr>
<tr><td>Maximum Shoreline Loading >100 g/m^2 (Deterministic)</td><td>~365 tonnes</td></tr>
</table>

Sensitive Location	Sensitive Receptors/ Values	Stochastic Oil Spill Modelling Outputs		Consequence Ranking	Priority Ranking	Order of Priority
Ningaloo Region	Marine turtles - nesting habitat for turtles. Whales - migratory pathway for humpback whales; foraging habitat/distribution/migratory pathway for pygmy blue whales. Dugongs – foraging, breeding, nursing and calving. Sharks - foraging habitat for whale sharks. Seabirds – breeding colonies. Migratory shorebirds – feeding area; important staging area. Coral reefs. Seagrass beds. Sandy beaches. Mangroves. 15 x shipwrecks. Traditional fishing. Commonwealth and State Marine Parks. Recreational Use Zone (IUCN Category IV). World Heritage Area. National Heritage Area. KEF. Tourism and recreational fishing.	Probability of Shoreline Contact >100 g/m^2	69.2%	C3	P2	4
		Minimum Time to Shoreline Loading >100 g/m^2	~14 days			
		Maximum Shoreline Loading >100 g/m^2	~75 tonnes			
Muiron Islands	Marine reptiles - important nesting areas for marine turtles. Surrounding waters: migratory pathway for humpback whales; distribution habitat for pygmy blue whales. Coral reefs. Marine Management Area. World Heritage Area. Tourism and recreational fishing.	Probability of Shoreline Contact >100 g/m^2	57.5%	C3	P2	5
		Minimum Time to Shoreline Loading >100 g/m^2	~11 days			
		Maximum Shoreline Loading >100 g/m^2 (Deterministic)	~50 tonnes			

Table A-5 Summary of sensitive receptors, their locations and assessment of oil spill response strategies

Sensitive Receptors	Priority Locations						Oil Spill Response Strategy							
	Barrow Island	Montebello Islands	Imperieuse Reef	Ningaloo Region	Muiron Islands	Source Control	Mechanical Dispersion	Operational & Scientific Monitoring	Surface Dispersant Application	Subsea Dispersant Application	Offshore Containment & Recovery	Shoreline Protection & Deflection	Shoreline Clean-up	Oiled Wildlife Response
Cetaceans	✓	✓	✓	✓	✓	R	C	R	C	C	C	N/A	N/A	C
Marine reptiles	✓	✓	✓	✓	✓	R	C	R	C	C	C	C	C	C
Dugongs	✓	✓	-	✓	✓	R	C	R	C	N/A	C	N/A	N/A	C
Seabirds/ shorebirds	✓	✓	✓	✓	✓	R	C	R	C	N/A	C	C	C	R
Fish, sharks, rays	✓	✓	✓	✓	✓	R	NR	R	N/A	C	C	N/A	N/A	NR
Marine invertebrates	✓	✓	✓	✓	✓	R	NR	R	N/A	N/A	N/A	N/A	N/A	NR
Sandy beaches	✓	✓	✓	✓	✓	R	C	R	N/A	N/A	N/A	C	R	N/A
Submerged reefs	✓	✓	✓	✓	✓	R	NR	R	N/A	N/A	N/A	N/A	N/A	N/A
Seagrass beds	✓	✓	✓	✓	✓	R	NR	R	NR	NR	N/A	N/A	N/A	N/A
Mangroves	✓	✓	-	✓	-	R	C	R	NR	NR	C	C	C	N/A
Australian & State Marine Parks	✓	✓	✓	✓	✓	R	C	R	NR	NR	C	C	C	N/A
National & World Heritage	-	-	-	✓	✓	R	C	R	C	NA	C	C	C	N/A
Key Ecological Features	-	-	-	✓	-	R	C	R	C	C	C	N/A	N/A	N/A
Tourism/ recreation	-	✓	✓	✓	✓	R	C	R	C	C	C	C	R	N/A
Fisheries	✓	✓	-	✓	✓	R	NR	R	C	C	C	N/A	N/A	N/A
Shipping	✓	-	-	-	-	R	C	R	N/A	N/A	N/A	N/A	N/A	N/A
Indigenous heritage	✓	✓	-	✓		R	C	R	N/A	N/A	C	C	C	N/A

Key:
✓ = receptor present
- = receptor not present
R = Recommended
NR = Not recommended
N/A = Not applicable
C = Considered

A-6 Environmental Impacts of Spill Response Activities

Based on the preliminary NEBA (**Section A-2**) and ALARP justification of each response element (**Section A-3**), response options that may be implemented in the event of a spill during the Activity are:

- Primary responses
  - Source Control – Emergency BOP Intervention.
  - Source Control – Capping Stack.
  - Source Control – Relief Well.
  - Monitor and Evaluate (Operational Monitoring).
  - Scientific Monitoring.
- Secondary responses
  - Shoreline Clean-up.
  - Subsea Dispersant Applicaiton.
  - Surface Dispersant Application.
  - Mechanical Dispersion.
  - Offshore Containment and Recovery.
  - Shoreline Protection and Deflection.
  - Oiled Wildlife Response.

In the event that response activities are required, there is the potential for environmental impacts and risks as a result of their implementation.

Most response strategies involve vessel and/ or aircraft-based activities. Impacts have been described in relevant sections of the EP for planned vessel and aircraft activities within the Operational Area. As most vessel and aircraft response activities will occur in similar environments to the Operational Area, associated impacts can be managed via the same control measures in the relevant sections of the EP.

Some spill response strategies introduce different hazards (e.g. application of chemical dispersants) or possible impacts to areas of higher sensitivity than the offshore environment within which the planned exploration well activities will occur. The key environmental hazards and associated potential impacts to sensitive receptors from these spill response strategies are discussed in **EP Section 8.8** together with a description of any additional control measures and the performance outcome and performance standard for the spill response.

Appendix B

Expanded IMT Structure andResourcing

The SapuraOMV IMT structure is designed to be scaleable to meet the particular requirements of any credible spill scenario during the Kanga-1 drilling campaign. The expanded (peak) IMT structure to manage the 'worst case' (ie maximum shoreline loading scenario) spill response (**Appendix D**) is shown in **Figure B-2**. The IMT will use an ICS structure and a planning process to execute field activities consistent with the requirements of this OPEP, including for source control.

To ensure adequate personnel availability for the peak IMT structure, the associated maximum IMT resourcing requirements have been evaluated in consultation with AMOSC. The evaluation included a conservative consideration of the work outputs (tasks), management of people/platforms/process, and leadership of the field operations necessary to combat a worst-case scenario (**Appendix D**) by the functional sections of the IMT, overseen by a command element, on a 24/7 cycle. This process established the required IMT team size, and from this a total required pool of IMT resources was determined (taking into account shift work and team swings across the duration of the response).

The resourcing evaluation indicates that in, the event of a worst case scenario, the size of the IMT ramps up from initiation to reach a peak of approximately 70 personnel over the first 7 days of the response, as shown below in **Figure B-1**.

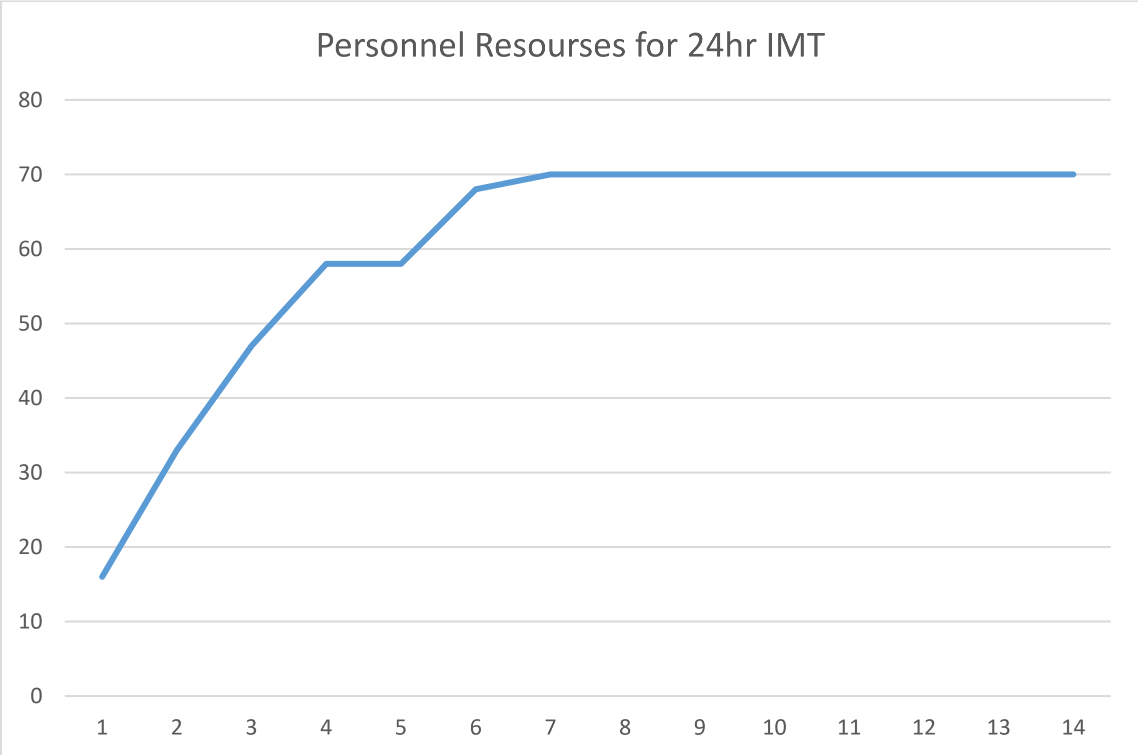

Figure B-1 Number of IMT personnel over first 14 days after start of LOWC

This manning level assumes, highly conservatively, that offshore operations (e.g. containment and recovery, dispersant application, etc) continue at maximum effort coincident with maximum nearshore/shoreline operations, over the duration of the response. In reality, if offshore operations are effective, the volume of oil and scale of associated nearshore/shoreline response would reduce accordingly, or alternatively the resources allocated to managing offshore response would be re-deployed to managing nearshore/shoreline response if offshore activities were ineffective in reducing oil ashore. The total number of personnel includes SapuraOMV resourcing of potential DOT IMT requirements, per the Offshore Petroleum Industry Guidance Note: Marine Oil Pollution Response and

Consultation Arrangements (DoT, 2020) and incorporates IMT Covid-19 considerations in accordance with the APPEA Disease Management Plan (APPEA 2020).

Assuming a protracted response requiring two rotational IMT teams with a day and night shift for each team, the total resourcing requirement for the peak IMT is estimated at 118 persons. SapuraOMV's internal (including parent group) resourcing and external contracting strategy (OPEP Section 6.2) provides access to a pool of at least 157 appropriately qualified personnel. The predicted allocation of resources to the peak IMT structure positions is shown in **Table B-1**. As shown in Figure B-2, support from AMOSC has been contracted to fulfil key peak IMT functional roles on a devolved basis.

The competency, including spill response training, requirements for each IMT position/role have been established (**Table B-2**) and considered in the designated resource allocation shown in **Table B-1**. SapuraOMV's training and exercise program (OPEP Sections 8.5 and 8.6) will ensure the availability of an appropriately trained pool of personnel to resource the expanded (peak) IMT structure, with confirmed access to the required numbers of competent personnel for the first rotational (ie 'on duty') team in place prior to the commencement of drilling activity. Additional training (if necessary) and/or quarantine requirements (if applicable) for the second rotational team would be achieved within its stand-up timeframe. The total pool of personnel with the required competencies for each role that will be available to SapuraOMV at the commencement of drilling is shown in **Table B-1**.

A summary of the key responsibilities and outputs for each of the IMT roles within a peak IMT structure is provided in **Table B-3**.

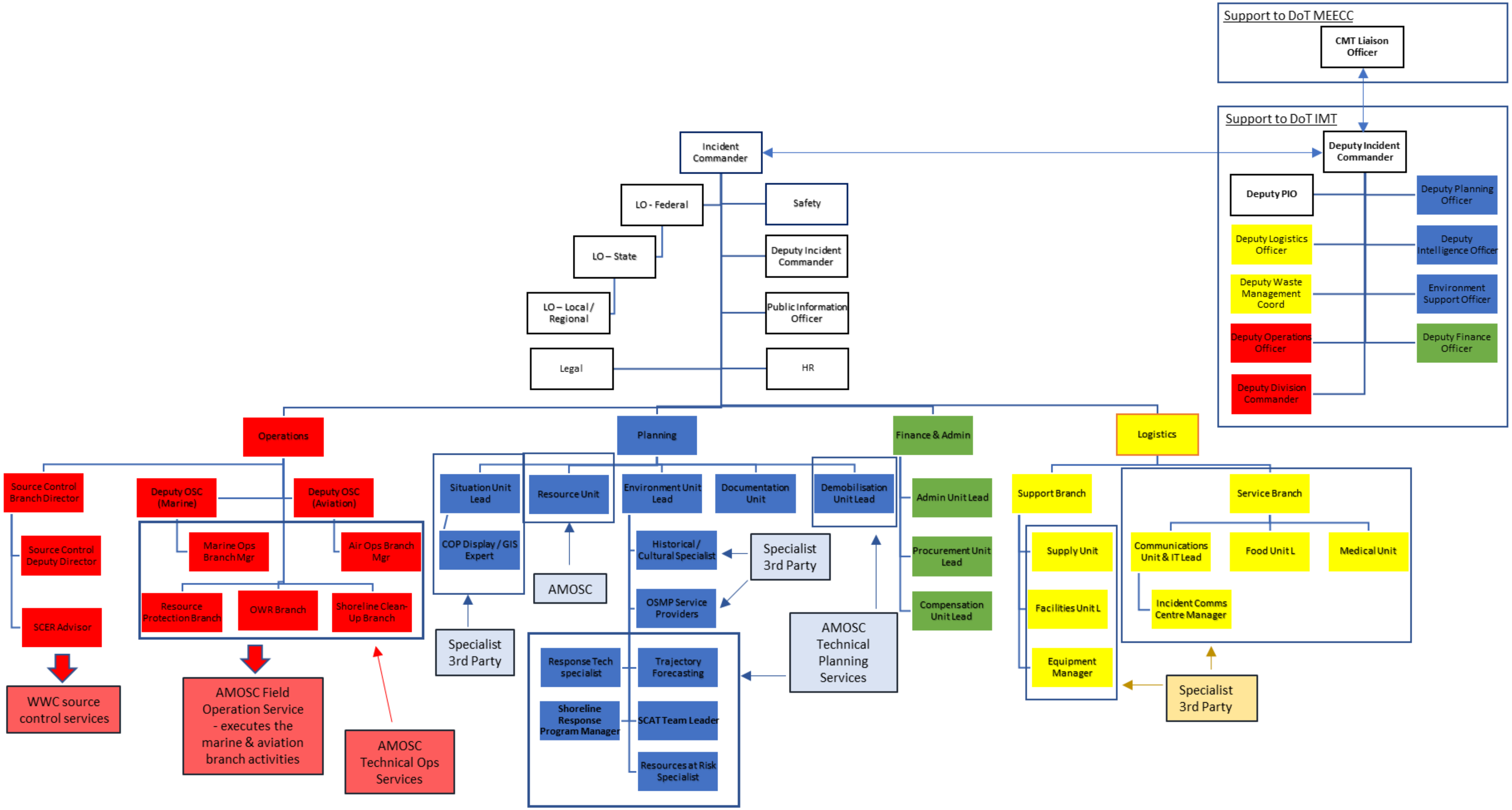

Figure B-2 Expanded (Peak) IMT Structure

Table B-1. Expanded IMT Resourcing Allocation and Availability

SapuraOMV (Group of Companies) - Expanded (Peak) Incident Management Team Resourcing Summary

#	IMT POSITION	Peak IMT Total Persons Required	Available Resources: Perth IMT	SapuraOMV Group	Contracted Spill Response Org's	Contracted Specialist Service Providers	Agency	Total Allocated Personnel Available via Contracting Strategy	Total Competent Personnel Pool Available via Contracting Strategy*
1	INCIDENT COMMANDER	3	1	2				3	7
	DEPUTY IC	3		2	1			3	14
2	Safety Officer	2	1	1				2	6
3	Public Information Officer	2		1		1		2	5
4	Federal LO	2	1		1			2	38
	State LO	2		1	1			2	38
	Local LO	2		1		1		2	38
5	HR	2	1	1				2	3
6	Legal	3				3		3	5
7	PLANNING SECTION CHIEF	3	1	2				3	46
	PLANNING: Documentation (LEAD)	2	2					2	54
	PLANNING: Environment Unit (LEAD)	3	1	1		1		3	5
	Trajectory Forecasting Lead	2			1	1		2	51
	Resources at Risk	2			1	1		2	52
	Historical & Cultural SME	2					2	2	2
	Response technical Specialist	2			2			2	67
	Shoreline Response Programme Manager	2			2			2	59
	SCAT Team Lead	2			2			2	67
	PLANNING: Situation (LEAD)	3			1	2		3	87
	CoP Display/GIS Expert	2				1	1	2	3
	PLANNING : Resource Unit (LEAD)	2			2			2	29
	PLANNING: Demobilisation Unit (LEAD)	2			2			2	29
8	OPERATION SECTION CHIEF	3	1	2				3	12
	DEPUTY OPERATION SECTION CHIEF (AIR)	2		1	1			2	32
	DEPUTY OPERATION SECTION CHIEF (MARINE)	2		1	1			2	32
	Air Operations Branch Manager	2			1		1	2	32
	Marine Operations Branch Manager	2			1		1	2	32
	Shoreline Cleanup Commander	2			2			2	66
	Resource Protection Division Commander	2			2			2	52
	Oil Wildlife Division (LEAD)	2			1	1		2	32
	Source Control Branch Director	3	1	2				3	7
	Source Control Deputy Director	2			2			2	9
	Source Control ER Advisor	2			2			2	2
9	LOGISTICS SECTION CHIEF	3	2	1				3	9
	Support Branch Director	3					3	3	18
	Supply Unit Lead	2					2	2	12
	Facilities Unit Lead	2					2	2	12
	Equipment Manager	2					2	2	12
	Service Branch Director	3					3	3	18
	Communications Unit (IT) Manager	2					2	2	12
	Incident Comms Center Manager	2					2	2	12
	Food Unit Lead	2					2	2	12
	Medical Unit Lead (includes infection Control COVID)	3					3	3	3
10	FINANCE SECTION CHIEF	3	1	2				3	4
	Procurement Unit	2		1			1	2	5
	Compensation Unit	2		1			1	2	5
	Admininstration & Records	2	1				1	2	6
	NEED excl DoT *Sub-total*	*107*	*14*				*29*	*107*	
	Department of Transport Office								
1	CMT Liaison Officer	1		1				1	3
2	Deputy Incident Controller	1	1					1	4
3	Deputy PIO	1	0			1		1	3
4	Deputy Planning Officer	1				1		1	1
5	Deputy Intelligence Officer	1			1			1	32
6	Environmental Support Officer	1				1		1	2
7	Deputy Logistics Officer	1					1	1	32
8	Deputy Operations Officer	1			1			1	32
9	Deputy Finance Officer	1	1					1	2
10	Deputy Division Commander (FOB)	1			1			1	32
11	Deputy Waste Management Coordinator	1				1		1	1
	Sub-total	*11*	*2*	*1*	*3*	*4*	*1*	*11*	
	TOTAL # required:	118					# available:	118	

* AMOSC core group competencies may vary over time; this # includes predicted estimate for certain competencies

Table B-2. Expanded IMT Competency Requirements

Position	ICS 100/200 (or above)	OSPR Intro – Specific to Kanga1 well OPEP	PMAOIR 418 – Coordinate incident Response or ICS 300	PMAOMIR 320/322 – Manage Incident Response Information or ICS300	AMOSC Oil Spill Mgt Course (or Course Equivalent to IMO II)	AMOSC Oil Spill C&C Course (or Course Equivalent to IMO III)	Function specific sessional training/ workshop
Incident Commander			Yes			Yes	Yes
Deputy Incident Commander			Yes			Yes	Yes
Safety Officer				Yes	Yes		
Public Information Officer				Yes			Yes
Federal LO				Yes	Yes		Yes
State LO				Yes			Yes
Local LO				Yes			Yes
HR				Yes			Yes
Legal							Yes
Planning Section Chief				Yes	Yes		Yes
Documentation				Yes			Yes
Environment Unit Lead				Yes	Yes		Yes
Trajectory Forecasting							Yes
Historical & Cultural SME							Yes
Response Technical Specialist					Yes		Yes
Resources at Risk					Yes		Yes
Situation Lead					Yes		Yes
COP Display / GIS Expert							Yes
Shoreline Response Programme Manager	Yes	Yes			Yes		Yes
SCAT Team Lead					Yes		Yes
Planning Resource Unit Lead							Yes
Planning Demobilisation Unit Lead							Yes
Operations Section Chief*				Yes	Yes		Yes
Deputy Operations Section Chief (Air)				Yes	Yes		Yes
Deputy Operations Section Chief (Marine)				Yes	Yes		Yes
Air Operations Branch Manager*				Yes	Yes		Yes
Marine Operations Branch Manager*				Yes	Yes		Yes
Shoreline Cleanup Commander				Yes	Yes		Yes
Resource Protection Division Commander				Yes	Yes		Yes
Oiled Wildlife Division (LEAD)				Yes	Yes		Yes
Source Control Branch Director				Yes	Yes		Yes
Source Control Deputy Director				Yes	Yes		Yes
Source Control Emergency Response Advisor				Yes	Yes		
Logistics Section Chief*				Yes	Yes		Yes
Support Branch Director*							Yes

Position	ICS 100/200 (or above)	OSPR Intro – Specific to Kanga1 well OPEP	PMAOIR 418 – Coordinate incident Response or ICS 300	PMAOMIR 320/322 – Manage Incident Response Information or ICS300	AMOSC Oil Spill Mgt Course (or Course Equivalent to IMO II)	AMOSC Oil Spill C&C Course (or Course Equivalent to IMO III)	Function specific sessional training/ workshop
Supply Unit Lead*							
Facilities Unit Lead							
Equipment Manager							
Service Branch Director							Yes
Communications Unit and (IT) Manager							
Incident Comms Centre Manager							
Food Unit Lead							
Medical Unit Lead (includes infection control – COVID)							Yes
Finance Section Chief*				Yes	Yes		Yes
Procurement Unit							
Compensation Unit							
Administration & Records							

Table B-3. Expanded IMT Roles and Responsibilities

IMT Role	Job Description	Outputs
1. Incident Commander*	Overall management of incident response operations.	Response operations tailored to the scenario and conditions presented at the time, consistent with the OPEP, EP, company policies and requirements of the National Plan.
2. Deputy Incident Commander	Deputises for the IC as required, directly supervises work of section chiefs and oversees the smooth implementation of the IMS. Oversees a particular portion of the response organisation.	As directed by the IC at the time.
3. Safety Officer*	Provides support to the site safety officers; oversights the preparation, distribution and execution of the response safety plan; undertakes investigations of near misses/incidents; ensures technical expertise such as industrial hygienists, air monitoring specialists, etc – are deployed as needed.	Site risk assessments are in place and safety plan is in force across all of the response.
4. Public Information Officer	Working with Liaison Officers, manage all external affairs for the response. Strong link with Crisis Management teams and external reach out to State and Commonwealth media/public affairs teams.	Key stakeholder groups identified and regularly updated – specific and holding statements are prepared and disseminated to relevant company spokespeople.
5. Federal Liaison Officer	Responsible for the management of company liaison into Commonwealth Government structures – OPICC, DIIS, relevant Minister's offices (Primary portfolio focus is Resources, secondary focus on Environment & Transport).	Facilitate the two way exchange of critical situational and crisis management information b/w the title holder and commonwealth government. Daily one-on-one briefings & meetings as determined by the commonwealth.
6. State Liaison Officer	Responsible for the management of company liaison into State Government structures – State	Facilitate the two way exchange of critical situational, crisis and incident management information b/w the title holder and state

	Control Agency and the Premier/Chief Minister's office.	government. Daily one-on-one briefings & meetings as determined by the state.
7. Local Liaison Officer	Responsible for the management of company liaison into Local Government, local land managers, commercial, heritage and indigenous groups.	Facilitate the two way exchange of critical situational, crisis and incident management information b/w the title holder and local bodies within the zone of predicted impact. Daily one-on-one briefings, town hall and small group meetings as determined as needed.
8. HR	Provide HR advice to the logistics section and the IC.	HR factors are considered and managed consistent with SapuraOMV systems. HR risks are minimised through the response.
9. Legal	Provide legal advice to the planning, operational, and logistic sections (as needed) and the IC.	Legal consideration is used to guide the activities of the response and minimise risks.
10. Planning Section Chief*	Lead the planning section	Ensure that the planning process is adhered to, an IAP comprising all relevant sections (List here ICS documentation) is produced,
11. Documentation	Implement a record keeping and archival system to capture all documents, consistent with organisational and legal requirements.	Establish and maintain record keeping system including decision making logs (minutes of meeting, personal notes) and provide forms/formats of records as required by the organisation.
12. Environment Unit Lead*	Ensures that environmental consequences are mitigated (managed in accordance with the EP/OPEP) and the operational & scientific monitoring plan is executed.	OSMP is enacted; SIMA/NEBA completed/up-to-date, response is undertaken in accordance with the OPEP.
13. Trajectory Forecasting	Monitors and predicts the fate and weathering of the oil.	Regular (twice/three times daily) mapping data that displays predictions of future oil locations, and how the oil may change in chemical make up (weathering).

14. Historical & Cultural SME	Based on the trajectory and field observations, provides specialist advice around sensitivity impact for the deterministic NEBA/SIMA.	Up to date NEBA/SIMA; validate oil spill response strategies chosen; provide advice to operations teams on strategy selection.
15. Response Technical Specialist	Works with the enviro team to provide data on oil spill response strategy impacts on sensitivities; and that new/emerging technology is considered as part of the response.	Quality assure tactical strategy execution.
16. Resources at Risk	Based on the trajectory and field observations, completes the deterministic NEBA/SIMA.	Up to date NEBA/SIMA; validate oil spill response strategies chosen; provide advice to operations teams on strategy selection.
17. Situation Lead	Receipt and manage the information/data that is used to produce the COP and other information tools/displays.	Up to date COP; future COP. IMS system (computer or paper based) status boards and other records are on display as needed for decisions making.
18. COP Display / GIS Expert	Operates the GIS system that produces the COP	Up to date COP; future COP
19. Resource Unit Lead	Tracks resources that have been ordered/receipted/ dispatched	Up to date resource tracking available at any time.
20. Demobilisation Unit Lead	Development of a demobilisation plan that considers equipment, people and platform remediation and return/repair.	Production of a bespoke demobilisation plan.
21. SCAT Team Lead	Leads the analysis of field data and the production of a shoreline treatment plan (STRs), along with the end point criteria for clean up operations.	Shoreline treatment recommendations for affected/potentially affected shorelines are developed and disseminated to operations units.
22. Shoreline Response Programme Manager	Leads the development of the SRP plan, with the DoT. Ensures that inwards data flows are objectively analysed and appropriate STRs are developed and communicated to logistics/operational teams for execution.	Creating the SRP plan (with the DoT), acting as the single point of contact for the IMT on all shoreline-related issues.

23. Operations Section Chief*	Lead the operations function.	Execute operations inline with the daily IAP. Draft the IAP for the following operational period.
24. Deputy Operations Section Chief (Air)	Lead the aviation activities	Tailored ICS 204, 204s and 204e, for each aviation strike team/tasking. Input to the safety documentation. Production of maps and displays for operations. Work with Sit; Plan; Doc to provide current information.
25. Deputy Operations Section Chief (Marine)	Lead the marine activities	Tailored ICS 204, 204s and 204e, for each marine strike team. Input to the safety documentation. Production of maps and displays for operations. Work with Sit; Plan; Doc to provide current information.
26. Air Operations Branch Manager*	Lead aviation operations. Draft and execute plans from the previous day (204s/Operational Briefing).	Draft and execute Air operations Plan (ICS220); aerial dispersant plan (AMSA/AMOSC JSOP plan). Coordinate aerial assets in the field.
27. Marine Operations Branch Manager*	Lead marine activities. Draft and execute plans from the previous day (204s/Operational Briefings/Operational Risk management plans).	Draft and execute marine operations plan (s) as they relate to the operations at the time. Coordinate marine assets in the field.

28. Oiled Wildlife Response Commander	In conjunction with the relevant state authorities, lead the implementation of industry equipment, materials and personnel for a OWR response. Work with planning to identify fauna that may be impacted by oiling (or response operations) and reduce / prevent the consequences on fauna.	Field activities, resourcing and facility support provided in aid of the OWR response.
29. Shoreline Clean-up Commander	In conjunction with the DoT, plan and lead the shoreline response operations	Tailored ICS 204, 204s and 204e (STRs) for each shoreline type by segment. Provide input to the safety documentation. Input into the production of maps and displays for operational teams. Work with Sit; Plan; Doc to provide current information. Monitor volumes of waste and concentrations of hydrocarbons to hard wastes.
30. Resource Protection Division Commander	In conjunction with the DoT, lead/provide input to the execution of nearshore protection activities (marine and shoreline). Draft and execute plans from the previous day (204s/Operational Briefings/Operational Risk management plans).	Draft and execute nearshore protection planning and execute plans from the previous day (204s/Operational Briefings/Operational Risk management plans).
31. SC Branch Director*	As per SC planning and guidance.	
32. SC Deputy Director*		
33. SCER Advisor*		
34. Logistics Section Chief*	Ensures development of logistics section of IAPs and provision of all facilities, services, support, persons and materials required for the response. Particular focus on the provision of vessels and aircraft for spill response activities, spill response	Equipment, materials and other resources are appropriately sourced, deployed, maintained and serviced as required by the response.

	equipment and specially trained personnel for these tasks.	
35. Support Branch Director*	The support branch is in charge of the logistics plans for the daily incident action plan. These plans cover the operations of Supply, Facilities, Ground and Vessel Support units.	Daily logistics planning completed.
36. Supply Unit Lead*	Procurement of resources for the response (personnel, equipment & supplies).	Procurement matches the need identified by operations for daily taskings.
37. Facilities Unit Lead	Setup, maintenance and demobilisation of incident facilities. Includes the provision of accommodation and sanitation facilities.	Ensure that operating bases; the ICP; accommodation and other facilities are provided as needed and fit fir purpose.
38. Equipment Manager	Service, repair, and fuel for all equipment and gear.	Supply for the operation of (OSPR in particular) equipment and platforms.
39. Service Branch Director	Manages and runs the service aspects of the response - Communications, Medical and Food Units.	Service units operate effectively and efficiently as per the need at the time.
40. Communications Unit (IT) Manager	Run the communication networks and IT infrastructure critical for the response.	Effective communications from the IMT to the field, and intra-field communications. Ensure that all computer devices, networks, printers, etc work as they should.
41. Incident Command Centre Manager	Manage the Incident Command Centre	Works closely with facilities' management to ensure that the ICC is fit for purpose for an ongoing response.
42. Food Unit Lead	Put in place all of the catering and potable water requirements for the response.	Food and water as needed to the operational and management force.
43. Medical Unit Lead (includes infection control – COVID)	Provide expertise on medical issues as a result of the response; drafts and advises on operational	Medical staff and expertise to assist develop and execute the safety risk management plan.

	issues from the execution of the Covid19 response plan.	
44. Finance Section Chief*	All financial, administrative and cost aspects of the incident, and management of the team.	Accurate financial records keeping and daily cash 'burn rate' is tracked. Appropriate financial DOA is working amongst the IMT. Financial software/tracking system is in place with line items and cost centres established.
45. Procurement Unit (marine & aviation asset contracting)	Provides contractual support, leases and agreements with external parties.	Contractually enables the control agency to bring together all of the necessary third-party contractors to support the response.
46. Compensation Unit	Responsible for the administration of the claims process (collation of data and logging of claim) from third parties who may be affected by the response.	System in place to engage with affected parties so that they may log their claims (compensation).
47. Administration & Records	Provide administrative services (systems and facilities) to the IMT.	IMS software/paper-based system is used by all sections. Access to other software – databases, spreadsheet, internal SharePoint systems, etc, are in place.

Appendix C

OSTM Activation Form

OIL SPILL TRAJECTORY MODELLING REQUEST

Email completed form to RPS APASA response staff response@apasa.com.au After sending this request, phone Duty Officer on telephone number provided.

Priority of Request: ☐ **Urgent** ☐ **Exercise** Date and Time of Request:

Incident Name	
Name of requesting person and position in response	Contact telephone number
Email address for model output (preferred method)	Fax number for receipt of model output

Surface or Subsurface spill? Surface ☐ Subsurface ☐ Depth of spill (m)	If subsurface spill, describe the spill source. ☐ Low Turbulence (eg. Low Pressure Pipeline Leak) ☐ Medium Turbulence (eg. Intermediate Pressure Pipeline Leak) ☐ High Turbulence (eg. Well Blowout under pressure, or ruptured pipeline under pressure)

Spill Start Date			Spill start time (use 24 hour clock, state time zone – GMT or Local)	Requested Simulation Length (hrs)
Day	Month	Year		

Oil Name:	Oil Type: *Bunker C, Diesel Fuel, Crude, Condensate*

Spill location (select one format)	Latitude of spill (N)	Longitude of spill (E)
Degrees, minutes & seconds	° ′ ″	° ′ ″
Degrees, minutes & decimal minutes	° . ′	° . ′
Degrees, minutes & decimal minutes	. °	. °
Easting & Northing (Zone)	S/N	E/W

Instantaneous spill ☐	Amount	(select one)	☐ Tonnes ☐ Cubic Metres ☐ Litres ☐ Barrels
Continuous spill ☐	Duration (hours)	Amount (per hour)	☐ Tonnes ☐ Cubic Metres ☐ Litres ☐ Barrels

Present wind speed and directions, sea states and water temperatures (°C) at the site (if known):

NOTES (describe special details of the incident, special concerns, doubts about information etc.)

Appendix D

Estimates of Collected Hydrocarbon Volumes, and Plant and Personnel Resourcing Required to Implement Selected Response Strategies

D-1 Worst Case Shoreline Loading Scenario

A deterministic simulation of the worst case shoreline loading across all shorelines was used to characterise maximum spill response resources required at peak escalation to guide the needs for the external services contracting strategy arrangements (**Section 6.2**). As previously summarised in **Section 6.3**, the predicted worst-case oiling of all shorelines from a Level 3 loss of well control incident is ~1,000 tonnes (see **EP Section 8.1**). **Figure D-1** illustrates that the predicted 50th and 90th percentile shoreline loadings are considerably less than 100 tonnes and 300 tonnes, respectively. Hence, the resourcing requirements characterised here for a maximum potential shoreline loading of ~1,000 tonnes are considered an upper estimate.

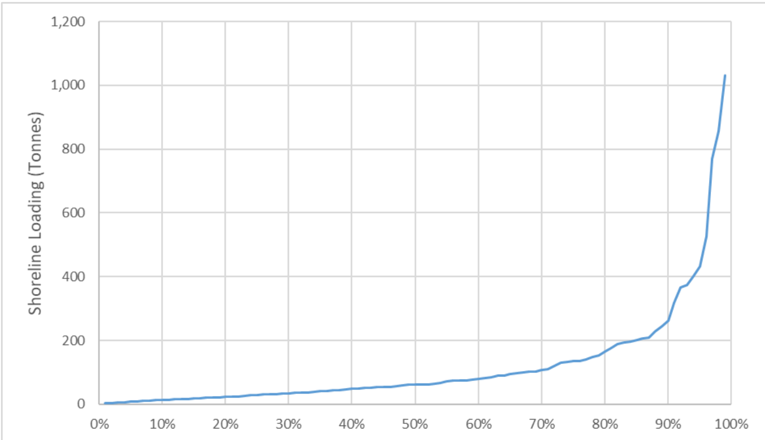

Figure D-1 Percentile of predicted accumulated loading across all shorelines across 120 stochastic simulations for a Level 3 spill

The time series of shoreline loadings at four of the five priority response locations are illustrated in **Figure D-2**, the fifth priority response location at Imperieuse Reef did not have any shoreline loading for this scenario.

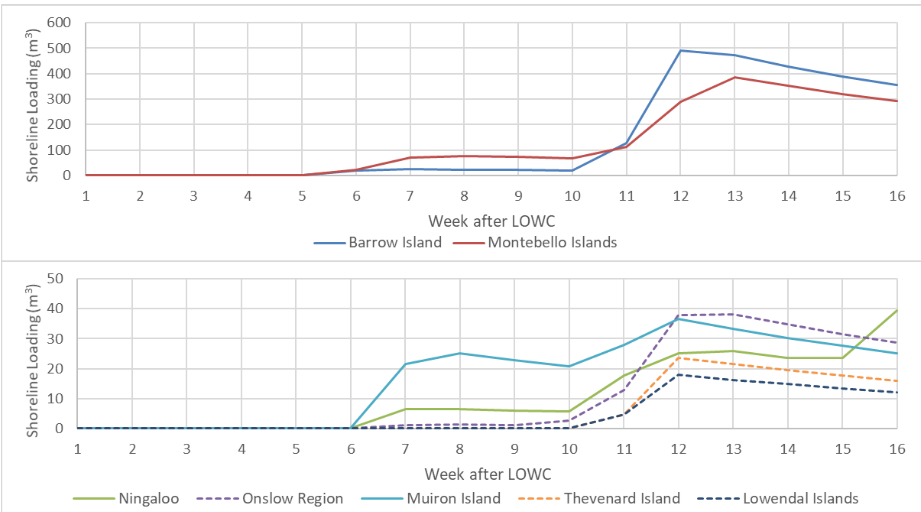

Figure D-2 Worst case shoreline oil loadings on priority response (solid) and other (dashed) locations

D-2 Response Strategy Overview

Table D-1 summarises the primary and secondary response strategies and those that were selected in this response resourcing assessment on the following basis:

- As substantial shoreline oiling is predicted, shoreline clean-up is invoked. Because of the relatively low shoreline loading and high sensitivity of the shorelines, stage 2 shoreline mechanical clean-up is not considered in this assessment.
- Vessel and aerial surface dispersant application is invoked primarily within ~50 km of the well where the surface oil concentraion is most often in excess of 50 g/m^2 (refer to Figure 8-4 in EP section 8.1), which is one of the surface dispersant application criterion (refer to Table 8-4 in EP section 8.1). Additionally, the other surface dispersant application criterion, namely an oil viscosity less than 10,000 cSt, is also met in this region with mean values of <1,000 cSt, <2,000 cSt and <4,000 cSt within ~10 km, ~20 km and ~50 km from the well (GHD 2020b). A subsea dispersant applicaton strategy was predicted to be ineffective (refer to EP section 8.1). Nonetheless, evaluation of whether the dispersant supply chain could be met in the event that it was effective and implemented is considered (see Section D-8).
- Though offshore containment and recovery and shoreline protection and deflection are not likely to be effective response strategies for the relatively low predicted volumes of surface oil and associated hydrocarbon thicknesses at affected shorelines, they are included to demonstrate the resourcing requirements that may be required during their implementation.

Table D-1 Response strategies considered in this resourcing assessment (shading: green primary response, yellow secondary response)

							Shoreline Cleanup			
	Monitor and Evaluate	**Scientific Monitoring**	**Aerial Surface Dispersant**	**Vessel Surface Dispersant**	**Offshore Containment & Recovery**	**Protection & Deflection**	**Stage 1 - Shoreline Pumps and Skimmers**	**Stage 2 - Shoreline Mechanical**	**Stage 2 - Shorline Manual Clean-Up**	**Stage 3 Shoreline Polishing**
Consider Strategy	Yes	**No**[15]	Yes	Yes	Yes	Yes	Yes	**No**	Yes	Yes

D-3 Response Assessment Methodology

The response assessment methodology used to estimate the required resources (personnel, plant, equipment, dispersant) is outlined in **Figure D-3**.

[15] Refer to Operational and Scientific Monitoring Implementation Plan.

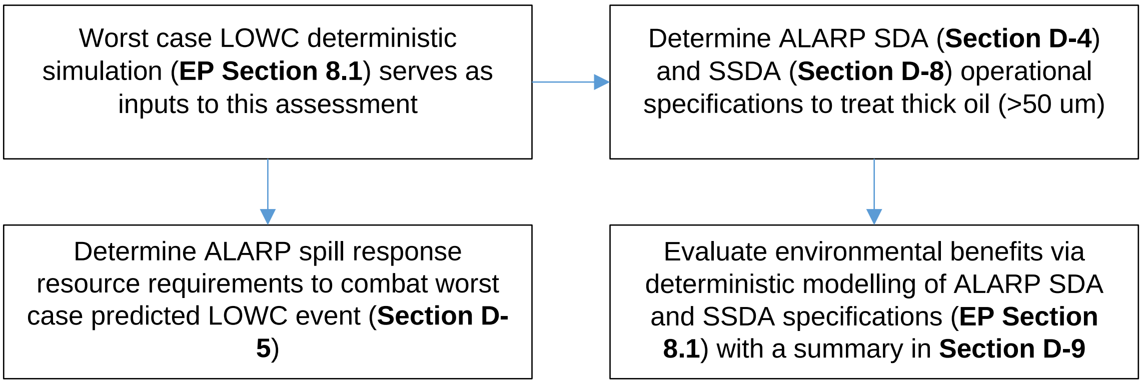

Figure D-3 Overview of response assessment methodology

D-4 ALARP SDA Operational Asset Specifications and Dispersant Supply Logistics

Table D-2 summarises the dispersant supply chain logistics from available State, National and International dispersant stockpiles. This supply chain is used to to determine if sufficient dispersant can be supplied as part of the ALARP demonstration for the SDA operational specifications described next.

Table D-2 Dispersant supply chain logistics

Week	AMSA[16]	AMOSC[17]	SFRT[18]	OSRL (SLA)[19]	OSRL (GDS)[20]	Total	Notes
1	120	125	250			**495**	AMSA, AMOSC and SFRT stockpiles in WA
2	253	137		350		**740**	AMSA and AMOSC stockpiles in Australia, OSRL (SLA) stockpiles from Singapore and UK
3-11					4,650	**5,000**	Supply from OSRL (GDS) stockpiles
Total Available	**373**	**262**	**250**	**350**	**4,650**	**6,235**	

Table D-3 provides the calculations to determine the SDA operational asset needs during the worst case shoreline loading LOWC simulation and demonstrates the following:

- Four (4) aircraft and five (5) vessel SDA assets have the dispersant capacity to apply dispersant to all (100%) of the treatable thick surface oil (>50 um) over the 12 weeks of the response except for week 10 (84% of treatable thick surface oil treated).
- Over the entire LOWC simulation the SDA assets have the capacity to treat ~185% of the treatable thick surface oil (i.e. (E[total] + I[total]) / B[total] = (98,100 m + 82,400 m^3) / 98,343 m^3 = 184% from **Table D-3**).
- The total available State, National and Global dispersant stockpiles that can be supplied via the supply chain (~6,200 m^3) can meet the needs to treat over100% of the treatable thick surface oil (~4,800 m3) (Q[total] > P[total] from **Table D-3**).
- Dispersant supply chain logistics can meet the weekly SDA response demand with maintenance of excess dispersant stockpiles at the Dampier supply base over the duration of the 12 weeks of the SDA response (weekly R in **Table D-3**).

[16] AMOSC confirmed 373 m^3 of dispersant volume and supply chain specifications.
[17] Confirmed 262 m^3 of dispersant volume and supply chain specifications.
[18] Half of 500 m^3 of SFRT dispersant volume available via AMOSC with commitment to replace.
[19] Confirmed 350 m^3 of dispersant volume available via Service Level Agreement (SLA) with access to Singapore and UK (excludes Corexit EC9527 as prohibited in Australia).
[20] Confirmed ~5,000 m^3 available in the OSRL Global Dispersant Stockpile (GDS).

Table D-3 Calculation table to determine ALARP SDA operational asset specifications and meet dispersant supply chain logistics

Source	Worst Case Shoreline Loading LOWC Determinstic Simulation with No Response (EP Section 8.1)		FWAC Asset Specification	Calculations			Vessel Asset Specification	Calculations									From Table D-2	Calculation
Parameter ID & Calculation Equations	**A**	**B**	**C**	**D=C×a×b×7**	**E=D×c**	**F=E×d**	**G**	**H=G×e×7**	**I=H×c**	**J=I×d**	**K=B/(D+H) if K>100% then 100%**	**L=(E+I)×K**	**M=L/B**	**N=(F+J)×K**	**O=N/B**	**P=(D+H)×K**	**Q**	**R=R(previous week)+Q-P**
Week	**Average Surface Oil (m^3)**	**Average Thick (>50 um) Surface Oil (m^3)**	**Average Number of FWAC**	**Max FWAC Dispersant Capability (m^3/week)**	**Max FWAC Thick Oil Treatment Capability (m^3/week)**	**Max FWAC Oil Dispersed Capability (m^3/week)**	**Average Number of Vessel Dispersant Operations (ops/week)**	**Max Vessel Dispersant Application Capability (m^3/week)**	**Max Vessel Thick Oil Treatment Capability (m^3/week)**	**Max Vessel Oil Dispersed Capability (m^3/week)**	**Percent of Max SDA Capabiity Required to Treat Thick Oil**	**Oil Treated by SDA (m^3/week)**	**% of Thick Oil Treated by SDA**	**Oil Dispersed by SDA (m^3/week)**	**% of Thick Oil Dispersed by SDA**	**SDA Dispersant Requirement (m^3/week)**	**Dispersant Supply Chain (m^3/week)**	**Excess Dispersant Stockpile (m^3/week)**
1	4,944	4,728	2.7[21]	285	5,700	2,850	3.9[22]	270	5,400	2,700	43%	4,728	100%	2,364	50%	236	495	259
2	9,955	8,758	4	420	8,400	4,200	5	350	7,000	3,500	57%	8,758	100%	4,379	50%	438	740	561
3	12,828	11,457	4	420	8,400	4,200	5	350	7,000	3,500	74%	11,457	100%	5,729	50%	573	556	543
4	15,689	13,701	4	420	8,400	4,200	5	350	7,000	3,500	89%	13,701	100%	6,851	50%	685	556	414
5	4,953	3,799	4	420	8,400	4,200	5	350	7,000	3,500	25%	3,799	100%	1,900	50%	190	556	779
6	6,657	4,500	4	420	8,400	4,200	5	350	7,000	3,500	29%	4,500	100%	2,250	50%	225	556	1,110
7	7,986	6,167	4	420	8,400	4,200	5	350	7,000	3,500	40%	6,167	100%	3,084	50%	308	556	1,357
8	6,281	4,616	4	420	8,400	4,200	5	350	7,000	3,500	30%	4,616	100%	2,308	50%	231	556	1,682
9	11,960	10,962	4	420	8,400	4,200	5	350	7,000	3,500	71%	10,962	100%	5,481	50%	548	556	1,689
10	19,940	18,424	4	420	8,400	4,200	5	350	7,000	3,500	100%	15,400	84%	7,700	42%	770	556	1,475
11	9,191	7,756	4	420	8,400	4,200	5	350	7,000	3,500	50%	7,756	100%	3,878	50%	388	556	1,643
12	4,950	3,348	4	420	8,400	4,200	5	350	7,000	3,500	22%	3,348	100%	1,674	50%	167	0	1,475
13	547	121	0	0	0	0	0	0	0	0	0%	0	0%	0	0%	0	0	1,475
14	107	6	0	0	0	0	0	0	0	0	0%	0	0%	0	0%	0	0	1,475
15	241	0	0	0	0	0	0	0	0	0	0%	0	0%	0	0%	0	0	1,475
16	102	0	0	0	0	0	0	0	0	0	0%	0	0%	0	0%	0	0	1,475
Total	**116,331**	**98,343**		**4,905**	**98,100**	**49,050**		**4,120**	**82,400**	**41,200**		**95,193**		**47,596**		**4,760**	**6,235**	

Parameter Description	Parameter ID	Parameter Value
Aerial Operation Parameters		
AMOSC/AMSA AT802 FWAC Capacity (m3 of dispersant)	a	3
Dispersant flights per day per FWAC	b	5
SDA Application Parameters		
Dispersant:Oil Application Ratio	c	20
Dispersant Effectiveness.	d	50%
Vessel Operation Parameters		
Vessel Dispersant Delivery Capacity (m3/day)	e	10

[21] Week 1 average for parameter C (average number of FWAC) was calculated as 0x, 1x, 2x and 4x available FWAC in week 1 during 0-24, 24-48, 48-72 and 72+ hours (as per EP Table 8-5).

[22] Week 1 average for parameter G (average number of vessel dispersant operations) was calculated as 0x, 2x and 5x ops available during week 1 commencing after 24 and 48 hours (as per EP Table 8-5).

D-5 Aerial and Marine Response Strategy Resourcing

Table D-4 summarises the response plant requirements for this resource assessment noting that support vessels for waste transport of the offshore containment and recovery and nearshore protection and deflection secondary strategies are included.

Table D-4 Plant and SDA dispersant requirements

Week	Aircraft – Observation (C in Table D-7)	Aircraft – Dispersant (A in Table D-7)	Vessel – Dispersant (G in Table D-7)	Vessel - C&R (L in Table D-7)	Vessel - P&D (R in Table D-7)	Dispersant (Aerial & Vessel) (m^3/ week) (P in Table D-3)
1	2	4	5	0	0	236
2	2	4	5	5	4	438
3	2	4	5	10	12	573
4	2	4	5	15	20	685
5	2	4	5	15	20	190
6	2	4	5	15	20	225
7	2	4	5	15	20	308
8	2	4	5	15	20	231
9	2	4	5	15	20	548
10	2	4	5	15	20	770
11	2	4	5	15	20	388
12	2	4	5	15	20	167
13	2	4	0	0	0	0
14	2	0	0	0	0	0
15	0	0	0	0	0	0
16	0	0	0	0	0	0

Table D-5 summarises the response personnel requirements of this resource assessment, which includes waste management, catering and other support for shoreline response.

Table D-5 Personnel requirements

Week	Aerial Operations (F in Table D-7)	Marine Operations (W in Table D-7)	Shoreline Operations (Z in Table D-8)	Total
1	30	35	5	**70**
2	30	91	10	**131**
3	30	172	15	**217**
4	30	253	15	**298**
5	30	253	60	**348**
6	30	253	105	**398**
7	30	253	105	**398**
8	30	253	105	**398**
9	30	253	105	**398**
10	30	253	105	**398**
11	30	253	240	**548**
12	30	253	285	**598**
13	30	0	330	**430**
14	9	0	375	**430**
15	0	0	375	**375**
16	0	0	375	**375**

Table D-6 summarises the response equipment requirements of this resource assessment, which includes waste management, catering and standby shoreline response.

Table D-6 Equipment requirements

Week	Vessel Dispersant Spray Sets (G in Table D-7)	Offshore Containment Boom Length (m) (J in Table D-7)	Offshore Recovery Devices (F in Table D-7)	Nearshore P&D Boom Length (m) (F in Table D-7)	Number of Shoreline Clean-Up Recovery Devices (D in Table D-8)	Length of Inshore Boom for Shoreline Clean-Up (E in Table D-8)
1	5	0	0	0	0	0
2	5	400	3	600	0	0
3	5	800	6	1,800	0	0
4	5	1,200	9	3,000	0	0
5	5	1,200	9	3,000	2	400
6	5	1,200	9	3,000	4	800
7	5	1,200	9	3,000	4	800
8	5	1,200	9	3,000	4	800
9	5	1,200	9	3,000	4	800
10	5	1,200	9	3,000	4	800
11	5	1,200	9	3,000	10	2,000
12	5	1,200	9	0	12	2,400
13	0	0	0	0	14	2,800
14	0	0	0	0	16	3,200
15	0	0	0	0	16	3,200
16	0	0	0	0	16	3,200

Table D-7 Calculation table to determine aerial and marine operational personnel, equipment, plant and waste generation

Response Strategy	Aerial Operations - Dispersant and Monitor						Marine Operations - Dispersant		Marine Operations - Offshore Containment & Recovery							Marine Operations - Nearshore Protection & Deflection						Marine Operations - Total		
Source	From Table D-3	Calc	OA Asset Spec	Calculations			From Table D-3	Calc	CRO Asset Spec	Calculations						PDO Asset Spec	Calculations							
Parameter ID & Calculation Equations	A	B=A×a	C	D=C×b	E=(B+D)/c where E rounded up	F=B+D+E	G	H=G×d	I	J=I×e×f	K=I×g	L=I×(h+i)	M=I×j	N=I×k×7	O=N×l	P	Q=P×m×n	R=P×o×xp	S=R×q	T=R×r×7	U=T×s	V=G+I+P	W=H+M+S+V	X = W x t x u / 1000 x 7
Week	Max Dispersant FWAC	Max FWAC Personnel	Max Observation Aircraft (OA)	Max AO Personnel	Max AO Team Leaders	Total AO Personnel	Max Vessel Dispersant Ops (VDO)	Max VDO Personnel	Max C&R Ops (CRO)	Max CRO Boom Length (m)	Max CRO Recovery Devices	Max CRO Vessels	Max CRO Personnel	Oil from CRO (m^3/week)	Oily Water Waste from CRO (m^3/week)	Max P&D Ops (PDO)	Max PDO Boom Length (m)	Max PDO Vessels	Max PDO Personnel	Oil from PDO (m^3/week)	Oily Solids Waste from PDO (m3/week)	Marine Ops Team Leader Personnel	Total Personnel for Marine Ops	Total Oily PPE (m3 per week)
1	4[23]	20	2	8	2	30	5[24]	30	0	0	0	0	0	0	0	0	0	0	0	0	0	5	35	8.8
2	4	20	2	8	2	30	5	30	1	400	3	5	30	35	350	1	600	4	24	7	70	7	91	22.9
3	4	20	2	8	2	30	5	30	2	800	6	10	60	70	700	3	1,800	12	72	21	210	10	172	43.3
4	4	20	2	8	2	30	5	30	3	1,200	9	15	90	105	1,050	5	3,000	20	120	35	350	13	253	63.8
5	4	20	2	8	2	30	5	30	3	1,200	9	15	90	105	1,050	5	3,000	20	120	35	350	13	253	63.8
6	4	20	2	8	2	30	5	30	3	1,200	9	15	90	105	1,050	5	3,000	20	120	35	350	13	253	63.8
7	4	20	2	8	2	30	5	30	3	1,200	9	15	90	105	1,050	5	3,000	20	120	35	350	13	253	63.8
8	4	20	2	8	2	30	5	30	3	1,200	9	15	90	105	1,050	5	3,000	20	120	35	350	13	253	63.8
9	4	20	2	8	2	30	5	30	3	1,200	9	15	90	105	1,050	5	3,000	20	120	35	350	13	253	63.8
10	4	20	2	8	2	30	5	30	3	1,200	9	15	90	105	1,050	5	3,000	20	120	35	350	13	253	63.8
11	4	20	2	8	2	30	5	30	3	1,200	9	15	90	105	1,050	5	3,000	20	120	35	350	13	253	63.8
12	4	20	2	8	2	30	5	30	3	1,200	9	15	90	105	1,050	5	3,000	20	120	35	350	13	253	63.8
13	0	20	2	8	2	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	2	8	1	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total														**1,050**	**10,500**					**343**	**3,430**			**648.9**

Parameter Description	Parameter ID	Parameter Value
Aerial Operations Parameters		
Personnel per FWAC (i.e. supervisors, ground crew)	a	5
Personnel per Observation Aircraft	b	4
Max Aerial Operations Personnel per Team Leader	c	20
Marine Operations Parameters		
Personnel per Vessel Dispersant Operation	d	6
C&R Offshore Boom Length (m)	e	200
Number of C&R Offshore Booms per Operation	f	2
Number of C&R Recovery Devices per Operation	g	3
Number of Vessels per C&R Operation	h	2
Number of Support/Waste Vessels per C&R Operation	i	3
Personnel per C&R Vessel	j	6
Volume of Oil Collected by C&R Operations (m^3/day)	k	5
C&R Oily Water Bulking Factor (m^3 oily water/m^3 oil)	l	10
P&D Nearshore Boom Length (m)	m	200
Number of P&D Nearshore Booms per Operation	n	3
Number of Vessels per P&D Operation	o	2
Number of Support/Waste Vessels per P&D Operation	p	2
Personnel per P&D Vessel	q	6
Volume of Oil from P&D Operations per Day (m^3/day)	r	1
P&D Oily Solids Bulking Factor (m^3 oily solids/m^3 oil)	s	10
PPE (Overalls, Boots, Gloves, Glasses, Hats) Changes (PPE/day/person)	t	3
Oiled PPE Change Volume (L/PPE)	u	12

[23] Week 1 maximum for parameter A of 4x FWAC available during week 1 after 72 hours in alignment with **EP Table 8-5**.

[24] Week 1 maximum for parameter G of 5x vessel operations during week 1 after 48 hours in alignment with **EP Table 8-5**.

Table D-8 Calculation table to determine shoreline clean-up personnel, equipment and waste

Source	Worst Case Shoreline Loading LOWC Determinstic Simulation with No Response (EP Section 8.1)	Calculation	Stage 1 Spec	Calculations					Calculations											SCAT Spec	Calculations					
Parameter ID & Calculation Equations	A	B = A x a	C	D = C x b	E = C x c	F = C x d	G = F x e	H = C x f	I = C x g	J = I x h x7	K = J / i	L = C x j	M = L x k x 7	N = M / l	O = O(previous week) + G + K + N	P = B - O	Q = M + J	R = H + I + L	S = C x m	T	U = T x n	V = C x o	W = C x p	X = C x q	Y = R + S + T + U + V+W + X	Z = (R + S + T + U + V) x 7 x r x s / 1000
Week #	Cumulative Shoreline Oil (m3)	Cumulative Shoreline Emulsified Oil (m3)	Max Stage 1 Pumps & Skimmers Ops	Max Sets of Stage 1 Pumps & Skimmers	Max Length of Stage 1 Inshore Booms	Max Emulsified Oil Removed during Stage 1 (m^3/week)	Max Emulsified Oily Water Removed during Stage 1 (m^3/week)	Max Stage 1 Personnel	Max Stage 2 Manual Recovery (MR) Personnel	Max Emulsified Oily Solids Removed during Stage 2 MR (m^3/week)	Max Emulsified Oil Removed during Stage 2 MR (m^3/week)	Max Stage 3 Manual Polishing (MP) Personnel	Max Emulsified Oily Solids Removed during Stage 3 MP (m^3/week)	Max Emulsified Oil Removed during Stage 3 MP (m^3/week)	Cumulative Total Emulsified Oil Removal Stages 1-3 (m^3)	Total Shoreline Emulsified Oil Remaining after Stages 1-3 (m^3)	Total Emulsified Solids Removed during Stages 2-3 (m^3 per week)	Total Stages 1-3 Labour Personnel	Total Stages 1-3 Team Leader Personnel	SCAT Segment Leaders	SCAT Team Personnel	Shoreline Waste Management Personnel	Shoreline Catering Personnel	Other Shoreline Operations Support Personnel	Total Shoreline Operations Personnel	Total Oily PPE (m3 per week)
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0	0	5	1.3
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	8	0	0	0	10	2.5
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	12	0	0	0	15	3.8
4	13	39	0	0	0	0	0	0	0	0	0	0	0	0	0	39	0	0	0	3	12	0	0	0	15	3.8
5	12	36	1	2	400	35	175	8	10	70	7	10	21	2.1	44	<0	91	28	3	3	12	6	3	5	60	13.1
6	80	240	2	4	800	70	350	16	20	140	14	20	42	4.2	132	107	182	56	6	3	12	12	6	10	105	22.4
7	137	411	2	4	800	70	350	16	20	140	14	20	42	4.2	221	190	182	56	6	3	12	12	6	10	105	22.4
8	149	446	2	4	800	70	350	16	20	140	14	20	42	4.2	309	138	182	56	6	3	12	12	6	10	105	22.4
9	142	425	2	4	800	70	350	16	20	140	14	20	42	4.2	397	28	182	56	6	3	12	12	6	10	105	22.4
10	130	389	2	4	800	70	350	16	20	140	14	20	42	4.2	485	<0	182	56	6	3	12	12	6	10	105	22.4
11	332	995	5	10	2000	175	875	40	50	350	35	50	105	10.5	706	289	455	140	15	3	12	30	15	25	240	50.4
12	1002	3005	6	12	2400	210	1050	48	60	420	42	60	126	12.6	970	2035	546	168	18	3	12	36	18	30	285	59.7
13	1087	3260	7	14	2800	245	1225	56	70	490	49	70	147	14.7	1279	1981	637	196	21	3	12	42	21	35	330	69.0
14	966	2898	8	16	3200	280	1400	64	80	560	56	80	168	16.8	1632	1266	728	224	24	3	12	48	24	40	375	78.4
15	859	2576	8	16	3200	280	1400	64	80	560	56	80	168	16.8	1985	591	728	224	24	3	12	48	24	40	375	78.4
16	779	2337	8	16	3200	280	1400	64	80	560	56	80	168	16.8	2337	0	728	224	24	3	12	48	24	40	375	78.4
Total						**1855**	**9275**			**3710**	**371**		**1113**	**111.3**			**4823**									**550.9**

Parameter Description	Parameter ID	Parameter Value
Emulsification Volume Factor	a	3
Stage 1 Pump & Skimmer Sets per Operation	b	2
Stage 1 Nearhore Booms Length per Operation	c	400
Stage 1 Oil Removal Rate with Pumps & Skimmers (m3 oil/day/operation)	d	5
Stage 1 Oily Water Volume Bulking Factor (m3 oily water / m3 oil)	e	5
Stage 1 Personnel per Pump & Skimmer Operation	f	8
Stage 2 Manual Recovery Personnel per Stage 1 Operation	g	10
Stage 2 Manual Oil-Substrate Recovery Rate (m3 oil-substrate/day/person)	h	1
Stage 2 Oil-Substrate/Oil Ratio for Manual Recovery (m3 oil-substrate/m3 oil)	i	10
Stage 2 Manual Polishing Personnel per Stage 1 Operation	j	10
Stage 3: Oil-Substrate Recovery by Manual Polishing (m3 oil-substrate/day/person)	k	0.3
Stage 3 Oil-Substrate/Oil Ratio for Manual Polishing (m3 oil-substrate/m3 oil)	l	10
Stages 1-3 Team Leader Ratio (Leaders/Operation) (1 leader for each stage 1, stage 2 & stage 3 op team)	m	3
Personnel per SCAT Team	n	4
Shoreline Waste Management Personnel per Stage 1 Operation	o	6
Shoreline Catering Personnel per Stage 1 Operation	p	3
Other Support Personnel per Stage 1 Operation	q	5
PPE (Overalls, Boots, Gloves, Glasses, Hats) Changes (PPE/day/person)	r	3
Oiled PPE Change Volume (L/PPE)	s	12

D-6 Shoreline Clean-up Response Strategy Effectiveness

Figure D-3 shows the time series of total shoreline loading (simulated volume of oil and emulsified oil on shorelines) used in this resourcing assessment and the estimated volume of emulsified oil cleaned up through shoreline operations, assuming that SDA, SSDA, offshore containment and recovery, and protection and deflection are not effective. The shoreline clean-up resourcing strategy here is sufficient to clean-up all the shoreline hydrocarbons for the worst-case simulation (1no oil remaining on shorelines after week 16). The predicted effect of the SDA response is to reduce the peak loading by ~50% (see **EP Section 8.1**), which would approximately translate into half the required sources and waste generation for the shoreline clean-up response outlined here.

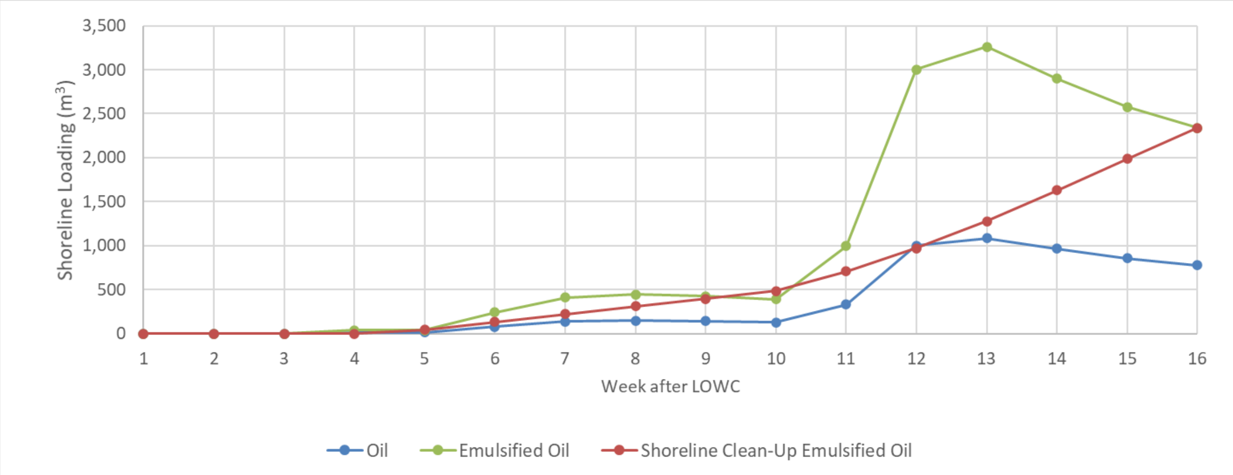

Figure D-3 Simulated shoreline oil and emulsified oil loading volume for the worst case deterministic simulation and the amount of emulsified oil removal from shoreline clean-up used here[25]

D-7 Response Strategy Waste Generation

Table D-9 summarises the total oily water and oily solid waste estimates from the resource assessment.

Table D-9 Oily water and oily solid waste estimates

Estimate	Total (m^3)
Oily Water Waste Volume	
Offshore C&R marine operations (m^3) (O[Total] in **Table D-7**)	10,500
Stage 1 Shoreline Operations (m^3) (G[Total] in **Table D-8**)	9,275
Total oily water waste (m^3)	**19,775**
Solid Waste Volume	
Stage 2 mechanical recovery shoreline operations (m^3)	Not carried out
Stage 2 manual removal shoreline operations (m^3) (J[Total] in **Table D-8**)	3,710
Stage 3 polishing shoreline operations (m^3) (M[Total] in **Table D-8**)	1,113
Nearshore P&D marine operations (m^3) (U[Total] in **Table D-7**)	3,430
PPE from all response operations (X[Total] in **Table D-7** + Z[Total] in **Table D-8**)	1,200
Total oily solid waste (m^3)	**9,453**

D-8 Dispersant Supply Chain Analysis for SSDA

[25] A ~3 emulsification bulking factor for shoreline oil was simulated by GHD (2020b).

Deterministic modelling of the SSDA response predicts this strategy is not effective (**EP Section 8.1**). In the event the SSDA response is enacted, the following assumptions are considered appropriate to assess if the dispersant supply chain is sufficient for this secondary response strategy:

- If SSDA is determined to be effective and is implemented, then the SDA response strategy will not be invoked.
- For the purposes of evaluating whether the dispersant supply chain can meet the temporal needs of the SSDA response, as with the deterministic modelling in **EP Section 8.1** it is assumed that it can be initiated from day 1 of the LOWC event onwards. This is a conservative assumption for this analysis as it will take longer to implement the strategy.
- The ratio of oil to dispersant is assumed to be 100:1, a typical ratio in the literature (Brandvik et al. 2016).

Table D-10 demonstrates that the supply chain can provide the required dispersant volumes to implement the SSDA secondary response strategy.

Table D-10 Dispersant supply chain assessment for SSDA response

Week #	Daily Oil Release Rate (m^3/day)	SSDA Implementation Days per Week	Maximum Treatable Oil (m^3/week)	Required Dispersant Volume (m^3/week)	Dispersant Supply Chain (m^3/week) (Q in Table D-3)	Excess Dispersant Stockpile (m^3/week)
1 (not day 1)	4,552	6	27,312	273	495	222
2	4,519	7	31,630	316	740	646
3	4,503	7	31,522	315	556	886
4	4,492	7	31,444	314	556	1,127
5	4,483	7	31,381	314	556	1,369
6	4,475	7	31,324	313	556	1,611
7	4,467	7	31,271	313	556	1,854
8	4,460	7	31,220	312	556	2,097
9	4,453	7	31,168	312	556	2,341
10	4,445	7	31,115	311	556	2,586
11	4,438	7	31,064	311	556	2,830
12	0	0	0	0	0	2,830
13	0	0	0	0	0	2,830
14	0	0	0	0	0	2,830
15	0	0	0	0	0	2,830
16	0	0	0	0	0	2,830

Appendix E

Summary of AMOSC, OSRL, AMSA and Mutual Aid Equipment Stockpiles

Detailed Oil Spill Response Equipment Stockpile

				AMSA August 2018			AMOSC 10 August 2018				Mutual Aid MoU January 2015 (AMOSC)				May 2020			
OSR Equipment	**Per Item**	**Units**	**OSR Use**	**Darwin**	**Karratha**	**Fremantle**	**Broome**	**Exmouth**	**Fremantle**	**Geelong**	**PTTEP Darwin**	**Woodside Dampier**	**Conoco Broome**	**Conoco Darwin**	**OSRL[26]**	**First Strike (Exmouth, Karratha)**	**Escalation (incl other Australia)**	**Escalation (incl OSRL)**
Offshore Boom - NOFI 250 EP Boom Bag	150	m	P&D / C&R		3	4						1				600	1,200	1,200
Offshore Boom - NOFI 250 EP Boom Bag	300	m			3	4						2				1,500	2,700	2,700
Offshore Boom - ROULANDS Ro-Bay 1500	200	m			3	4										600	1,400	1,400
Offshore Boom - LAMOR Heavy Duty Open Water	200	m		2							2					-	800	800
Offshore Boom - VIKOMA Hi Sprint	300	m		1	2	2										600	1,500	1,500
Offshore Boom - RoBoom	200	m						2	6	7						400	3,000	3,000
Offshore Boom – 450 mm curtain boom	30	m							18	41						-	1,770	1,770
Offshore Boom	9,400	m													1	-	-	9,400
Inshore Boom	21,525	m													1	-	-	21,525
Inshore Boom - Structureflex	100	m		9	15	15										1,500	3,900	3,900
Inshore Boom - Zoom Boom	25	m					8	20	30	113		6				650	4,425	4,425
Inshore Boom - Beach Guardian	25	m					4	3	23	51						75	2,025	2,025
Boom - Sweep System - NOFI Current Buster 4			C&R	1	1	1										1	3	3
Spray System - AYLES FERNIE - Boatspray 100-TS & Pump			Vessel Dispersant	2	2	2									25	2	6	31
Spray System - VIKO								1		1		1				2	3	3
Spray System - Afedo							2	1	1	1			1			1	6	6
Spray System - Elastiec Boom Vane										1						-	1	1
Spray System - Model 3210											1					-	1	1
Spray System															23	-	-	23
Boom System - Neatsweep															3	-	-	3
OWR Container			OWR	1	1					1						1	3	3
OWR Kit							1	1		2						1	4	4
Skimmer - Brush Skimmer Minimax 12 W/S			Shoreline Clean-Up/C&R				1				2					-	3	3
Skimmer -LAMOR Weir skimmer LWS 5000											1					-	1	1
Skimmer - Multi Head - LAMOR 15 Ton				2	4	4										4	10	10
Skimmer - Rope Mop - ORI PIRANNA 1000				1												-	1	1
Skimmer - Rope Mop - ORI BARRACUDA 2000						1										-	1	1
Skimmer - Suction - VIKOMA Vikovac						1										-	1	1
Skimmer - Weir - DESMI Termite				1	1	1										1	3	3

26 50% of OSRL stockpiles are available to first incident, if another incident is underway then 25% of the OSRL stockpiles are available, which still meet the peak escalation estimate requirements solely from OSRL.

Detailed Oil Spill Response Equipment Stockpile

				AMSA August 2018			AMOSC 10 August 2018				Mutual Aid MoU January 2015 (AMOSC)				May 2020			
OSR Equipment	Per Item	Units	OSR Use	Darwin	Karratha	Fremantle	Broome	Exmouth	Fremantle	Geelong	PTTEP Darwin	Woodside Dampier	Conoco Broome	Conoco Darwin	OSRL[26]	First Strike (Exmouth, Karratha)	Escalation (incl other Australia)	Escalation (incl OSRL)
Skimmer - Weir - LAMOR 50 Ton				1	2	2										2	5	5
Skimmer – Current Buster										1						-	1	1
Skimmer – Speed Sweep										1						-	1	1
Skimmer - Desmi 250										1					2	-	1	3
Skimmer - Ro-Skim										2						-	2	2
Skimmer - Multi-Head (Canadyne)										1						-	1	1
Skimmer - 30k Disk										2						-	2	2
Skimmer - 20k Disk									1						7	-	1	8
Skimmer - 12k Disk								1	1	2		1			4	2	5	9
Skimmer - GT 185 Weir								1	1	1					5	1	3	8
Skimmer - Versaech Multihead									1	1						-	2	2
Skimmer -LWS 500 \GTA 30 Weir										3						-	3	3
Skimmer - RoMop OM240DP								1		1						1	2	2
Skimmer - RoMop OM260DP									1	1						-	2	2
Skimmer - Ro-Vac								1		3						1	4	4
Skimmer - Delta Ray Head												1				1	1	1
Skimmer - Dragon Fly Weir Skimmer												1				1	1	1
Skimmer - Global 30 m3/hr Weir Skimmer												1				1	1	1
Skimmer - Combi															14	-	-	14
Skimmer - Mechanical															14	-	-	14
Skimmer - Oleophilic															60	-	-	60
Skimmer - Vacuum															31	-	-	31
Skimmer - Weir															45	-	-	45
Tracking Buoy - Isphere/Pathfinder			Monitor and Evaluate				1		7	4			6	8		-	26	26
Fluorometer															4	-	-	4
Storage - Stationary - VIKOMA Flexidam 10 Ton	10	m^3	Oily Waste Storage	1	2	3				1						20	60	60
Storage - Stationary - FASTANK VIKOMA 10 Ton	10	m^3		1	2	2										20	50	50
Storage - Stationary - Fastank 1000/2000/10000	10	m^3							1	3		1				10	50	50
Storage - Stationary - Fastank 3	3	m^3							1	4						-	15	15
Storage - Stationary -Viko Tank 1300	13	m^3					1			1						-	26	26
Storage - Stationary - Fastank 9000	9	m^3						2								18	18	18
Storage - Stationary - Lamor 11 m3 Temporary Storage Tank	11	m^3							4							-	44	44
Storage - Stationary - Temporary Storage Tank	11	m^3									1					-	11	11
Storage - Inshore	2,291	m^3													1	-	-	2,291
Storage - Vessel Deck/Stationary - 1000 L IBC Containers	1	m^3														-	-	-

Detailed Oil Spill Response Equipment Stockpile

OSR Equipment	Per Item	Units	OSR Use	AMSA August 2018			AMOSC 10 August 2018				Mutual Aid MoU January 2015 (AMOSC)				May 2020	First Strike (Exmouth, Karratha)	Escalation (incl other Australia)	Escalation (incl OSRL)
				Darwin	Karratha	Fremantle	Broome	Exmouth	Fremantle	Geelong	PTTEP Darwin	Woodside Dampier	Conoco Broome	Conoco Darwin	OSRL[26]			
Storage - Vessel Deck/Stationary - 1000 L Metal IBC Containers	1	m^3	Oily Waste Storage/ Deck Transport													-	-	-
Storage - Vessel Deck/Stationary - Deck/Land Bladder Storage	25	m^3							3	1						-	100	100
Storage - Vessel Deck/Stationary - IBC	1	m^3								14						-	14	14
Storage - Vessel Deck/Stationary - 50-tonne Deck tank	50	m^3									1					-	50	50
Storage - Offshore	1,365	m^3	Oily Waste Offshore Storage												1	-	-	1,365
Storage - Towable - Lancer Barge	25	m^3	Oily Waste Marine Transport							4						-	100	100
Storage - Towable - CANFLEX Sea Slug 10 Ton	10	m^3		1	2	1										20	40	40
Storage - Towable - CANFLEX Sea Slug 25 Ton	25	m^3		1		1										-	50	50
Storage - Towable - CANFLEX Sea Slug 50 Ton	50	m^3		1	1	1										50	150	150
Storage - Towable - CANFLEX Sea Slug 20 Ton	20	m^3		1	1	1										20	60	60
Storage - Towable - LANCER 25 TON	25	m^3				2										-	50	50

Appendix F
Well Containment Plan (WCP) Contents

The Well Containment Plan contains the interface with the SOMV IMP and the information necessary to activate plans for well capping and containment activities, as well as to commence drilling of a relief well.

1) Emergency response process integration (e.g. SOMV IMP interface)
2) Source Control Emergency Response Plan
   a. Comprehensive contact lists
   b. Contractual status and any required actions to activate contracts
   c. First response ROV intervention plan – primary BOP
   d. Capping stack information (location, specifications, drawings, logistics, deployment etc)
   e. Debris removal plans and subsea architecture information (BOP/LMRP/Riser/Capping Stack)
   f. Subsea Dispersant Application Plans – Hardware and dispersant locations/stockpiles
   g. Relief well plans, including intersection tool mobilisation plans.
3) Logistics plan
   a. Relief well sourcing plan, including MODU and vessels (+ Safety Case) –live brokerage/tracking of vessels.
   b. Anticipated vesssel availability for duration of Activity.
   c. Likely primary response vessel(s) IMS risk assessment(s)
   d. Wellhead / Casing / Service Contracts – locations and mobilisation plans
   e. Estimated timings for each component
   f. Customs clearance and importation plans
   g. Source Control Personnel Resourcing plan
   h. Personnel mobilisation plans – including visas, COVID19 exemptions and quarantine arrangements where applicable.
   i. If necessary, relief well MODU mobilisation plan for MODU outside Australian waters.
4) Capping Stack Deployment Plan
   a. Capping stack feasibility including subsea plume analysis
   b. Capping stack deployment plan
   c. Capping stack landing plan

Appendix F.2 Kanga-1 Exploration Well OPEP for a MDO Spill

SapuraOMV Upstream (WA) Pty Ltd

Kanga-1 Exploration Well Oil Pollution Emergency Plan for a MDO Spill

April 2021

SapuraOMV Upstream (WA) Pty Ltd
Level 2, 251 St Georges Terrace
Perth, WA 6000
T: +61 8 6118 4990
ACN 629 043 518
www.sapura-omv.com

Quick Access Guide

In the event of a Level 2 MDO spill, initiate response in the following sequence:

IMMEDIATE

Relevant Person or Group	Time post incident	Action	Refer to
SapuraOMV Offshore Representative	Immediate	• Alert On-Duty Incident Commander	Section 2.4
IC	Immediate	• Activate Incident Management Team (IMT)	Section 2.6
IC	<1 hour	• Gain situational awareness	Section 3.1
IMT	<1 hour	• Activate Notification Plan	Section 3.2
IMT	<3 hours	• Activate Source Control Plan	Section 3.3
IMT	<3 hours	• Activate Monitor and Evaluate (Operational) Plan and Scientific Monitoring Plan	Sections 3.4 and 3.5
IMT	Continuous	• Ongoing Response	Section 4

DOCUMENT RECORD & MANAGEMENT

DOCUMENT INFORMATION

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CURRENT REVISION APPROVALS

Action	Name	Position	Initial	Date
Prepared by	GHD	-		23 April 2021
Reviewed by	Michael Chua	Senior HSE Specialist		23 Apr 2021
Endorsed by	Richard Baillie	Drilling Manager		23 Apr 2021
Approved by	Zamin Zawawi	Country / Asset Manager		23/Apr/2021

REVISION / AMENDMENT RECORD

Rev	Date	Prepared	Reviewed	Endorsed	Approved	Description
A	8 June 2020	GHD Pty Ltd	MC, RB, ZZ	-	-	Issued for review
B	29 June 2020	GHD Pty Ltd	MC, RB, ZZ	-	-	Issued for review
0	22 July 2020	GHD Pty Ltd	MC	RB	ZZ	Submission to NOPSEMA
1	27 November 2020	GHD Pty Ltd	MC	RB	ZZ	Update following NOPSEMA RFFWI 20/09/2020
2	23 April 2021	GHD Pty Ltd	MC	RB	ZZ	Update following NOPSEMA OMR 22/12/2020

Table of Contents

Table Index

Figure Index

Appendices

LIST OF ACRONYMS

Abbreviation	Description
ppb	Parts per billion
ppm	Parts per million
km	Kilometre
m	Metre
m^3	Cubic metre
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
AMOSC	Australian Marine Oil Spill Centre Pty Ltd
AMOSPlan	Australian Marine Oil Spill Plan
AMSA	Australian Maritime Safety Authority
APASA	Asia-Pacific Applied Science Associate
ASAP	As Soon As Possible
BAOAC	Bonn Agreement Oil Appearance Code
CMT	Crisis Management Team
DAWE	Department of Agriculture, Water and the Environment
DBCA	Department of Biodiversity, Conservation and Attractions
DMIRS	Western Australia Department of Mines, Industry Regulation and Safety
DoT	Western Australia Department of Transport
DPaW	Department of Parks and Wildlife (now DBCA)
EP	Environment Plan
EPBC	Environment Protection and Biodiversity Conservation
EPO	Environmental Performance Outcome
EPS	Environmental Performance Standard
ERT	Emergency Response Team
ESC	Environmental Scientific Coordinator
G&G	Geophysical and Geotechnical
GPS	Global Positioning System
HMA	Hazard Management Agency
HSE	Health, Safety and Environment
HSEMS	Health, Safety and Environment Management System
IC	Incident Commander
IAP	Incident Action Plan
IMP	Incident Management Plan
IMT	Incident Management Team
IPIECA	International Petroleum Industry Environmental Conservation Authority
JRCC	Joint Rescue Coordination Centre - Australia
MDO	Marine Diesel Oil
MEE	Maritime Environmental Emergencies
MEECC	Maritime Environmental Emergency Coordination Centre
MEER	Maritime Environmental Emergency Response
MGO	Marine Gas Oil
MoC	Management of Change
MODU	Mobile Offshore Drilling Unit
MoU	Memorandum of Understanding
NatPlan	National Plan for Maritime Environmental Emergencies
NEBA	Net Environmental Benefit Analysis
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NRT	National Response Team
NWS	North West Shelf
OIM	Offshore Installation Manager
OPEP	Oil Pollution Emergency Plan
OPGGS	Offshore Petroleum and Greenhouse Gas Storage Act 2006

Abbreviation	Description
OPGGS(E)R	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
OSMF	Operational and Scientific Monitoring Framework
OSMIP	Operational and Scientific Monitoring Implementation Plan
OSRL	Oil Spill Response Limited
OSTM	Oil Spill Trajectory Modelling
OWA	Oiled Wildlife Advisor
OWD	Oiled Wildlife Division
OWR	Oiled Wildlife Response
PPE	Personal Protective Equipment
PROWRP	Pilbara Region Oiled Wildlife Response Plan
RCC	Rescue Coordination Centre
SAG	Scientific Advisory Group
SapuraOMV	SapuraOMV Upstream (Western Australia) Pty Ltd
SAP	Sampling and Analysis Plan
SAT	Shoreline Assessment Team
SCT	Site Control Team
SITREP	Marine Pollution Situation Report
SMEEC	State Maritime Environmental Emergency Coordinator
SOPEP	Shipboard Oil Pollution Emergency Plan
SRT	State Response Team
WA	Western Australia
WAOWRP	Western Australian Oiled Wildlife Response Plan
WDC	Wildlife Division Coordinator

1. Introduction

1.1 Purpose

This Oil Pollution Emergency Plan (OPEP) accompanies the *Kanga-1 Exploration Drilling Environment Plan (AU-HSE-KG1-EX-PLN-036)* (EP), as required by Regulation 14(8) of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS(E)R).

This OPEP describes the offshore oil spill response arrangements to be undertaken for a marine diesel oil (MDO) (or marine gas oil (MGO)) spill incident arising from the Kanga-1 exploration well drilling (the Activity) (see **Section 1.2**). The two primary incidents that are identified in the EP as potentially causing MDO spills to sea are a support vessel collision and refuelling incident during MODU bunkering operations. A separate OPEP (*Kanga-1 Exploration Well OPEP for a Crude Oil Spill (AU-HSE-KG1-EX-PLN-037)*) describes the oil spill response arrangements to be undertaken for a crude oil spill incident during the activity (i.e. loss of well control). Two separate OPEPs for MDO and crude oil spills have been prepared because of differences in the spill response arrangements for these two hydrocarbon types, which makes these documents operationally much clearer for implementation in the event of an incident.

This OPEP is to be read in conjunction with the Kanga-1 Exploration Drilling Environment Plan (EP) when considering the existing environment, environmental impacts, risk management, performance standards, reporting compliance, and the decision processes that will apply in the event that a spill occurs. It contains the necessary information to carry out the initial response during an emergency marine oil pollution incident arising from a MDO (or MGO) spill during the Activity, and is consistent with the National Plan for Maritime Environmental Emergencies (NatPlan).

In accordance with MARPOL Annex I, all vessels greater than 400 gross tonnage are required to carry a Shipboard Oil Pollution Emergency Plan (SOPEP). SOPEPs are the principal operational plans for crew in the event of a spill from a vessel.

1.2 Summary of Proposed Activity

SapuraOMV Upstream (Western Australia) Pty Ltd (SapuraOMV) is the registered titleholder and operator for petroleum exploration permit WA-412-P in offshore Commonwealth waters on the North West Shelf (NWS) of Western Australia (WA). SapuraOMV propose to drill the Kanga-1 exploration well in the permit area between Quarter 1 (Q1) 2022 and Q4 2022 (**Figure 1-1**). The activity will be carried out with a semi-submersible mobile offshore drilling unit (MODU) and is expected to take approximately 40 days. To account for potential weather delays, technical difficulties and rig/vessel scheduling; the EP allows for the activity to take up to 80 days.

The Operational Area is ~163 km north-northwest of Karratha (nearest town) and ~125 km north-northwest of Legendre Island (nearest land) in water depths of ~147 m.

1.3 Overview of Potential Spill Impacts

The EP identified four unplanned events during the Activity that could cause a hydrocarbon spill into the marine environment (**EP Sections 8.1** to **8.4**). This OPEP focuses on a credible worst case MDO spills from a vessel collision scenario (200 m^3, **EP Section 8.2**) and refuelling incident during MODU bunkering operations (32 m^3, **EP Section 8.3**), A crude oil spill from a loss of well control scenario is covered in a separate OPEP for improved response, operability and implementation (*Kanga-1 Exploration Well OPEP for a Crude Oil Spill (AU-HSE-KG1-EX-PLN-037)*). Minor hydrocarbon spills (**EP Section 8.4**) are managed via the SOPEP.

To summarise, there are three levels of spill and associated oil pollution emergency plans, which are outlined below:

- **Level 1 spills** (<10m^3) are those that can be resolved with existing onsite resources, equipment and personnel. Level 1 oil spills include those classified in **EP Section 8.4** as minor spills (e.g. deck spill, hose rupture, in-water ROV hydraulic fluid loss) or if less than 10 m^3 is spilled from a refueling incident during MODU bunkering operations. Level 1 spills are expected to spread rapidly on the sea surface or disperse rapidly in the water column (ROV spill) (refer to **EP Section 8.4)**. ***These Level 1 spills will be managed in accordance with the vessel or MODU SOPEP and onboard spill kits/equipment.***
- A **Level 2 spill** (10-1,000 m^3) of marine diesel oil (MDO) or marine gas oil (MGO) from a vessel collision. MDO is classified as a Group III oil, which is expected to rapidly spread in the direction of prevailing winds and currents, to have 20-40% of the spill removed via evaporation, and to disperse the residues as droplets in the upper layers of the water column. As MDO has greater persistence in the marine environment than MGO, it provides a more conservative indication of the areas that may be exposed to hydrocarbons in the event of a spill. Maximum credible Level 2 MDO spills were identified in **EP Sections 8.2** (vessel collision, spill of 200 m^3) and **8.3** (refuelling during MODU bunkering operations, spill of 32 m^3). Predictions of potential impacts from a Level 2 MDO spill from a vessel collision scenario are described in **EP Section 8.2** on the basis of GHD (2020a) oil spill modelling. The modelling indicates that under all conditions, the spill would remain in Commonwealth waters (not enter State waters) and there would be no nearshore or shoreline contact. ***Oil spill response arrangements in the event of a MDO spill incident are addressed by this OPEP.***
- A **Level 3 spill** (>1,000 m^3) of crude oil from a loss of well control. Crude oil, once at the surface, is expected to spread, thin out and weather readily. The predicted impacts from a loss of well control scenario of a representative crude oil are described in **EP Section 8.1** on the basis of GHD (2020b) oil spill modelling. ***Oil spill response arrangements in the event of a crude oil spill from a loss of well control are addressed in Kanga-1 Exploration Well OPEP for a MDO Spill (AU-HSE-KG1-EX-PLN-037).***

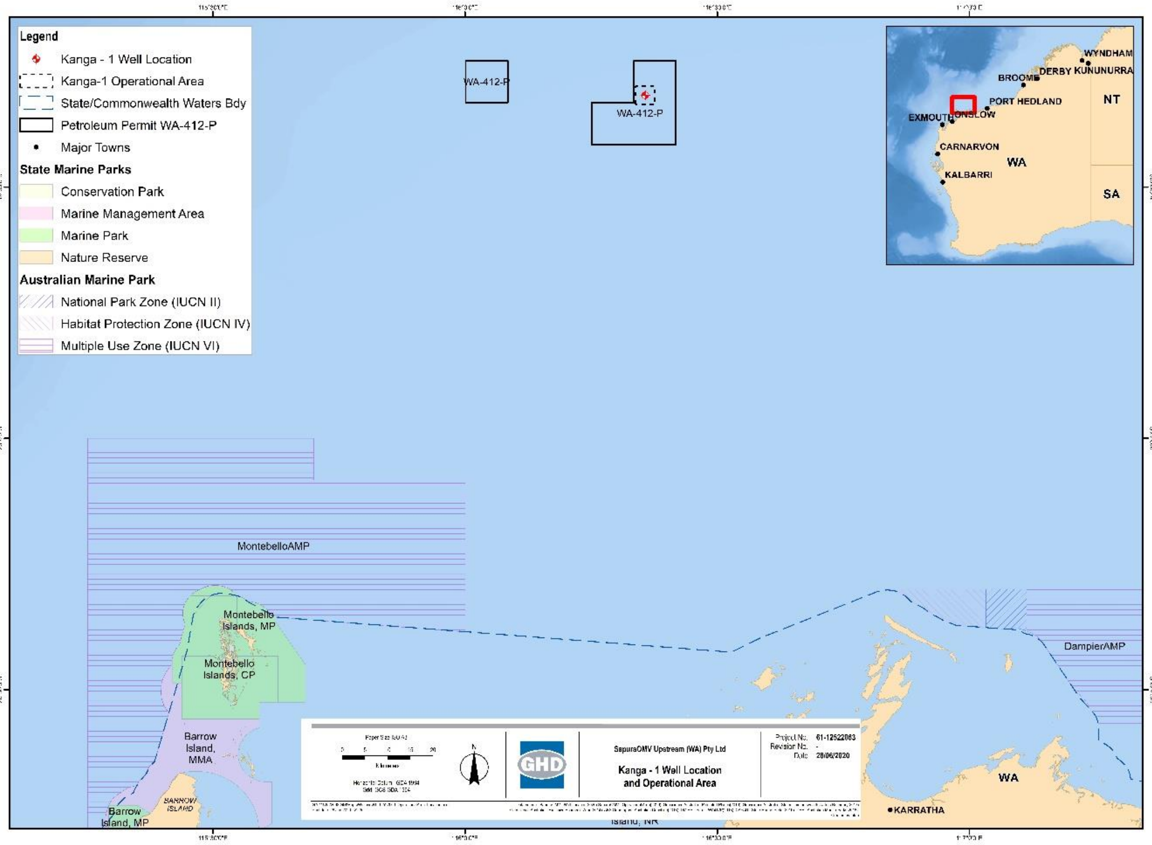

Figure 1-1 Location of operational area

1.4 Selected Spill Response Strategies

A preliminary net environmental benefit analysis (NEBA) was used to select response strategies in the event of a Level 2 spill (**Appendix A**). During a Level 2 spill, operational NEBAs will be undertaken by the IMT during the Incident Action Plan (IAP) development process (**Section 4.1**), so spill response strategies and their implementation may evolve over time. The 'As Low As Reasonably Practicable' (ALARP) principle was used to select control measures to implement for each of the spill response strategies (**Appendix A**). A summary of the selected response strategies and control measures for a Level 2 spill in this OPEP are provided in **Table 1-1**.

Table 1-1 Selected primary and secondary response strategies for a Level 2 spill

Response Strategy	Level 2	Control Measure or Justification for Not Selected
Source Control – Vessel Spill	Primary	SOPEP.
		Vessel-based spill clean-up equipment.
Monitor and Evaluate (Operational Monitoring)	Primary	Manage by IAP and OSMP.
		Oil Spill Trajectory Modelling.
		Spill surveillance via oil spill tracking buoys, aerial and/or vessel observations, shoreline assessment and/or satellite imagery.
In situ Burning	No	Not applicable due to insufficient oil thickness and time to mobilise.
Surface Dispersant Application – Vessel	No	Not applicable due to insufficient oil thickness and time to mobilise.
Surface Dispersant Application – Aerial	No	

Response Strategy	Level 2	Control Measure or Justification for Not Selected
Mechanical Dispersion	No	Not applicable as no predicted oil pollution of sensitive shorelines, and intertidal or shallow subtidal receptors.
Containment & Recovery	No	Not applicable due to insufficient oil thickness and time to mobilise.
Shoreline Protection & Deflection	No	No predicted shoreline exposure.
Shoreline Clean-up	No	No predicted shoreline exposure.
Oiled Wildlife Response	Secondary	AMOSC membership.
		AMOSC equipment availability.
Scientific Monitoring	Primary	Managed by IMT during response, scientific monitoring contractor thereafter.
		Call-off arrangements with service providers.

1.5 Prioritisation of Sensitive Locations

For spill response planning purposes, on the basis of oil spill modelling (GHD, 2020) and the environmental risk of a Level 2 MDO spill (**EP Section 8.2**), no protection priority sites were identified in the EP. During a Level 2 spill protection priorities may be identified on the basis of the nature and scale of the event.

1.6 Integration with Other SapuraOMV and Contractor Plans

This OPEP interfaces with other SapuraOMV and contractor plans as described in **Table 1-2**.

Table 1-2 Crisis and emergency management plans

Title	Document Number	Scope and Function
SapuraOMV Health, Safety and Environment Management System (HSEMS)	HSE-MM-MAN-0001	SapuraOMV HSEMS expectations to achieve Operating Excellence with respect to health, safety and environmental management.
SapuraOMV Incident Management Plan (IMP)	AU-HS-PLN-002-1.0	IMT response procedures for the safe, rapid, effective and efficient management of incidents in Australia.
SapuraOMV Kanga-1 Exploration Drilling EP	AU-HSE-KG1-EX-PLN-036	Sets out environmental management requirements for the Activity.
Vessel SOPEP	As per contractor document control.	SOPEP as per MARPOL requirements.

1.6.1 SOPEP

Under MARPOL Annex I requirements, all vessels >400 gross tonnage are required to have a current SOPEP. The SOPEP is the principal working document for vessel and crew in the event of a marine oil spill. It provides specific management response provisions to mitigate and combat oil spills originating from vessels including:

- Actions by the Vessel Master to report an oil spill incident, including the list of authorities to be contacted and the details on the spill that needs to be provided.
- Actions by crew onboard in the event of an oil spill including steps taken to contain the source with equipment available on the vessel.
- Roles and responsibilities of all personnel onboard during a oil spill incident.

- Procedures and point of contact on the ship for coordinating shipboard activities with National and Local Authorities.
- Details of spill equipment onboard the vessel.
- Vessel drawings (drainage and layout).
- Testing and drill requirements.
- Emergency procedures to control discharges for bunkering spills, hull damage, grounding and stranding, fire and explosion, collision, tank failure, sinking and vapour release.

1.7 Organisational Roles and Responsibilities

The roles and responsibilities of organisations referred to in this OPEP are provided in this section.

1.7.1 Jurisdictional Authority

The Jurisdictional Authority is the relevant Statutory Authority identified that has the jurisdictional or legislative responsibilities for oil pollution in the area to ensure there is adequate prevention of, preparedness for, response to and/or recovery from a specific incident.

1.7.2 Control Agency

The Control Agency is the agency or organisation assigned by legislation, administrative arrangement or within the Oil Pollution Emergency Plan (OPEP) to control the response activities of an actual or impending oil spill incident.

1.7.3 SapuraOMV Upstream (WA) Pty Ltd

As required by Regulation 14(8) of the OPGGS(E)R, SapuraOMV is required to include an OPEP to accompany the EP that describes preparedness for the possiblity of an oil spill, and emergency response arrangements to be implemented if an oil spill occurs. The EP includes control measures to ensure the implementation of SapuraOMV's oil spill response responsibilities. As per SapuraOMV's Incident Management Plan (AU-HS-PLN-002-1.0), SapuraOMV's Incident Commander (IC) would be notified in the event of a spill incident and SapuraOMV's Incident Management Team (IMT) would be activated if required by the IC.

1.7.4 Vessel Contractor / MODU Contractor

In the event of a MDO (or MGO) spill from/on the support vessels / mobile offshore drill unit (MODU), the Vessel Master / Offshore Installation Manager (OIM) will take on the role of On Scene Commander (OSC). The OSC will be responsible for the implementation of emergency response procedures as per the SOPEP and the onsite requirements of this OPEP. This includes first response measures under the SOPEP with resources immediately available to the vessel.

1.8 Jurisdictional Authorities and Control Agencies

For vessel collision MDO (or MGO) spills the Jurisdictional Authority and Control Agency is the Australian Maritime Safety Authority (AMSA) for Commonwealth waters (**Table 1-3**). Modelling of a Level 2 vessel collision MDO spill predicts that it will not enter into WA state waters and not contact shorelines (GHD, 2020). So cross-jurisdictional arrangements between WA State and Commonwealth waters will not be applicable as the spill is not predicted to impact State waters or shorelines. This would also be the case with a Level 2 MODU refuelling spill (~32 m^3), which is considerably smaller than the maximum credible volume of a vessel collision spill (~200 m^3).

Table 1-3 Jurisdictional authority and Control Agency for MDO (or MGO) spills in Commonwealth waters for this Activity

Location	Incident	Jurisdictional Authority	Control Agency		
			Level 1 Spill	Level 2 Spill	Level 3 Spill
Australian Commonwealth waters	Vessel MDO Spill	AMSA	AMSA	AMSA	Not Credible
	MODU MDO Spill	NOPSEMA	SapuraOMV	SapuraOMV	Not Credible

1.8.1 Commonwealth Waters

For all vessel spill incidents in Commonwealth waters, AMSA is both Jurisdictional Authority and Control Agency. AMSA manages the NatPlan, Australia's key maritime emergency contingency and response plan. For any vessel-based large oil spill incident, the Vessel Master will notify AMSA immediately to facilitate the most efficient and effective response. SapuraOMV will make contact with AMSA post the initial notification to render support in a Supporting Agency capacity if required.

For MODU MDO spills (Level 1 and 2 spills, Level 3 is not credible) during the Activity, SapuraOMV is the Control Agency and NOPSEMA is the Jurisdictional Authority.

1.8.2 Cross-Jurisdictional Spills

Cross-jurisdiction relates to a marine oil pollution incident that originates in Commonwealth waters and moves into State waters, resulting in the DoT exercising their Hazard Management Agency (HMA) obligations in respect to actual or impending response activities in State waters.

Oil spill trajectory and fate modelling of the worst-case Level 2 MDO spill scenario (200 m^3) in the Operational Area within Commonwealth waters does not predict any surface, submerged or shoreline oiling of State waters (**EP Section 8.2**, GHD (2020)). Hence, it is highly unlikely that cross-jurisdictional arrangements will apply in the event of a Level 2 MDO spill from a support vessel collision (maximum release of 200 m^3) or MODU refuelling incident (maximum release of 32 m^3) for this Activity.

2. Crisis and Incident Management Response

2.1 Overview of Crisis and Incident Management System

Crisis and incident response is managed by a hierarchy of teams within SapuraOMV supported by the resources of SapuraOMV's office in Kuala Lumpur. Response teams are progressively activated depending on the level of incident severity, resource needs, and incident complexity. Responsibility begins at the site level Contractor Emergency Response Team (ERT) or Site Control Team (SCT) and rises through the Incident Management Team (IMT) in Perth and the Crisis Management Team (CMT) in Kuala Lumpur (see **Figure 2-1**).

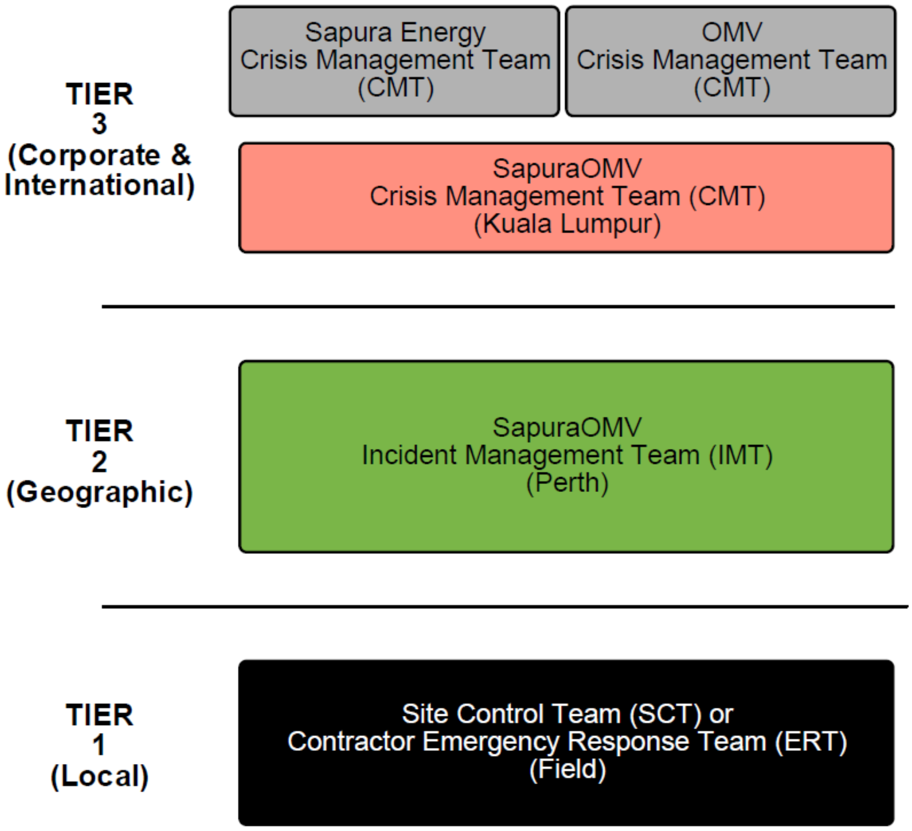

Figure 2-1 Crisis and incident management structure

2.2 Responsibilities of Crisis and Incident Management Teams

A high level overview of the responsibilities of the ERT/ SCT, core IMT sections and CMT is provided in **Table 2-1**.

Table 2-1 Strategic responsibilities of ERT/ SCT, core IMT sections and CMT

Personnel/ Teams	Responsibilities
ERT/ SCT	• Initiates the OPEP (and SOPEP) response to a Level 2 spill; • Onsite management of the spill response, especially during the early stages; • Notify and communicate directly with the IMT; and • Site-based employee safety and welfare issues.

Personnel/ Teams	Responsibilities
IMT	Incident Commander (IC) The IC leads the IMT and is responsible for the overall management and support to the response operations of the incident. Planning Section • Conduct short-term (e.g. preparation of Incident Action Plans [IAPs]) and long-term planning (e.g. preparation of a General Plan) to meet Strategic Objectives of the response as set by Command Section. • Manage information associated with emergency response operations by establishing and maintaining a situation status display (the Information Centre) and collecting and preserving documentation. • Environmental Unit provides advice, monitoring and technical support and will include a 3rd party specialist to assist with OSMP implementation. Operations Section • Provide strategic direction to the ERT. • Incorporates any mobilised specialist technical capability to support the response. This technical knowledge may include (but not limited to) environmental, oil spill response and trajectory analysis expertise. • Direct assessment and planning for spill response actions. • Development of spill response section of the IAP. • Management, supervision and monitoring of spill response operations. • Responsible for informing IMT on nature and status of spill response operations. Logistics Section • Support emergency response operations by sourcing personnel, equipment, materials, and supplies needed to carry out the operations. • Coordinate the services to sustain emergency response including food, water, housing, clothing, transportation, first aid, security, fuel, spare parts and anything else to keep people and equipment working in a safe and productive fashion. Finance and Administration Section • Manage all financial aspects of the response ensuring that the IMT has the necessary financial resources and processes in place. • Monitor expenditure and maintains records for insurance / cost recovery purposes.
CMT	Addresses the implications of the problem and its potential impacts on the Company’s viability, operability and credibility.

2.3 IMT Functional Role and Structure

The IMT is accountable for managing the overall physical and tactical response. The IMT also manages all other issues arising from an emergency that have implications to personnel or operations. The functional role of the IMT is to:

- Establish and maintain contact and provide guidance and support to the On Scene Commander (Vessel Master), who is conducting the physical and immediate response to the incident at and near the incident scene.
- Develop objectives and associated plans for the overall management of the incident and its consequences, ensuring the response moves from a reactive to a proactive response as quickly as possible.
- Obtain and mobilise resources as appropriate to support the operations of the IMT and support staff.
- Ensure that initial notifications and interactions with Commonwealth, State and Local Government regulatory bodies are completed.
- Manage relationship with traditional and social media, including issuing media statements.

- Manage all immediate financial matters related to the incident including implementing procurement and cost tracking processes.
- Escalate the stakeholder impacts and broader emergency management concerns and requests for support to the CMT in Kuala Lumpur (if activated but not likely for a Level 2 incident).

The IMT is organised in accordance with the principles of the International Petroleum Industry Environmental Conservation Authority (IPIECA) Good Practice Guidelines – Incident Management System. SapuraOMV's IMT structure is illustrated in **Figure 2-2** and designed to be scaleable according to the particular nature and response demands of the incident.

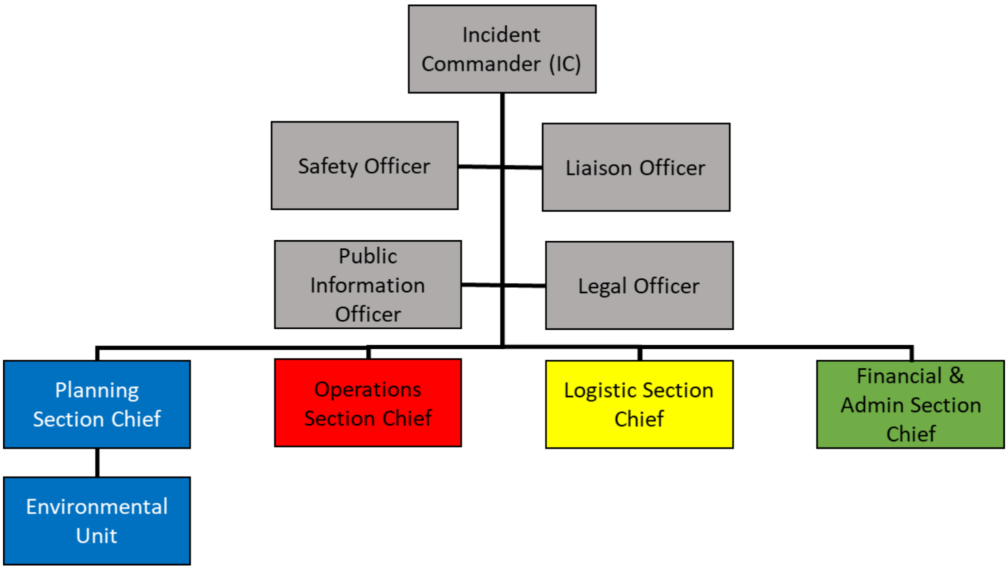

Figure 2-2 IMT structure

The responsibilities of key IMT personnel are summarised in **Table 2-3**.

Table 2-2 Key IMT personnel responsibilities

Section	Responsibilities
Command	<u>Incident Commander (IC)</u> The IC leads the IMT and is responsible for the overall management and support to the response operations of the incident including: • Establishing command and taking control of the incident. • Activate the IMT in accordance with Incident Management Plan. • Monitoring and reviewing safety and welfare. • Facilitating media management. • Developing, implementing and monitoring the IAP. • Notifying CMT. • Notifications as per Notification Plan (**Section 3.2**). • Approve involvement of additional third parties. • Conclude and review emergency activities. The IC may be assisted by a Deputy IC and may delegate some activities accordingly.
Planning	<u>Planning Section Chief</u> The Planning Section is lead by the Planning Section Chief who is responsible for: • Collecting, analysing and utilising incident information. • Engage other Section Chiefs to assist in response actions. • Organising incident response mobilisation/demobilisation. • Risk analysis of the incident and provision of specialist information (e.g. weather, spill behaviour, projections).

Section	Responsibilities
	• Ensure that NEBA assessments are carried out appropriately to support the development of IAPs. • Dissemination of incident information including to the media and public where required. • Coordination of surveillance flights. • Maintaining a record of communications and actions including resources requested/allocated/in use. • Liaises with the DBCA OWA (Oiled Wildlife Advisor) through the SapuraOMV OWA (provided by AMOSC). The Planning Section Chief may be assisted by a Deputy and may delegate some activities accordingly. <u>Environmental Unit</u> The Environmental Unit Leader will operate under the direction of the Planning Section Chief and will provide: • Environmental support. • Environment monitoring. • Technical advice.
Operations	<u>Operations Section Chief</u> The Operations Section is lead by the Operations Section Chief who is responsible for: • Development of spill response section of the IAP. • Notify most of the relevant organisations in the Notification Plan (**Section 3.2**). • Coordinating spill response operations. • Engaging with other Section Chiefs to assist in response actions. • Mobilisation of OSRL and AMOSC resources if required.
Logistics	<u>Logistics Section Chief</u> The Logistics Section is lead by the Logistics Section Chief who is responsible for: • Development of logistics section of the IAP. • Organise resources (e.g. helicopters, vessels). • Waste disposal planning / resources • Estimate future service and support requirements. • Provision of technical advice to the Planning Section Chief. •
Finance and Administration	<u>Finance and Administration Section Chief</u> The Finance and Administration Section is lead by the Finance and Administration Section Chief who is responsible for ensuring that finances are available to all areas that require the purchasing or hire of goods (e.g. equipment) and services (e.g. personnel, transportation) and to keep financial records of all spill response expenditures. <u>Procurement Group</u> The Procurement Group will operate under the direction of the Finance and Administration Section Chief. This group will: • Handle administration for procurement and contracting. • Manage imports/exports and customs matters relating to procurement of resources.
IMT Support	<u>IMT Command Roles</u> • <u>*Liaison Officer*</u> – communicate information to all relevant stakeholders, including ongoing consultation throughout a hydrocarbon spill emergency. • <u>*Safety Officer*</u> – provide HSE services in support of the oil spill response and source control team. Ensure the response operations are undertaken in a safe manner, consistent with work place safety legislation and also ensures the security of responders, the IMT and other SapuraOMV employees and contractors during a crisis. • <u>*Public Information Officer*</u> - responsible for managing the IMT related media issues for the response effort. • <u>*Legal Officer*</u> - provide legal advice for all actions undertaken or considered by the IMT in response to the incident. <u>Third Party Resources</u>

Section	Responsibilities
	Third Party Resources that are apart of the IMT inclues: • *Public Relations Support* - a public relations consultant will be in place for the duration of a major response to support the Public Information Officer and coordinate media releases and statements to ensure information flow is maintained and managed accurately and in a timely manner. SapuraOMV will engage a public relations consultant throughout the campaign planning phase. • *Legal Support* – a legal consultant may be appointed into the Legal Officer role to support the IMT. • *Environmental Specialist Support* - an environmental specialist consultant will be in place for the duration of a major response to support the Environment Unit under the Planning Section Chief. Responsibilities will include the recommendation and implementation of strategies outlined in the Operational and Scientific Monitoring Implementation Plan (OSMIP, Doc No AU-HSE-KG1-EX-PLN-038).

2.3.1 Emergency Control Centre

The SapuraOMV Board Room will be utilised as the Primary Emergency Control Centre (ECC) Room.

The IMT tools are stored in the IMT cupboard and appropriately equipped with communications equipment, meetings rooms and status boards.

If the Primary ECC is not useable for any reason, the IC will make alternative arrangements at the time, commensurate with the nature and scale of the emergency or crisis. Large venues within walking distance to the SapuraOMV office that have access to power, water, amenities, tables, chairs, communications and internet services.

2.4 Internal Emergency Response Activation Process

In the event of a Level 2 spill, the SapuraOMV Offshore representative is to contact the On-Duty Incident Commander, via the SapuraOMV Offshore Representative.

Figure 2-3 shows SapuraOMV's internal emergency response activation process in the event of a large (Level 2) hydrocarbon spill.

Contact numbers for personnel in **Figure 2-3** are listed in SapuraOMV's Emergency Contact List in Annex 1 of the Incident Management Plan (AU-HS-PLN-002-1.0). This list is regularly updated and distributed to all relevant parties.

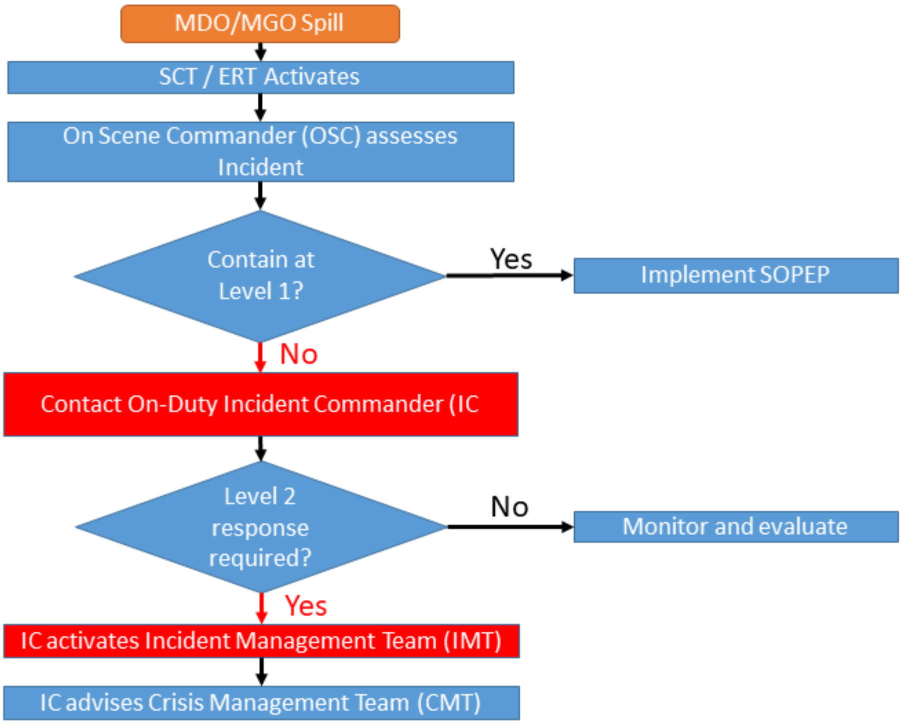

Figure 2-3 Internal emergency response activation process

The responsibilities of those involved in emergency response notification procedures relevant to a Level 2 spill are detailed in **Table 2-3.**

Table 2-3 Summary of contractor and SapuraOMV oil spill response roles and responsibilities during emergency response activation

Role	Position	Location	Responsibility
SapuraOMV Personnel			
SapuraOMV Offshore Representative(s)	SapuraOMV Offshore Representative	MODU	• Responsible for emergency communications with the SapuraOMV IMT.
Incident Commander (IC)	On-Duty SapuraOMV Management of IMT	Perth	• Ensure adequate structure of the IMT for response escalation if required. • Liaison between Statutory Authorities, Control Agency, Response Agencies and other stakeholders. • Inform SapuraOMV CMT.
Contractor Personnel			
On Scene Commander (OSC)	Vessel Master	Support Vessel	• Responsible for emergency communications with AMSA. • Responsible for implementation of emergency response procedures.
Third Party Contractors	Various	Vessels / Aircraft	• Follow instruction from the IC and IMT.

2.5 Communication and Integration with Other Organisations and Plans

2.5.1 Australian Maritime Safety Authority (AMSA) and National Plan for Maritime Environmental Emergencies (NatPlan)

NatPlan sets out national arrangements, policies, and roles and responsibilities of states, territories and industry, in managing maritime environmental emergencies. NatPlan integrates Commonwealth and State government oil spill response frameworks to facilitate effective response to marine pollution incidents. The Australian Maritime Safety Authority (AMSA) manages NatPlan and works with State governments (who manage the equivalent State plans that integrate into the NatPlan), shipping, petroleum, chemical industry and emergency services to optimise Australia's marine pollution response capability. This plan applies to all hydrocarbon spills in Commonwealth waters seaward of the State water limit while the WA State Hazard Plan – MEE applies in State waters within 3 nautical miles (nm) of the territorial sea baseline.

For a Level 2 spill incident the Vessel Master (or delegate) will notify AMSA immediately in the interest of facilitating the most efficient and effective response. Upon notification of an incident involving a ship, AMSA will assume control of the incident and respond in accordance with NatPlan.

2.5.2 Australian Marine Oil Spill Centre (AMOSC) and AMOSPlan

SapuraOMV will has access to AMOSC oil spill recovery and response equipment, dispersant and technical (human) capabilities along with those resources held by member companies as outlined in the AMOSPlan on a 24-hour, 7-days a week basis before and throughout the drilling operations. SapuraOMV's primary interface with the AMOSPlan during an oil spill response is via AMOSC's 24/7 Duty Officer, who will provide the initial point of contact for oil spill responses that require AMOSC assistance.

AMOSC is a member of the Global Response Network.

2.5.3 WA Department of Biodiversity, Conservation and Attractions (DBCA) and WA Oiled Wildlife Response Plan (WAOWRP)

The DBCA has responsibility and statutory authority to protect wildllife (fauna) as outlined in the WA *Biodiversity Conservation Act 2016* . It also has leglislative requirement to ensure the humane treatment, housing and release or euthanising of fauna under the *Animal Welfare Act 2002*.

For spills in State waters, DoT is the Controlling Agency and DBCA is the Jurisidictional Authority and lead agency for oiled wildlife response (OWR). The role of DBCA (formerly DPaW) in OWR is outlined in Western Australia Oilded Wildlife Response Plan (WAOWRP) (DPaW, 2014a) and regional sub-plans. The WAOWRP sets out the minimum standard required for OWR in WA in both State and Commonwealth waters. The Plilbara Region Oiled Wildlife Response Plan (PROWRP) (DPaW, 2014b) outlines specific 'on ground' information required to carry out OWR specific to this region (e.g. environmental values, high risk environmental areas, designated oiled wildlife facilities, equipment lists and resource lists, contact lists).

For a Level 2 spill originating from a vessel incident in Commonwealth waters that move into State waters, SapuraOMV will retain command until formal incident control is etablished by WA DoT. In the event that wildlife has been impacted or there is imminent threat of impact requiring OWR, the WAOWRP and PROWRP will be activated. A Wildlife Division Coordinator (WDC) will be established and will liaise with the DoT to identify and coordinate the necessary OWR functional units of the Oiled Wildlife Division (OWD), as per the WAOWRP. In the event of oiled wildlife, DBCA will provide an Oiled Wildlife Advisor (OWA). The OWA and WDC will provide advice to the DoT on the level of OWR required and will ensure provision of resources to support OWR operations.

If DoT becomes the Controlling Agency in State waters, they will be responsible for overall control of OWR in State waters. SapuraOMV will provide necessary resource (equipment and personnel, primarily through SapuraOMV's AMOSC membership), as directed by DoT to support their functions.

For a Level 2 spill impacting only Commonwealth waters, DBCA will similarly provide advice on OWR to the SapuraOMV IMT through a nominated OWA.

2.6 IMT Activation

The activation of the SapuraOMV incident management response is on the basis of the Level of a spill, where for a:

- Level 1 MDO spill: The Vessel Master (vessel spill) or Offshore Installation Manager (OIM) is in control of the response. The IC will be advised/informed, but the IMT will not normally require activation.
- Level 2 MDO spill: The IMT is activated and will typically take control of the response. The CMT will not require activation but will be informed by the IC.

As described previously in **Section 2.4** (Internal Emergency Response Activation Procedure), contact numbers of IMT personnel are listed in SapuraOMV's Emergency Contact List per Annex 1 of the Incident Management Plan (AU-HS-PLN-002-1.0), which is updated and distributed to all relevant parties. Also refer to the Notification Plan in **Section 3.2**.

A range of mutual support agencies may be invited to the IMT at the start of a Level 2 incident. Refer to the Notification Plan in **Section 3.2** for the internal and external notification procedure in the event of a Level 2 spill incident.

3. Immediate Actions

Immediate actions after a Level 2 spill are described in this section to expedite spill response by the IMT. These actions are to be undertaken while the Incident Action Plan (IAP) is updated during the subsequent 'Ongoing Response' (**Section 4)**. Immediate actions to be executed by the IMT include:

- Gain situational awareness of the incident (**Section 3.1**).
- Execute the Notification Plan (**Section 3.2**).
- Support the Source Control Plan (**Section 3.3**).
- Initiate the Monitor and Evaluate Plan (**Section 3.4**).
- Initiate the Scientific Monitoring Plan (**Section 3.4.2**).

3.1 Incident Situational Awareness

3.1.1 Information Acquisition

The IMT must initially gain situational awareness by obtaining onsite information immediately after activation. Responsibility for collection of onsite information of a Level 2 spill will reside with the On Scene Commander. At a minimum the following questions need answers:

- What caused the spill?
- How much MDO (or MGO) has been spilled?
- Is the spill release under control?
- What is the spill's trajectory?
- Is there anything in the path of the predicted spill trajectory?
- Can the spill be contained?
- What are the wind and sea state conditions?

3.1.2 Classification of Spill Level

Following information acquisition (**Section 3.1.1**), the spill level will be classified via **Table 3-1** to gauge a proportionate response. Where doubt exists over the severity or appropriate response to spill event, the On Scene Commander (Vessel Master or OIM) is to discuss the situation with the IC. **The principle of prudent over-reaction and rapid de-escalation applies when considering the level of activation as it is easier and usually more effective to scale down an over-reaction than to ramp up an under-reaction.**

Table 3-1 Guideline to determine MDO spill level and response

Level 1 Spills	
Small spills up to 10 tonnes (>0 - ~70 bbl or >0 - ~10 m^3)	
Possible Scenario	Spill from handling error (e.g. dropped object) or containment failure (e.g. leaking/ hose rupture).
Worst Case Credible Volume	Volume up to 10 m^3 (**EP Section 8.4**)
Resourcing Requirements	As described in Vessel /MODU SOPEP
Description	• Incident can be controlled with onsite resources (immediate response and containment). • Any spill into marine waters rapidly dissipates. • Low danger of explosive vapours. • No potential impact to environmental sensitive areas and/or local communities. • Unlikely any media interest.
Level 2 Spills	
Spills between 10 and 1,000 tonnes (~70 - ~7,000 bbl. >0 - ~1,000 m^3)	
Possible Scenario	MDO (or MGO) spill due to vessel collision releasing contents of single fuel tank or a refuelling incident during MODU bunkering operations.
Worst Case Credible Volume	Volume of single support vessel fuel tank (up to 200 m^3) (**EP Section 8.2**) Refuelling incident during MODU bunkering operations (up to 32 m^3) (**EP Section 8.3**)
Resourcing Requirements	As described in support vessel / MODU SOPEP, AMOSPlan and NatPlan, possibly WAOWRP and PROWRP, and external services contracting strategy (**Section 6.2**).
Description	• Incident cannot be controlled solely by use of onsite resources and requires additional support and resources to manage the spill. • Risk of fire or explosion. • Potential for additional release. • Potential impact to environmental sensitive areas and/ or local communities. • Spill extends beyond spill source site. • Local / national media attention.

3.2 Notification Plan

Figure 3-1 shows the SapuraOMV notification procedures for Level 2 MDO spills from a vessel (i.e. Jurisdictional Authority and Control Agency AMSA in **Table 1-3**) and the MODU in **Figure 3-2** (i.e. Jurisdictional Authority NOPSEMA and Control Agency SapuraOMV in **Table 1-3**). The On Scene Commander (Vessel Master/MODU OIM) is responsible for activating the initial onsite response for all MDO spills. The IC (or delegate) is responsible for subsequent activations and notifications on the basis of the spill circumstances. Notifications will include:

- Information and circumstances regarding the incident.
- Actions taken to avoid or mitigate any adverse environmental impacts.
- Any corrective actions that have been taken (or proposed) to prevent a similar incident.

The environmental performance outcome, performance standard and measurement criteria for the Notification Plan are provided in **Table 3-2**. Key SapuraOMV roles, and regulator and spill response organisations contact details are provided in **Table 3-3**.

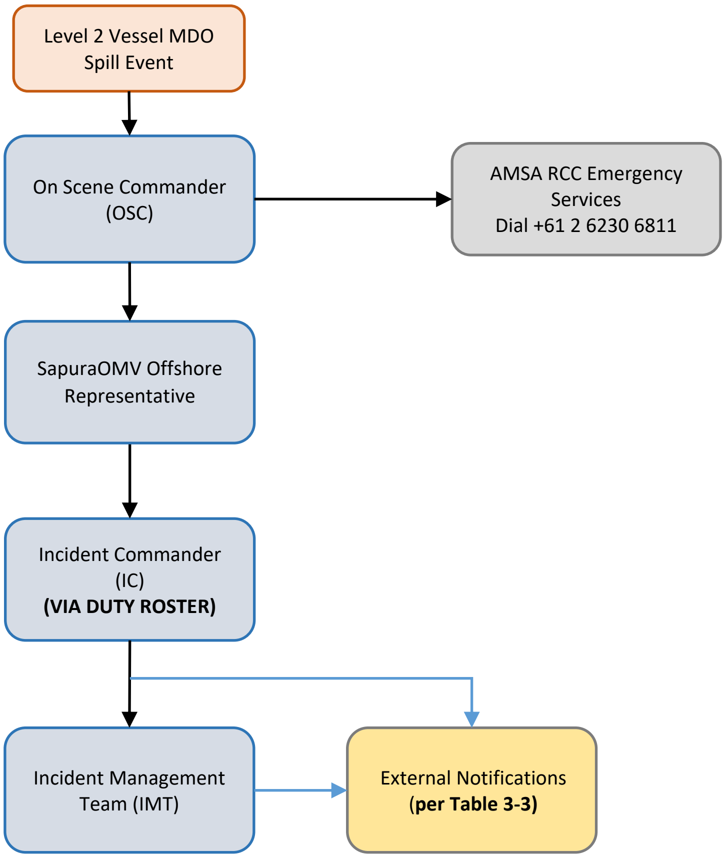

Figure 3-1 Summary of internal and external spill notification procedure for a Level 2 vessel MDO spill

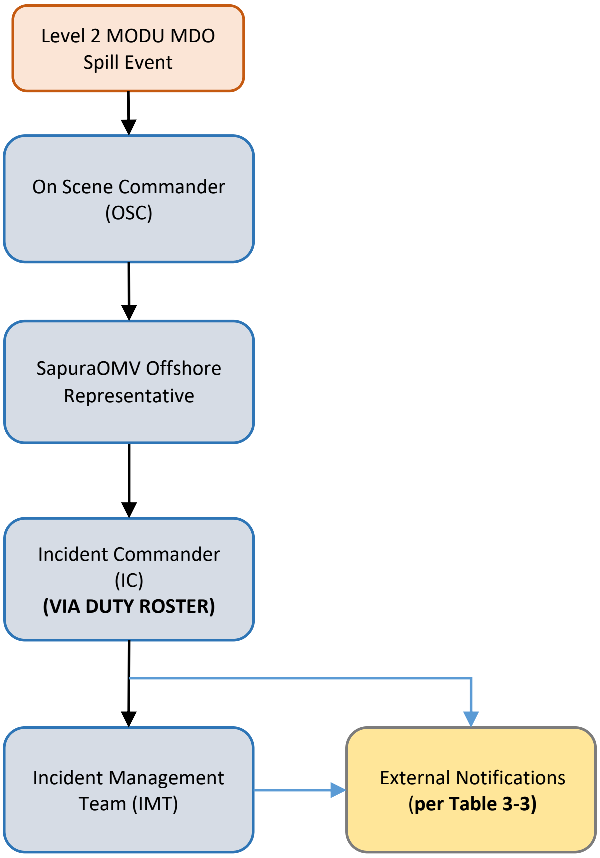

Figure 3-2 Summary of internal and external spill notification procedure for a Level 2 MODU MDO spill

Table 3-2 Performance criteria for spill notifications

Environmental Performance Outcome	Performance Standard	Measurement Criteria
Environmental agencies are informed of the incident and the response arrangements within regulatory stipulated timeframes.	Undertake communications in accordance with the Notification Plan.	• Communications records. • Incident log. • Applicable notifications within nominated timeframes.

Table 3-3 Notification plan contact details

From	To	Description	Type	Timing
Level 2 Vessel MDO Spill				
Vessel Master	SapuraOMV Offshore Representative	Notify of incident and provide situational awareness information and updates.	Verbal	ASAP and no later than 15 minutes of incident.
			SapuraOMV Initial Incident Notification Form	ASAP and no later than 1 hour of incident.
	AMSA (Rescue Coordination Centre) +1 800 641 792 (24 hrs, in Australia) + 61 2 6230 6811 (24 hrs, outside of Australia) *Do not use this number when testing notification plan.*	Legal requirement to notify in the event of any spill of oil to sea. Notification and request for mobilisation of NatPlan resources. Jurisdictional Authority and Control Agency for all spills from vessels in Commonwealth waters.	Verbal.	ASAP and no later than 30 minutes of incident.
			POLREP (i.e. pollution report) (https://amsa-forms.nogginoca.com/public/polrep.html).	As soon as practicable, but no later than 1 day of incident. Copy to SapuraOMV IC
Level 2 Vessel or MODU MDOSpill				
SapuraOMV Offshore Representative	On-duty Incident Commander (IC) +61 8 6118 0530	Notify of incident and provide preliminary situational awareness info.	Verbal.	ASAP or within 1 hour of incident.
IC (or delegate)	NOPSEMA (if reportable incident) +1 300 674 472 submissions@nopsema.gov.au	Requirement to notify NOPSEMA for spills >80L (cc WA Department of Mines, Industry Regulation and Safety (DMIRS) at: petroleum.environment@dmirs.wa.gov.au).	Verbal.	ASAP and no later than 2 hours of incident.
			Written notification.	As soon as practicable after oral notification.
			Written report (FM0831- http://www.nopsema.gov.au/environmental-management/notification-and-reporting/).	As soon as practicable, but within 3 days of incident.
	NOPSEMA (if recordable incident) submissions@nopsema.gov.au	Requirement to provide monthly report for spills <80L	Written – monthly report	No later than 15 days after month ended
	National Offshore Petroleum Titles Administrator (NOPTA)	Requirement to notify as per Guidance Note (N-03000-GN0926) Notification and Reporting of Environmental Incidents	Written report.	Within 7 days of the initial report being submitted to NOPSEMA.

From	To	Description	Type	Timing
IC (or delegate)	AMOSC +61 438 379 328 (24 hrs) amosc@amosc.com.au	Support organisation for spill response operations.	Verbal.	As soon as practicable.
	GHD +61 400 384 727	Support organisation for scientific monitoring.	Verbal.	As soon as practicable.
	WA Department of Biodiversity, Conservation and Attractions (DBCA) 08 9219 9108 State Duty Officer (OWR)	Provision of advice and support for Oiled Wildlife Response and/or oiling of shorelines / waters managed by DBCA.	Verbal.	As soon as practicable if potential for oiled wildlife and/or oiling of DBCA managed water/shorelines.
	Department of Agriculture, Water and the Environment (DAWE) Phone: +61 2 6274 1111 epbcmonitoring@environment.gov.au	Responsible for administration of EPBC Act in Commonwealth Waters and to be notified if spill threatening wildlife in Commonwealth Waters. This allows for timely response and for DAWE to provide an informed response to enquiries from media and stakeholders.	Written.	Within 7 days if spill incident injures of kills one or more of the following: • EPBC threatened, migratory and/or marine species. • Cetaceans.
	Commonwealth Director of National Parks 0419 293 465 (24 hour Marine Compliance Duty Officer)	Responsible for Australian (Commonwealth) Marine Parks. The notification should include: • Titleholder details • Time and location of incident (including name of marine park likely to be affected) • Response arrangements as per this OPEP (e.g. dispersant, contain and recover) • Contact details of response coordinator	Verbal.	As soon as practicable or within 3 hours of incident identification if spill enters or predicted to enter a Commonwealth Marine Park.
	WA DoT Maritime Environmental Emergency Response (MEER) Duty Officer 08 9480 9924 (24 hrs) marine.pollution@transport.wa.gov.au	Controlling Agency and HMA (Jurisdictional Authority) for responses in WA State waters to Level 2 spills originating in Commonwealth waters. Requirement to submit POLREP for any spill so WA State response agencies can be alerted if required.	Verbal.	As soon as practicable and no later than 2 hrs of becoming aware of incident if spill enters or predicted to enter State waters.
			Written WA POLREP form (https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-PollutionReport.pdf).	As soon as practicable after verbal notification if spill enters or predicted to enter State waters.
			Written WA SITREP form (https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-SituationReport.pdf).	If requested, within 24 hours if spill enters or predicted to enter State waters.

3.3 Source Control Plan

The initial and highest priority response to a spill incident is to prevent, stop and/or limit further loss of hydrocarbons into the marine environment. This will only be attempted if personnel safety is not compromised and source control actions do not further risk or impact the environment. In most circumstances, the net benefit of source control outweighs the risks from further hydrocarbon release. The Source Control Plan is the vessel's SOPEP for a Level 2 vessel MDO spill with a generic overview in **Table 3-4** and the MODU's SOPEP for a Level 2 refuelling MDO spill with a generic overview in **Table 3-5**.

Table 3-4 Source control plan for Level 2 vessel collision MDO spill

<table>
<tr><th colspan="5">Source Control Plan: Vessel Fuel Tank Spill</th></tr>
<tr><td>Initiation Trigger</td><td colspan="4">Notification of a Level 2 vessel MDO spill.</td></tr>
<tr><td>Aim</td><td colspan="4">Safely stop loss of MDO/MGO from a vessel fuel tank rupture to minimise releases to the marine environment.</td></tr>
<tr><td rowspan="4">Procedure</td><td colspan="2">Required Timeframe and Action (if safe)</td><td>Responsible</td><td>Tick When Complete</td></tr>
<tr><td colspan="2">Day 0 - Implement vessel SOPEP MDO/MGO spill reduction measures as appropriate such as:
• Reduce ruptured tank head (pressure) driving MDO/MGO spill by dropping or pumping tank contents into empty or slack tank;
• Consider pumping water into leaking tank to create water cushion to prevent further MDO/MGO loss;
• If affected tank not easily identified, reduce MDO/MGO in tanks in vicinity of suspected area if vessel stability not compromised;
• Attempt repair and plugging of hole or rupture;
• Evaluate transfer of MDO/MGO to other vessels; and/or
• Trim or lighten vessel to avoid further damage to intact tanks.</td><td>Vessel Master</td><td>□</td></tr>
<tr><td colspan="2">Day 1 after AMSA request - Mobilise support vessel to location if requested by AMSA.</td><td>IMT</td><td>□</td></tr>
<tr><td colspan="2">Ongoing - Use on-board spill kits to clean-up oil from deck. Oily waste will be bagged, labelled and segregated into bunded hazardous waste area. Hazardous wastes to be transferred onshore with licensed waste management contractor and disposed at suitably classed State waste disposal facility.</td><td>Vessel Master</td><td>□</td></tr>
<tr><td rowspan="2">Resources Required</td><td>Resource</td><td colspan="3">Available From: (Refer to Section 6.2)</td></tr>
<tr><td>Support vessel</td><td colspan="3">Supplier(s) as per the external services contracting strategy (Section 6.2).</td></tr>
<tr><td>Termination Criteria</td><td colspan="4">Direct observation: MDO/MGO from ruptured fuel tank is secured on the vessel and actions have been taken to prevent any further release, or that no more MDO/MGO can be released.</td></tr>
<tr><td>Key Response Documents</td><td colspan="4">Vessel SOPEP.
Kanga-1 Exploration Well OPEP for a Level 2 Spill – This document.</td></tr>
<tr><td>Environmental Performance Outcome</td><td colspan="4">Contain the unplanned MDO/MGO release from a Level 2 vessel fuel tank rupture.</td></tr>
<tr><td>Control Measure</td><td colspan="2">Performance Standard</td><td colspan="2">Measurement Criteria</td></tr>
<tr><td rowspan="2">Vessel SOPEP</td><td colspan="2">SapuraOMV Lead Engineer will ensure a SOPEP copy is in the Perth office prior to the Activity for IMT reference if a Level 2 spill.</td><td colspan="2">Copy of Vessel SOPEP in SapuraOMV offices.</td></tr>
<tr><td colspan="2">Vessel Master activates SOPEP source control measures immediately after fuel tank rupture.</td><td colspan="2">Vessel and communication logs.</td></tr>
<tr><td>OPEP</td><td colspan="2">IMT activates mobilisation of support vessel as soon as practicable after Level 2 spill notification, if requested by AMSA.</td><td colspan="2">Incident response logs.</td></tr>
</table>

	IMT provides further support of Source Control Plan if requested by AMSA.	Incident response logs.
Refer to **EP Section 8.8** for Environmental Performance Outcomes, Performance Standards and Measurement Criteria relating to potential environmental risks from implementation of oil spill response.		

Table 3-5 Source control plan for Level 2 MODU refuelling MDO spill

Source Control Plan: Vessel Fuel Tank Spill			
Initiation Trigger	Notification of a Level 2 MDO spill from a refuelling incident during MODU bunkering operations.		
Aim	Safely stop loss of MDO/MGO from refuelling incident to minimise releases to the marine environment.		
Procedure	**Required Timeframe and Action (if safe)**	**Responsible**	**Tick When Complete**
	Immediate - Cease any fuel pumping activities. Identify and remove failed equipment.	OIM / Vessel Master	◻
	Ongoing - Use on-board spill kits to clean-up oil from deck. Oily waste will be bagged, labelled and segregated into bunded hazardous waste area. Hazardous wastes to be transferred onshore with licensed waste management contractor and disposed at suitably classed State waste disposal facility.	OIM / Vessel Master	◻
	Post-Spill - Before washing down the deck, confirm that the deck drainage network is still closed and the water will not be released into the marine environment.	OIM / Vessel Master	◻
Resources Required	**Resource**	**Available From: (Refer to Section 6.2)**	
	MODU/ support vessel spill kits	Supplier(s) as per the external services contracting strategy (**Section 6.2**).	
Termination Criteria	Direct observation: MDO/MGO from refuelling incident is secured and actions have been taken to prevent any further release, or that no more MDO/MGO can be released.		
Key Response Documents	MODU SOPEP. Kanga-1 Exploration Well OPEP for a MDO Spill – This document.		
Environmental Performance Outcome	Minimise the unplanned MDO/MGO release from a Level 2 (likely Level 1) refuelling spill during MODU bunkering operations.		
Control Measure	**Performance Standard**	**Measurement Criteria**	
MODU SOPEP	SapuraOMV Lead Engineer will ensure copies of the MODU SOPEP are in the Perth office prior to the Activity for IMT reference if a Level 2 spill.	Copies of MODU SOPEP in SapuraOMV offices.	
	Vessel Master/OIM activates SOPEP source control measures immediately after fuel tank rupture.	Vessel/MODU and communication logs.	
OPEP	IMT provides further support of Source Control Plan as requested by OIM.	Incident response logs.	
Refer to **EP Section 8.8** for Environmental Performance Outcomes, Performance Standards and Measurement Criteria relating to potential environmental risks from implementation of oil spill response.			

3.4 Monitor and Evaluate Plan

In the event of a Level 2 MDO spill incident involving operations on the MODU (e.g. refuelling incident during MODU bunkering operations), the Operational and Scientific Monitoring Program (OSMP) will be initiated to inform spill response (the monitor and evaluate plan also referred to as operational monitoring) and to evaluate the impacts to and recovery of the marine environment (scientific monitoring, see **Section 3.4.2**). The OSMP or elements of the OSMP will also be implemented for a Level 2 vessel MDO spill incident if requrested by the Control Agency AMSA. The overall structure of SapuraOMV's OSMP is illustrated in **Figure 3-3**.

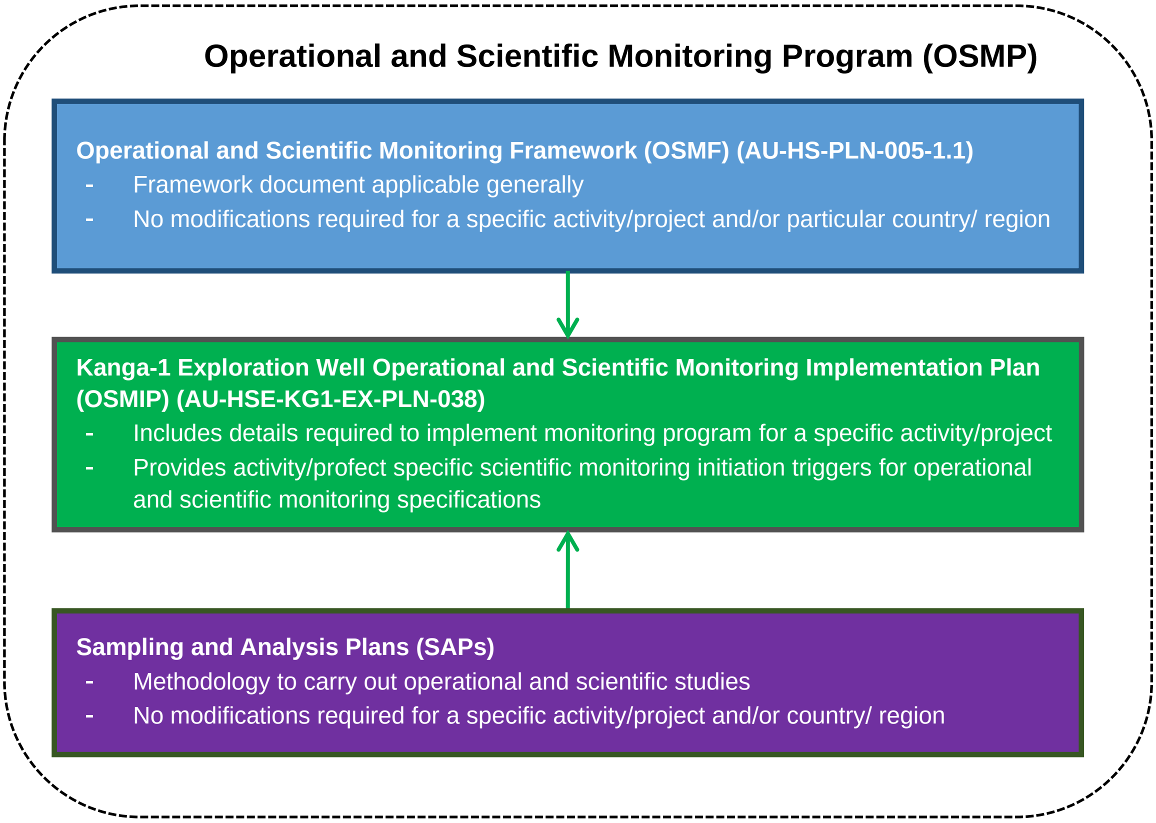

Figure 3-3 Overview of structure of OSMP

For a Level 2 MDO spill, the monitor and evaluate plan (operational monitoring) is initiated by the IMT except for available onsite resources (e.g. oil spill tracking buoys) for immediate surveillance that is initiated by the On Scene Commander (OSC). The monitor and evaluate plan for a Level 3 oil spill is shown schematically in **Figure 3-4**. The overall aim of the Monitor and Evaluate Plan (i.e. operational monitoring) is to:

- Understand the behaviour of the spill.
- Maintain situational awareness to inform the IMT and update the IAP (IAP, **Section 4.1**) and to inform the IMT.
- Provide ongoing information for the assessment of the response strategies.
- Provide ongoing information for scientific monitoring planning to assess environmental impacts from the spill.

Accurate and ongoing operational monitoring information is required to plan and to maintain appropriate response arrangements, which is achieved through:

- Forecasting environmental receptors at risk of impact.
- Identifying environmental receptors that have been impacted.
- Informing response escalation and de-escalation processes.

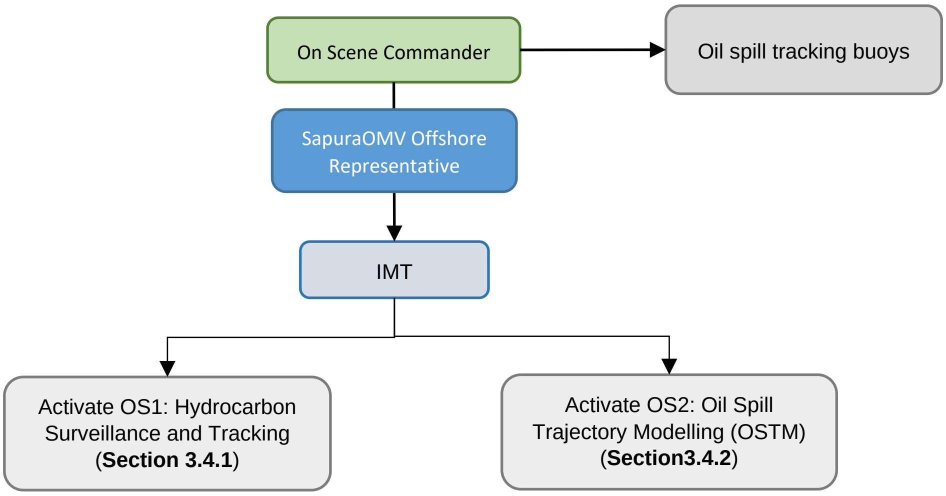

Figure 3-4 Overview of Level 2 MODU MDO spill monitor and evaluate plan

The monitor and evaluate plan for a Level 2 MDO spill is comprised of the following two operational monitoring studies:

- Operational Monitoring Study (OS) 1: Hydrocarbon Surveillance and Tracking.
- OS2: OSTM.

The Kanga-1 exploration well OSMIP (Doc No AU-HSE-KG1-EX-PLN-038) provides performance objectives, performance standards and measurement criteria for each of the operational monitoring studies. The scientific monitoring plan is used to assess impacts and subsequent recovery of environmental receptors from the spill and is described in **Section 3.4.2**.

In the event of Level 2 vessel MDO spill, the Monitor and Evaluate Plan will be coordinated by the Control Agency (AMSA). SapuraOMV will participate in operational monitoring as directed by AMSA in a Support Agency role. This section provides the immediate actions of the Monitor and Evaluate Plan that will be initiated by SapuraOMV during a Level 2 MODU MDO spill. Elements of this Monitor and Evaluate Plan may be implemented during a Level 2 support vessel MDO spill if requested by AMSA, the Control Agency for such an incident.

3.4.1 OS1: Hydrocarbon Surveillance and Tracking

Surveillance and tracking of the spill will commence as instructed by the IMT (through IC or delegate) and/or the On Scene Commander (Vessel Master for tracking buoy and initial support vessel surveillance) when conditions are conducive (e.g. safety).

3.4.1.1 Spill Tracking Buoys

Deployment of an oil spill tracking buoy in the spill from the vessel allows the slick's trajectory to be followed and thereby inform response planning. Two tracking buoys will be stored in the field during the Activity, with at least one on the MODU and the other on a support vessel. Monitoring of the buoy's location will be undertaken through AMOSC's online web-based tracking capability.

3.4.1.2 Satellite Imagery

Satellite imagery can identify and track surface oil distributions and movements. Satellite imagery can be accessed via AMOSC's Konsberg Satellite Service (KSAT).

3.4.1.3 Aerial and Vessel Surveillance

Aerial surveillance will be the preferred method while vessel surveillance will be undertaken opportunistically. Initial observations will be provided by the support vessel and/or MODU crew, as well as aircraft of opportunity, including a helicopter, if available. GPS coordinates and date/ time observations will be recorded to allow estimates of the spill extent along with any marine fauna sightings. The thickness of the slick will be estimated by trained observers with the Bonn Agreement Oil Appearance Code (BAOAC) (Bonn Agreement 1998).

Aerial surveillance is preferred over vessel surveillance because of the greater spatial coverage of observations, though not as wide as coverage from satellite imagery. Trained observers in aircraft on a call-off arrangement will comprise the aerial surveillance team. The surveillance aircraft will be available at short notice from SapuraOMV IMT. Trained observers will be sourced from AMOSC. Observations will be recorded and filed with supporting photographic images or video records. GPS coordinates and date/time observations are to be recorded and archived to allow for estimates of the spill extent.

Table 3-6 OS1: hydrocarbon surveillance and tracking for a Level 2 MDO spill

<table>
<tr><th colspan="4">OS1: Hydrocarbon Surveillance and Tracking</th></tr>
<tr><td>Initiation Trigger</td><td colspan="3">Notification of a Level 2 MDO spill</td></tr>
<tr><td>Aim</td><td colspan="3">Tracking buoy, satellite imagery, vessel (opportunistic) and/or aerial surveillance as required to inform IMT, to determine the size and trajectory of the slick, and to identify any oiled wildlife.</td></tr>
<tr><td rowspan="9">Procedure</td><td>Required Timeframe and Action</td><td>Responsible</td><td>Tick if Complete</td></tr>
<tr><td>Within 1 hour – Launch tracking buoys from vessel</td><td>Vessel Master / OIM</td><td>□</td></tr>
<tr><td>3 hours – Initiate mobilisation of additional aerial surveillance support (aircraft, observers)</td><td>IMT</td><td>□</td></tr>
<tr><td>3 hours – Initiation of satellite imagery surveillance</td><td>IMT</td><td>□</td></tr>
<tr><td>24 hours – Initiate mobilisation of additional vessel surveillance support</td><td>IMT</td><td>□</td></tr>
<tr><td>Ongoing – Tracking buoy location provided via online web-based portal</td><td>AMOSC</td><td>□</td></tr>
<tr><td>Ongoing – Aerial and vessel observations regularly recorded in observer log and provided to the IMT:
Time, date and person recording the log
Weather and sea state
Location and presence of oil
Appearance of oil (using BAOAC)
Any photos, sketches and videos
Presence of any oiled or non-oiled wildlife
Presence of any marine fauna and actions taken to adhere to Part 8 of the EPBC Regulations 2000 and the Australian Guidelines for Whale and Dolphin Watching (NRMMC, 2005[1]).</td><td>Vessel Observer via IMT</td><td>□</td></tr>
<tr><td>Ongoing – Provision of aerial/vessel observer logs to OSTM provider and monitoring leaders within 3 hours of receipt.</td><td>IMT</td><td>□</td></tr>
<tr><td>Ongoing if satellite imagery support requested by AMSA
Provide ad hoc satellite imagery as required to IMT and OSTM service provider within 4 hours of receipt.</td><td>IMT</td><td>□</td></tr>
<tr><td rowspan="3">Resources Required</td><td>Resource</td><td colspan="2">Available From: (Refer to Section 6.2)</td></tr>
<tr><td>2x Tracking buoys</td><td colspan="2">AMOSC</td></tr>
<tr><td>Fixed wing aircraft</td><td colspan="2">Supplier(s) as per the external services contracting strategy (Section 6.2)</td></tr>
</table>

1 NRMMC (Natural Resource Management Ministerial Council). (2005). The Australian National Guidelines for Whale and Dolphin Watching.

	Oil spill observers	AMOSC (core group through AMOSPlan)
	Ad hoc satellite imagery	AMOSC (via KSAT)
Escalation and Maintenance of Response	SapuraOMV will maintain an adequate level of surveillance to inform response planning and to gauge the effectiveness of response measures throughout an incident. SapuraOMV is capable of contracting on an as-needs basis tracking buoys, vessels, aircraft and oil spill observers to escalate and to maintain surveillance of the spill over the duration of an incident. Refer to the external services contracting strategy in **Section 6.2**.	
Termination Criteria	Oil source controlled. Surface water does not have an oiled appearance, specifically 'silver/grey' as per the Bonn Agreement Oil Appearance Code (BAOAC).	
Key Response Documents	• The OS1 sampling and anlaysis plan (SAP) provides guidance and a checklist for the IMT to support AMSA (if requested) surveillance of a spill • Operational and Scientific Monitoring Implementation Plan (OSMIP) • Operational and Scientific Monitoring Framework (OSMF)	
Environmental Performance Outcome	Provide IMT and regulatory authorities with reliable and timely tracking buoy location and surveillance observations to inform response planning and operations if requested by AMSA.	

Control Measure	Performance Standard	Measurement Criteria
Satellite Tracking Buoys	1x tracking buoy deployed from vessel within 1 hour of spill or as determined by Vessel Master. Another tracking buoy on the MODU can be deployed if and as required.	• Vessel storage logs confirm tracking buoys on-board MODU and support vessel(s) • Emails between IMT and AMOSC confirm start of tracking • Incident log records tracking buoys deployed • Web-based buoy tracking portal • Tracking buoy data archive
Aerial Surveillance	Aerial surveillance requested by IMT within 3 hours and initial survey within 24 hours (daylight permitting) with untrained observers and 48 hours with trained observers.	• IMT logs. • Flight logs. • Arrangement with AMOSC for core group access.
	Surveillance results made available within 1 hour of completion of flight and continued until termination criteria met.	• IMT logs. • Completed OS1 aerial observation data sheets or similar reporting. • Flight logs.
Satellite Imagery	Satellite imagery support provided *ad hoc* (as required) at frequency requested to track spill trajectory.	• Emails between IMT and AMOSC and/or OSRL. • Incident log. • Archive of satellite imagery.
	Provision of satellite imagery to OSTM service provider within 4 hours of receipt.	• Emails between IMT and OSTM service provider • Incident log indicates date and time of satellite imagery sent to OSTM provider
Refer to **EP Section 8.8** for Environmental Performance Outcomes, Performance Standards and Measurement Criteria relating to potential environmental risks from implementation of oil spill response.		

3.4.2 OS2: Oil Spill Trajectory Modelling (OSTM)

Oil Spill Trajectory Modelling (OSTM) is used to predict the transport and fate of hydrocarbon spills into the future (3-4 days) to inform response planning (operational) and potential impacts/risks to environmental receptors (scientific). SapuraOMV will initiate and maintain OSTM throughout a Level 2 MODU MDO spill incident. OSTM for a Level 2 vessel MDO spill will be managed by AMSA, the Control Agency for such an incident.

Table 3-7 OS2: OSTM for Level 2 MODU MDO spill

<table>
<tr><th colspan="4">OS2: Oil Spill Trajectory Modelling</th></tr>
<tr><td>Initiation Trigger</td><td colspan="3">Notification of a Level 2 MDO spill or if OS1 predicts exposure to shorelines.</td></tr>
<tr><td>Aim</td><td colspan="3">OSTM to forecast MDO distributions (3-4 days into the future) to inform response planning (operational) and to inform potential impacts/risks to environmental sensitivities (scientific).</td></tr>
<tr><td rowspan="3">Procedure</td><td>Required Timeframe and Action</td><td>Responsible</td><td>Tick if Complete</td></tr>
<tr><td>Within 3 hours – OSTM initiated through notification of OSTM service provider via Modelling Activation Form in Appendix B.</td><td>IMT</td><td>□</td></tr>
<tr><td>Ongoing – Provide daily OSTM forecasts to inform response planning, to evaluate effectiveness, and to plan operational and scientific monitoring.</td><td>IMT</td><td>□</td></tr>
<tr><td rowspan="2">Resources Required</td><td>Resource</td><td colspan="2">Available From: (Refer to Section 6.2)</td></tr>
<tr><td>OSTM Service Provider</td><td colspan="2">Supplier(s) as per the external services contracting strategy (Section 6.2)</td></tr>
<tr><td>Escalation and Maintenance of Response</td><td colspan="3">This response will be maintained through contractual assurances with OSTM service provider(s) via the external services contracting strategy to maintain services during an incident scenario.</td></tr>
<tr><td>Termination Criteria</td><td colspan="3">Oil source is controlled, and OSTM and other Monitor and Evaluate Plan activities predict that no further regions will be affected by the spill.</td></tr>
<tr><td>Key Response Documents</td><td colspan="3">• OS2 SAP provides guidance and a checklist for the IMT to rapidly initiate OSTM of a spill.
• OSMIP.
• OSMF.</td></tr>
<tr><td>Environmental Performance Outcome</td><td colspan="3">Provide IMT and regulatory authorities with reliable and timely OSTM predictions to inform response planning, operations and environmental impact/risk assessment.</td></tr>
<tr><td>Control Measure</td><td>Performance Standard</td><td colspan="2">Measurement Criteria</td></tr>
<tr><td rowspan="2">OSTM</td><td>OSTM commissioned within 2 hours of OS1 initiation.</td><td colspan="2">• Emails between IMT, and OSTM service provider show date and time of OSTM request
• Completed SAP OS2 initiation checklist</td></tr>
<tr><td>OSTM continues until spill source is controlled and no further regions affected by the spill.</td><td colspan="2">• IMT access-enabled web portal with quasi-real-time modelling results
• OSTM forecast report(s) to IMT</td></tr>
</table>

3.5 Scientific Monitoring Plan

The Operational and Scientific Monitoring Plan (OSMP) is comprised of an overarching Operational and Scientific Monitoring Framework (OSMF), a Kanga-1 exploration well Activity specific Operational and Scientific Monitoring Implementation Plan (OSIMP), and a library of Sampling and Analysis Plans (SAPs) as described in **Section 3.4**. The Monitor and Evaluate Plan is the operational monitoring component of the OSMP, and is designed to rapidly provide key information to inform/guide response planning and implementation during an incident (**Section 3.4**).

Of the thirteen scientific studies that comprise SapuraOMV's OSMP in **Table 3-8,** three will be initiated for a Level 2 MODU MDO spill or if operational monitoring of any spill predicts exposure to sensitive areas/receptors. The OSMIP provides performance outcomes, performance standards and measurement criteria for each of the scientific studies. **Table 3-8** provides the initiation triggers for each of the scientific studies, which are also in the OSMIP. Scientific monitoring for a vessel MDO spill will be managed by AMSA, the Control Agency for such an incident.

Table 3-8 OSMP scientific studies

Scientific Study	Initiation Trigger	Initiate for Level 2 Spill
SM01 Weathering Assessment	Not applicable.	No
SM02 Dispersant Effects on Subsurface Concentrations		
SM03 Ecotoxicology		
SM04 Marine Waters	Immediately for a **<u>Level 2</u>** MODU MDO spill or if operational monitoring predicts exposure to sensitive areas/ receptors.	Yes
SM05 Marine Sediments		
SM06 Subtidal and Intertidal Habitats	Not applicable.	No
SM07 Mangrove Habitat		
SM08 Turtle Nesting		
SM09 Marine Megafauna		
SM10 Marine Avifauna		
SM11 Hydrocarbons in Representative Commercial and Recreational Fish		
SM12 Marine Invertebrates		
SM13 Hindcast Modelling	After cessation of response activities for a **<u>Level 2 MODU MDO</u>** spill.	Yes

Table 3-9 Scientific monitoring plan for a Level 2 spill

Scientific Monitoring Plan			
Initiation Trigger	Notification of a Level 2 MODU MDO spill or if operational monitoring of any MODU MDO spill predicts exposure to sensitive areas/receptors.		
Aim	Characterise short (impact) and long-term (recovery) environmental effects from a Level 2 MODU MDO spill.		
Procedure	**Required Timeframe and Action**	**Responsible**	**Tick if Complete**
	Within 1 day of spill – Activate scientific studies SM04 (Marine Waters) and SM05 (Marine Sediments), if requested by AMSA.	IMT	☐
	Ongoing – Evaluate need for initiation of other scientific studies.	IMT	☐
	Ongoing – Implementation of the scientific monitoring program.	Scientific Monitoring Contractor(s)	☐
	After cessation of Monitor and Evaluate Plan (operational monitoring) – Carry our SM13 (Hindcast Modelling).	Scientific Monitoring Contractor(s)	☐
Resources Required	**Resource**	**Available From: (Refer to Section 6.2)**	
	Plant, equipment, personnel	Refer to SAPs of scientific studies for equipment needs and OSMIP for plant and personnel needs. Vessels to be sourced from call-off arrangements as per the external services contracting strategy (**Section 6.2**). Scientific personnel to be sourced from scientific monitoring supplier(s) as per the external services contracting strategy (**Section 6.2**).	
Escalation and Maintenance of Response	SapuraOMV will maintain an adequate level of scientific monitoring as required to characterise impacts and subsequent recovery from a Level 2 spill. Refer to the external services contracting strategy in **Section 6.2**.		
Termination Criteria	The short and long term environmental effects from the spill have been adequately characterised under endorsement by the Scientific Advisory Group (SAG)[2].		

[2] The SAG provides external review of scientific monitoring reports, and provide guidance regarding scientific monitoring including whether termination criteria have been satisfactorily met.

<table>
<tr><td>Key Response Documents</td><td colspan="2">SAPs provide guidance and a checklist for the IMT to initiate scientific monitoring
OSMIP
OSMF</td></tr>
<tr><td>Environmental Performance Outcome</td><td colspan="2">Demonstrated readiness to implement scientific monitoring programs that will identify the extent, severity and duration of environmental impacts in the event of an oil spill incident (including response activities).</td></tr>
<tr><td>Control Measure</td><td>Performance Standard</td><td>Measurement Criteria</td></tr>
<tr><td>Scientific Monitoring</td><td>Maintain capability to implement scientific monitoring program.</td><td>Environmental consultant capability review completed prior to each activity to demonstrate readiness to implement scientific monitoring studies.</td></tr>
<tr><td colspan="3">Refer to EP Section 8.8 for Environmental Performance Outcomes, Performance Standards and Measurement Criteria relating to potential environmental risks from implementation of oil spill response.</td></tr>
</table>

4. Ongoing Response

4.1 Incident Action Plan (IAP)

The IAP describes the ongoing response strategies and its efficient implementation on a strategic and tactical level as selected via an operational NEBA[3].

The initial IAP is to undertake the Immediate Actions as set out in **Section 3**.

The SapuraOMV IMT action planning process is based on the Incident Command System (ICS). A brief overview of the process to update the IAP is illustrated in **Figure 4-1**. This process will be used by the IMT to tailor the response to the Level 2 MODU MDO spill depending on the behaviour of the spill and effectiveness of the response measures.

Phase 1: Understand the situation

Gather information (Monitor and Evaluate Plan, responder feedback) to gain situational awareness

Phase 2: Establish incident objectives

Update IAP objectives to guide appropriate response measures

Phase 3: Develop the plan

i - Assess current response priorities and suitable response strategies
ii - Assess suitable response strategies by NEBA process
iii - Assess available response resources and need to increase/decrease to meet IAP objectives

Phase 4: Prepare and disseminate the plan

Compile plan and distribute/brief the plan once approved by IC

Phase 5: Execute, evaluate and revise plan

i - Brief the response team with command structures and tasks allocated
ii - Constantly evaluate the response strategies with feedback from onsite teams and information from the Monitor and Evaluate Plan
iii - Following comletion of operational phase or new information regarding behaviour of spill, recommence IAP process at phase 1.

Figure 4-1 IAP process

[3] Refer to **Appendix A** for a description of the strategic NEBA that served as a basis to select primary, secondary and rejected response strategies.

4.2 Oiled Wildlife Response (OWR) Plan (Secondary Response Strategy)

The OWR Plan includes pre-emptive capture or hazing of wildlife to prevent contact withhydrocarbons, treatment and rehabilitation of impacted wildlife and euthanasia of critically impacted wildlife individuals.

The decision to implement OWR during a Level 2 MODU MDO spill will be undertaken by the IMT with advice from Oiled Wildlife Advisors (OWAs) on the basis of operational monitoring information (i.e. OS1 Hydrocarbon Surveillance and Tracking) and the operational NEBA process.

For a Level 2 vessel MDO spill the decision to implement OWR will be made by AMSA. SapuraOMV will participate in OWR as directed by AMSA in a Support Agency role.

The WAOWRP (DPaW, 2014a) sets out the minimum standard for OWR in WA in both State and Commonwealth waters. The PROWRP (DPaW, 2014b) outlines specific 'on ground' information to carry out an OWR specific to this Pilbara. In the event that wildlife has been impacted or there is imminent threat of impact requiring OWR, the WAOWRP and PROWRP will be activated. A Wildlife Division Coordinator (WDC) will be established and will liaise with the IMT via the Planning Section Lead to identify and coordinate the necessary OWR functional units of the Oiled Wildlife Division (OWD), as per the WAOWRP. The OWAs and WDC will provide advice to the IMT on the level of OWR required and will ensure provision of resources to support OWR operations.

Table 4-1 OWR plan for Level 2 MODU MDO spill

OWR Plan			
Initiation Trigger	Selected as response measure by IMT through IAP process during a MDO spill		
Aim	• Safely and effectively capture oiled wildlife for treatment and rehabilitation and release; • Prioritise treatment of species of conservation value and carry out humane triage operations when necessary and resources are limited; and • Prevent (e.g. hazing) oiling of wildlife threatened by slicks.		
Procedure	**Required Timeframe and Action**	**Responsible**	**Tick if Complete**
	Ongoing - (Consideration of implementation of response strategy) – Implementation of response strategy considered during IAP process.	IMT	□
	Within 1 day of IMT decision to implement – Initiate mobilisation of OWAs through notification of DBCA and AMOSC.	IMT	□
	Within 1 day of IMT decision to implement – Request AMOSC to mobilise OWR initial response equipment situated in Exmouth and Broome, and containerised washing facility in Fremantle.	IMT	□
	Within 1 day of IMT decision to implement – Notify DoT Maritime Environmental Emergency Response (MEER) unit and DBCA that OWR equipment is being mobilised.	IMT	□
	Within 1 day of IMT decision to implement – Request AMOSC to establish Oiled Wildlife Division (OWD) and Wildlife Division Coordinator (WDC) as described in the WAOWRP and PROWRP.	IMT	□
	Within 1 week of IMT decision to implement t – Request AMOSC to mobilise trained OWR responders and resources as described in the WAOWRP and PROWRP.	IMT	□
	Ongoing[4] - Capture and treatment of offshore oiled wildlife (e.g. seabirds). Auditory hazing techniques may also be used for moving seabirds out of 'at risk' areas.	IMT	□

[4] Ongoing response will be implemented per the WAOWRP and PROWRP once activated and this specific response may or may not be required.

<table>
<tr><th colspan="3">OWR Plan</th></tr>
<tr><td>Net Benefit Assessment of Response</td><td colspan="2">If hazing likely to result in a net adverse impact then do not carry out.
If capture and rehabilitation causes a net impact (stress of capture causes increased mortality than presence of oil alone) then do not carry out.
Re-assess during incident.</td></tr>
<tr><td rowspan="10">Resources Required</td><td>Resource</td><td>Available From: (Refer to Section 6.2)</td></tr>
<tr><td>OWA and WDC</td><td>WA DBCA
AMOSC core group</td></tr>
<tr><td>Trained OWR (operations) personnel to act as field supervisors of OWR recovery and rehabilitation teams</td><td>AMOSC core group
WA SRT (escalation)</td></tr>
<tr><td>Support personnel</td><td>Supplier(s) as per the external services contracting strategy (Section 6.2)</td></tr>
<tr><td>DBCA and veterinarians</td><td>Guidance on basis of WAWORP and PROWRP for Western Australia</td></tr>
<tr><td>OWR kits</td><td>AMOSC at Broome and Exmouth</td></tr>
<tr><td>OWR container cleaning stations</td><td>AMOSC mobilised from Fremantle and Geelong</td></tr>
<tr><td>Support aircraft</td><td rowspan="3">Supplier(s) as per the external services contracting strategy (Section 6.2)</td></tr>
<tr><td>Support vessels</td></tr>
<tr><td>Waste contractor</td></tr>
<tr><td>Escalation and Maintenance of Response</td><td colspan="2">SapuraOMV has membership with AMOSC for OWR equipment as per the external services contracting strategy in Section 6.2. SapuraOMV can also request additional AMOSC resources through the AMOSPlan if required and requested by AMSA.</td></tr>
<tr><td>Termination Criteria</td><td colspan="2">AMSA in consultation with SapuraOMV terminate the response.</td></tr>
<tr><td>Key Response Documents</td><td colspan="2">Western Australian OWR Plan (WAOWRP) (DPaW, 2014a).
Pilbara Region OWR Plan (PROWRP) (DPaW, 2014b).</td></tr>
<tr><td>Environmental Performance Outcome</td><td colspan="2">Provide resources to support OWR strategies as directed by DBCA and AMSA.</td></tr>
<tr><td>Control Measure</td><td>Performance Standard</td><td>Measurement Criteria</td></tr>
<tr><td rowspan="3">OWR</td><td>Maintain AMOSC membership to ensure that equipment and personnel can be provided.</td><td>• AMOSC membership contract.</td></tr>
<tr><td>DBCA notified as soon as possible after sighting of oiled wildlife if such communications by IMT requested by AMSA.</td><td>• IMT records verify that verbal and/or written notification was provided to DBCA and AMSA as soon as possible after sighting.</td></tr>
<tr><td>AMOSC OWR equipment deployed to site within timeframes if requested by AMSA as directed by DBCA and AMSA.</td><td>• Incident records verify oiled wildlife response kits are deployed to site as directed by DBCA and AMSA.</td></tr>
<tr><td colspan="3">Refer EP Section 8.8 for Environmental Performance Outcomes, Performance Standards and Measurement Criteria relating to potential environmental risks from implementation of oil spill response.</td></tr>
</table>

5. Forward Operations

5.1 Marine Operations Base

The SapuraOMV IMT as a Support Agency may be requested by AMSA to manage part of the response to a Level 2 spill. Under such circumstances, and if SapuraOMV's role requires a Marine Operations Base, it will likely be located at Dampier. For a Level 2 spill, a relatively modest base is envisaged primarily to assist the IMT with the primary response strategies (i.e. support vessel to assist with source control of the vessel spill, vessel surveillance logistics, and operational and scientific monitoring logistics). In the event OWR is needed, the Marine Operations Base may also serve as a potential OWR centre.

If instructed by the IMT, the Marine Operations Base contractor (see **Section 6.2**) will assist SapuraOMV in the establishment, maintenance and removal of the Marine Operations Base, and will subcontract services to provide required services (e.g. catering facilities, power, ablutions). If required, a Waste Management Contractor (see **Section 6.2**) will set up the non-oily and oily waste management infrastructure, and associated logistics at the Marine Operations Base. Supplies to the Marine Operations Base will be provided by (or the responsibility of) the Marine Operations Base contractor (see **Section 6.2**).

5.2 Oiled Wildlife Response Centre

In addition to the AMOSC OWR container, OWR operations require significant space with freshwater supply, wastewater and solid waste handling, lighting, power, crib room and toilets. If required and requested by AMSA, the OWR Centre will be established and maintained initially at the Marine Operations Base. The PROWRP also identifies three potential locations in Karratha/Dampier that may be suitable for an OWR Centre. The OWR Centre will be established and supported by AMOSC initially via OWR kits located in Exmouth and mobilisation of an OWR container from Fremantle. AMSA also have an OWR kit and container that could be mobilised from Karratha.

5.3 Waste Transfer Station

Even though significant waste volumes are not anticipated to be generated (i.e. no substantive response efforts in terms of shoreline clean-up, offshore containment and recovery, and protection and deflection measures), if required and requested by AMSA a waste transfer station will be established at the Marine Operations Base by the Waste Management Contractor (see **Section 6.2**).

5.4 Logistical Considerations

Estimated travel times between the Marine Operations Base and Perth and the Activity's Operational Area are summarised in **Table 5-1** and ilustrated in **Figure 5-1**.

Table 5-1 Estimated travel times between Marine Operations Base in Dampier and Operational Area / Perth (hours)

Location 1	Location 2	Flight (~800 km/hr)	Road (~100 km/hr)	Vessel (~12 knots, ~22 km/hr)	Helicopter (~105, knots, ~195 km/hr)
Operational Area	Dampier	-	-	6	1
Perth	Dampier	2	16	-	-

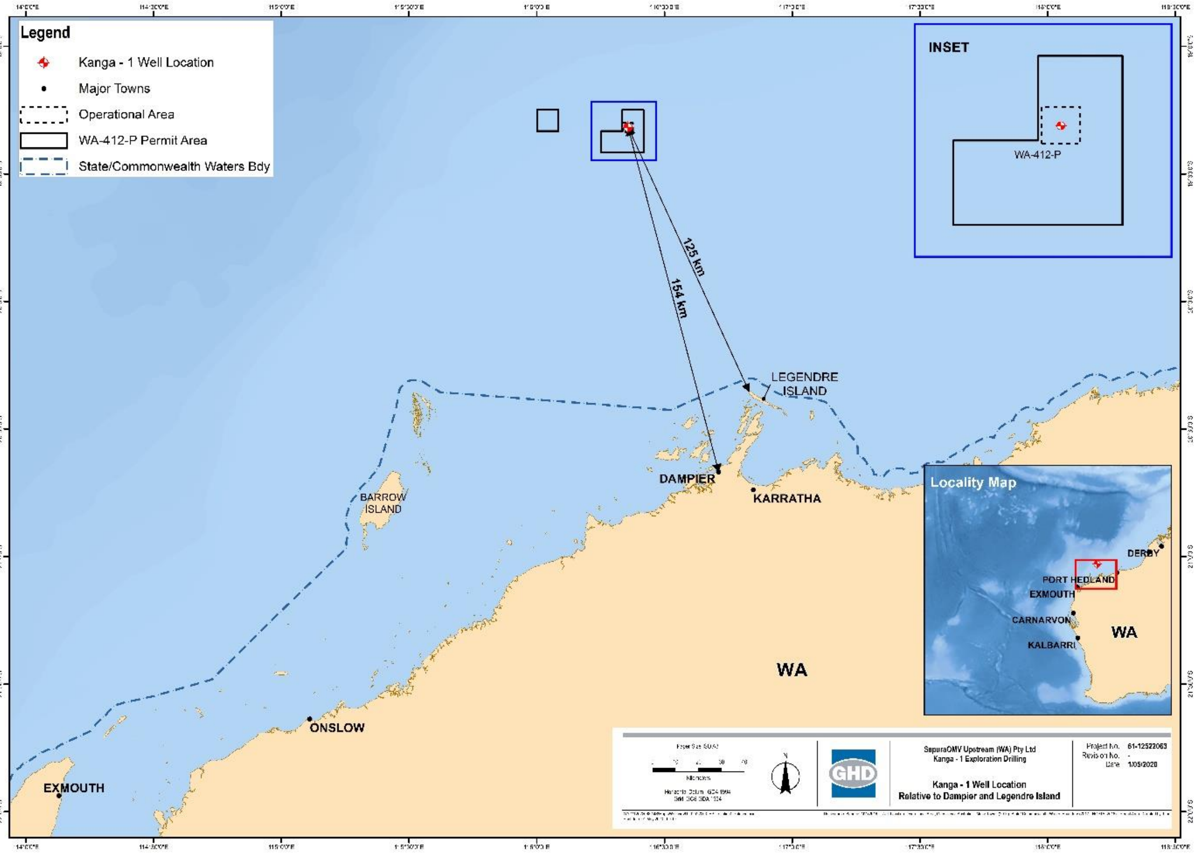

Figure 5-1 Distances between the operational area and the likely Marine Operations Base

6. OPEP Resourcing

6.1 Incident Management Team

Level 2 incidents will require specialist skills for a period of time. First response IMT manning will be fulfilled by personnel from SapuraOMV and other contracted organisations along with provision of additional support. The SapuraOMV duty roster is updated weekly. The IMT structure is designed to be scaleable according to the particular nature and response demands of the incident._As the modelling for a worst case MODU MDO spill indicates no exposure of State waters, nearshore areas or shorelines, expanded IMT resourcing is unlikely to be required for a MDO spill. The Kanga-1 OPEP for a Crude Oil Spill (Doc No AU-HSE-KG1-EX-PLN-027) describes the additional IMT resourcing available to SapuraOMV for the Kanga-1 drilling campaign.

6.2 External Services Contracting Strategy

A Level 2 spill may require deployment of spill response resources for a period of time. SapuraOMV resources primarily comprise the CMT (if activated) and key IMT roles. Most spill response resources (i.e. equipment, plant, people) will be obtained from third party contractors, industry support groups and government support agencies (collectively referred to as 'external services'). Key external services organisations, summary roles and service provision arrangements are provided in the external services contracting strategy in **Table 6-1**.

In the event of a Level 2 spill and activation of relevant external resources, the IMT will:

- Request and receive up to date equipment inventories from each contractor.
- Response personnel will be resourced as per the external services contracting strategy in **Table 6-1**.
- An up to date contact list will be maintained by SapuraOMV on their network and in hardcopy in the Emergency Control Centre (ECC) to rapidly mobilise OPEP resources in the event of a Level 2 incident.

6.3 Confirmation of Availability and Mobilisation of Spill Response Plan, Personnel and Equipment

Availability of spill response plant, equipment and personnel from external organisations (e.g. AMOSC) and mobilisation timeframes in this OPEP will be confirmed and related contracts/arrangements/agreements will be in place prior to the Kanga-1 exploration drilling campaign.

Table 6-1 External services contracting strategy

Scope of Work	Supplier/s	Contract Type	Contract	Specific	imeframe
Support vessels	Vessel contractors via Clarkson's.	A or B	Additional vessel call off option in-place with primary vessel supplier prior to start of drilling or contracted when required via Mutual Aid MoU or vessel brokers / direct..	Vessels to support following source control of a vessel-based spill (refer to **Section 3.3**).	As per **Section 3.3**.
Oil spill response vessels	Vessel contractors via Clarkson's.	A or B	Additional vessel call off option in place with primary vessel supplier prior to drillingor contracted when required direct from local suppliers.	Vessels to support following spill response efforts: • Scientific monitoring plan (refer to **Section 3.5** and **OSMIP**). • Oiled wildlife response (refer to **Section 4.2**). Transport personnel and equipment to/from remote locations, and response use in shallow, nearshore environments.	As per **Sections 3.5** and **4.2**).
- 2x satellite tracking buoys on MODU during the Activity. - Further tracking buoys to call-off as necessary	AMOSC service agreement	A and B	In-place 6 weeks prior to start of Activity.		As per **Section 3.4.1.**
Oil Spill Observers	AMOSC service agreement	B	In-place.	Trained observers and sampling of spilled oil and water column.	As per **Section 3.4.1.**
Helicopter services for spill monitoring	Helicopter provider(s) e.g. CHC Others as-qualified	A	In-place 6 weeks prior to start of Activity.	Dedicated helicopter will be available if not otherwise required for safety reasons.	As per **Section 3.4.1.**
Fixed-wing aircraft services for spill monitoring	Aircraft from qualified contractors.	B	Call off arrangement in place via primary aerial services provider.	Provision of aircraft for aerial observation.	As per **Section 3.4.1.**
Satellite imagery	AMOSC service agreement OSRL membership	B C	In-place In-place	May be accessed direct or via AMOSC.	As per **Section 3.4.1.**

Scope of Work	Supplier/s	Contract Type	Contract	Specific	imeframe
Oil Spill Trajectory Modelling	AMOSC service agreement	B	In-place	Provision of OSTM and 3D modelling during spill.	As per **Section 3.4.1.**
Scientific Monitoring personnel and equipment	Environmental consultancy	B	Access to trained personnel and equipment necessary for scientific monitoring via a dedicated scientific monitoring standby contract in-place prior to start of Activity.	Demonstrated capability and capacity to implement Scientific Monitoring Plan including: - nominated personnel with expertise in relevant disciplines that meet the minimum qualifications and experience requirements for key OSMIP roles - confirmed local (ie WA) resourcing (personnel and equipment) capacity sufficient to meet immediate OSMIP implementation requirements - experience coordinating and implementing scientific monitoring studies for oil and gas operators in WA.	As per **Section 3.4.2**.
Oiled wildlife response (OWR) personnel, kits, container	AMOSC service agreement OSRL membership WA DBCA (via WA State Hazard Plan) AMSA (via National Plan	B C E E	In-place In-place N/A N/A	Trained in the implementation of oiled wildlife response plan including long-term care, relocation and remediation of marine fauna.	As per **Section 4.2**.
Waste management equipment and services.	Licensed waste management contractor	A	In-place 6 weeks prior to start of Activity.	Set up secure temporary waste storage/laydown areas at marine operations base, manage collection, transport and delivery of wastes to licensed facilities, and maintain all relevant waste documentation. Waste will include non-hazardous and potentially hazardous solid and liquid wastes.	As-per **Sections 5.1** and **5.3**.
Mainland transport Contractor	Logistics and transport contractor	B	In-place prior to start of Activity.	Vehicles and drivers (with controlled waste licences), hotshot services, transport of personnel mobilised during response.	Immediate.
Marine Operations Base.	Toll	A	In-place 6 weeks prior to start of Activity.	Likely established at primary supply port (Dampier) Storage, laydown and biosecurity areas, forklifts, office space warehouses, lifting equipment, cleaning and servicing facilities.	Immediate.

Scope of Work	Supplier/s	Contract Type	Contract	Specific	imeframe
Contract Type					
A: SapuraOMV dedicated contract					
B: SapuraOMV call-off agreement					
C: SapuraOMV global call-off agreement					
D: Assignment from other titleholders/operators					
E: No contract arrangement needed					

7. Termination Strategy

The decision to terminate the spill response will be made by the Control Agency. The decision to terminate spill response strategies will be made with consideration of the following:

- The effectiveness and environmental benefit of the current response activities.
- The significance of any impacted environmental receptors.
- The potential for further spills/leaks.
- The potential for additional environmental damage caused by ongoing clean-up activities.
- An assessment of prevailing weather conditions that has the potential to cause increased risk to response teams or to increase the efficacy in weathering hydrocarbons.
- Termination criteria, as adopted by the Control Agency have been met.

The Control Agency IC will ensure that all relevant organisations, stakeholders and personnel are notified to stand down once the decision to terminate or the termination criteria have been satisfied.

8. OPEP Administration

8.1 OPEP Custodian

Name: Senior HSE Specialist, HSE Department

Address: SapuraOMV Upstream (WA) Pty Ltd
Level 2, 251 St Georges Terrace
Perth, WA 6000

Telephone: 08 6118 4990 (office)

Email: kanga.australia @sapura-omv.com

8.2 OPEP Custodian Responsibilities

The OPEP custodian is responsible for:

- Distribution and tracking copies of the OPEP.
- Monitoring associated response plans (i.e. NatPlan, WA State Hazard Plan-MEE, WAOWRP) and other related resources for material changes, and ensuring spill response activities meet requirements/guidelines.
- Accepting, assessing and collating any requests for revision of the OPEP.
- Making revisions to the OPEP.
- Maintaining an up to date digital version of the OPEP and a copy of the OPEP as currently issued.
- Issuing updates for revised sections of the OPEP.
- Submission of revisions of the OPEP to NOPSEMA in accordance with Regulation 14 (8AA) (refer to Section 8.3 below).

8.3 OPEP Review and Update

This OPEP will be reviewed and updated as necessary in response to one or more of the following:

- When major changes occur that may affect the spill response coordination or capabilities.
- Changes to the EP that affect spill response coordination or capabilities (e.g. a significant increase in spill risk).
- Following routine testing of the OPEP if improvements are identified.
- After an actual Level 2 incident.

The OPEP custodian (or delegate) will review the OPEP in accordance with SapuraOMV HSE procedures and relevant statutory requirements.

Any significant changes in the content of the OPEP or capability to respond to an incident will be captured through SapuraOMV's Management of Change (MoC) Standard (refer to **EP Section 9.4.4**). SapuraOMV will submit a revised OPEP to NOPSEMA as soon as practicable where there are significant changes to the content of the OPEP or capability to respond to an incident.

8.4 Maintenance of the OPEP

SapuraOMV will submit a revised OPEP to NOPSEMA as soon as practicable where there are significant changes to the content of the OPEP or capability to respond to an incident. Any significant changes in the content of the OPEP or capability to respond to an incident will be captured through SapuraOMV's Management of Change (MoC) procedure (refer to Section 9.4.4 of the EP for further information).

8.5 OPEP Training

All crew onboard the vessels will be trained (inducted) in the application of the vessel's SOPEP. Regular SOPEP drills and exercises are typically carried out on vessels in accordance with their SOPEP to maintain crew knowledge of response equipment and incident response procedures. This verifies emergency response efficiency, effectiveness of procedures and detects any failure in equipment. These drills include, but are not limited to spill response, collision, grounding, fire and explosion. All drills are documented, debriefings held, and corrective actions identified (including revisions to the SOPEP) and tracked to completion by the Vessel Master.

All nominated personnel in this OPEP will be trained to an appropriate level to undertake their role in its implementation. Classroom training will be supported by drills and exercises to ensure that competencies are maintained.

SapuraOMV staff receive spill response training commensurate for their nominated OPEP roles as listed in **Table 8-1** where:

- IMO is the International Maritime Organisation ranking for oil spill response training.
- IPIECA is the Incident Management System SapuraOMV has adopted.
- The relevant training levels/courses are aligned with the Australian PMA Chemical, Hydrocarbons and Refining Training.

This OPEP relies on the supply of trained observers from other organisations (e.g. AMOSC, AMSA) therefore SapuraOMV will not be responsible for their training. Competency requirements for key roles associated with OSMP implementation are detailed in the OSMIP (Doc No AU-HSE-KG1-EX-PLN-038). A briefing on the Bonn Agreement oil appearance code (BAOAC) will be provided to relevant response personnel that can assist with the initial assessment of a spill in the event of an incident.

Table 8-1 Training requirements for IMT and ERT oil spill response personnel

<table>
<tr><th>Team</th><th>Oil Spill Response Position</th><th>Minimum Training Level Course</th></tr>
<tr><td rowspan="8">IMT</td><td>Incident Commander</td><td>IMO 3 / PMAOMIR418 or ICS300</td></tr>
<tr><td>Operations Section Chief</td><td rowspan="7">PMAOMIR320 / 322 (or equivalent to ICS300), oil spill response training equivalent to IMO II</td></tr>
<tr><td>Logistics Section Chief</td></tr>
<tr><td>Finance Section Chief</td></tr>
<tr><td>Planning Section Chief</td></tr>
<tr><td>Safety Officer</td></tr>
<tr><td>Liaison Officer</td></tr>
<tr><td>Public Information Officer</td></tr>
<tr><td>ERT</td><td>Vessel Crew</td><td>Vessel SOPEP and response equipment</td></tr>
</table>

8.6 OPEP Testing

Most of the spill response testing and exercises outlined in Section 8.6 of the Kanga-1 OPEP for a Crude Oil Spill (Doc No AU-HSE-KG1-EX-PLN-037) are also relevant to this OPEP. Additionally, a desktop exercise to specifically validate this OPEP will occur 2 months prior to the commencement of the Activity or in the event that the OPEP is significantly amended. A Level 2 MODU MDO spill incident desktop exercise will be used to validate the effectiveness of oil spill incident response to simulate the first several hours of an incident. It is anticipated that local (Perth) staff and contractors will partake in the exercise along with key external OPEP contractors. Any improvements identified during the exercise will be incorporated into the OPEP.

9. References

AMOSPLAN Ver.14.01, Australian Maritime Oil Spill Centre (AMOSC).

Australian Marine Safety Authority (AMSA) Technical Guidelines for Preparing Contingency Plans for Marine and Coastal Facilities (2015).

Bonn Agreement Oil Appearance Code (2004) Annex A of the Bonn Agreement Aerial Surveillance Handbook.

CSIRO (2016) Oil Spill Monitoring Handbook. Editors S. Hook, G. Batley, M. Holloway, P. Irving and A. Ross.

Department of Transport (2018). Western Australia State Hazard Plan for Maritime Environmental Emergencies. (An amalgamation of the Westplan-MOP and the Westplan-MTE). Version 0.1.01. December 2018. Available at: https://www.transport.wa.gov.au/mediaFiles/marine/MAC_P_StateHazardPlanMaritimeEnviroEmergMEE.pdf

Department of Parks and Wildlife (DPaW) (2014a). Western Australian Oiled Wildlife Response Plan (WAOWRP). Version 1.1, 18/08/2014. Available at: https://www.dpaw.wa.gov.au/management/marine/marine-wildlife/marine-wildlife-response?showall=&start=2

Department of Parks and Wildlife (DPaW) (2014b). Pilbara Region Oiled Wildlife Response Plan (PROWRP). Version 1.1, 27/10/2014. Available at: https://www.dpaw.wa.gov.au/management/marine/marine-wildlife/marine-wildlife-response?showall=&start=2

[GHD] GHD Pty Ltd (2020). Kanga-1 Geophysical and Geotechnical Survey EP Marine Diesel Oil Spill Modelling Report. April 2020. Report to SapuraOMV Upstream (Western Australia).

National Plan for Maritime Environmental Emergencies (NatPlan). Australian Maritime Safety Authority (AMSA),

Appendix

Appendix A

Preliminary NEBA and ALARP Justification for OPEP Response Strategies

A1 Source of Risk

The Kanga-1 Exploration Drilling EP has identified credible worst case MDO spill scenarios as:

- **Level 2 vessel collision MDO spill**: Vessel collision with a surface MDO spill from a vessel's ruptured fuel tank of 200 m^3 (**EP Section 8.2**).
- **Level 2 MODU refuelling MDO spill**: Refuelling incident with a surface MDO spill during bunkering operations of 32 m^3 (**EP Section 8.3**).
- **Level 1**: Small spills with a worst case surface release of up to 10 m^3 (**EP Section 8.4**).

A2 Strategic NEBA of Potential Response Strategies

The overall aim of spill response is to effectively mitigate damage to the environment. Not all potential spill response strategies may be environmentally effective for a particular spill. This section describes a strategic NEBA undertaken across potential spill response strategies for a Level 2 credible worst-case spill scenario for this Activity (**Table A-1**). The NEBA evaluates each potential spill response strategy on the following criteria: environmental benefit(s), environmental risk(s)/impact(s), and operational constraints. If a response strategy is considered applicable, then its appropriateness as a primary or secondary response strategy is evaluated. This strategic NEBA employed the following process:

- List the available potential response strategies for the Level 2 spill.
- Identify the benefit, environmental impact(s)/risk(s) and operational constraints of each response strategy.
- Evaluate the applicability of each response strategy for a Level 2 credible worst case scenario.
- Identify applicable strategies for a Level 2 credible worst case scenario.

The response strategies are further delineated as:

- Primary response strategies are to be used as soon as possible in the event of a spill.
- Secondary response strategies are to be implemented if needed and when practicable with net environmental benefit.
- Not applicable (N/A) response strategies.
- Rejected response strategies due to lack of net environmental benefit.

In the event of an oil spill, operational NEBAs will be undertaken by the Incident Management Team (IMT) during the ongoing Incident Action Plan (IAP) process to evaluate response options that have a net environmental benefit (**OPEP Section 4.1**). Hence, the combination of spill response strategies and their implementation may evolve over time as conditions change on the basis of these operational NEBAs.

Table A-1 Strategic NEBA of potential response strategies for Level 2 spill

Spill Response Strategy	Overview of Environmental Benefits	Associated Environmental Risks	Operational Constraints	Response Applicability	Primary or Secondary Response	Justification Note
Source Control – Secondary Containment	Limit MDO/MGO spill (e.g. transfer from leaking tank) to reduce potential impacts to sensitive receptors.	No significant impacts.	Health and safety considerations may delay implementation under certain circumstances.	Yes	Primary	Will be the immediate primary response to limit further spill of oil to environment.
Source Control – SOPEP	Limits spill of MDO/MGO to environment using applicable strategies for reducing volumes of hydrocarbon released as stated in the SOPEP.	No significant impacts.	Health and safety considerations may delay implementation under certain circumstances.	Yes	Primary	Will be the immediate primary response to limit further spill of MDO/MGO to environment.
In-situ Burning	Combustion of oil on sea surface reduces the volume remaining on the surface. Generates modest waste products for recovery and disposal.	Generate highly visible smoke, particulates and atmospheric emissions including greenhouse gases. Incomplete combustion residues that have marine toxicity and can physically impact marine biota (e.g. coating of gills and feathers). Smoke particulates have associated health risks. Vessel-based impacts/risks (e.g. routine discharges, marine fauna collision).	Need thick oil film for ignition/ combustion (5-10 mm). Availability of fireproof booms. Never carried out in Australia; limited experience nationally. Ignition of oil requires specialist training and equipment. Calm conditions required for safe and controlled burning [wind limited to 10 kts, and wave height <1 m (IPIECA-IOGP, 2015) [5]].	No	Reject	Mobilisation time too long to burn oil of sufficient thickness due to natural dispersion after short spill release period. No predicted impacts/risks to nearshore and/or shoreline environmental sensitivities.
Monitor and Evaluate (Operational Monitoring)	Spill monitoring required for real-time decisions to identify emerging	Vessel- and aircraft- based impacts/risks (e.g. routine discharges, marine fauna collision, noise emissions).	Visual observations at night or during poor weather restricted. Stringent safety requirements for aerial and marine operations.	Yes	Primary	Surveillance activities ensure constant monitoring and evaluation of the spill.

5 IPIECA-IOGP (2015). Dispersants: Subsea Application. Good Practice Guidelines for Incident Management and Emergency Response Personnel. IOG Report 533.

Spill Response Strategy	Overview of Environmental Benefits	Associated Environmental Risks	Operational Constraints	Response Applicability	Primary or Secondary Response	Justification Note
	environmental risks, plan spill response, and assess response effectiveness		Coordination of multiple vessels/ aircraft in limited area (SIMOPS).			
Dispersant Application	Accelerates breakup of surface oil thereby reducing potential impacts to surface (e.g. seabirds) and shoreline (e.g. mangroves) receptors. Reduction in onshore hydrocarbon waste disposal.	Add chemical (dispersant) to environment when spill may not greatly impact environmental receptors. Vessel- and aircraft- based impacts/risks (e.g. routine discharges, marine fauna collision, noise emissions). No removal of hydrocarbons from environment. Increased subsurface hydrocarbon concentrations.	Dispersant application for MDO/MGO spills not overly effective. Insufficient mobilisation time for episodic release.	No	Reject	Mobilisation time too long to apply dispersant on oil of sufficient thickness due to natural dispersion after short spill release period. No predicted impacts/risks to nearshore and/or shoreline environmental sensitivities.
Mechanical Dispersion	Enhances dispersion and break-up of surface hydrocarbons to facilitate natural degradation processes.	Increased subsurface oil concentrations. Vessel-based impacts/risks (e.g. routine discharges, marine fauna collision).	Vessel propellers do not cavitate so inefficient at breaking up slicks. OHS risks through ignition or inhalation of vapours. Small oil droplet size required otherwise resurfaces, so limited benefit for some oils unless combined with dispersant application.	No	Reject	No predicted impacts/risks to nearshore and/or shoreline environmental sensitivities.
Containment and Recovery	Contain spill as close as possible to the source. Reduce spread of surface oil and thereby risks to sensitive receptors. Removal of oil from the environment.	Vessel-based impacts/risks (e.g. routine discharges, marine fauna collision). Recovered oil waste and oily water. Oily waste from contaminated booms and response vessels.	Require low currents (<0.5 m/s) and waves that limit operability in Operational Area. Require minimum slick concentration of 10 g/m^2. Logistics, equipment and labour intensive.	No	Reject	Mobilisation time too long to implement containment and recovery response on oil of sufficient thickness due to natural dispersion after short spill release period. No predicted impacts/risks to nearshore and/or shoreline environmental sensitivities.

Spill Response Strategy	Overview of Environmental Benefits	Associated Environmental Risks	Operational Constraints	Response Applicability	Primary or Secondary Response	Justification Note
Shoreline Protection and Deflection	Protect nearshore and shoreline target receptors by deflecting oil to lower priority areas.	Vessel-based impacts/risks (e.g. routine discharges, marine fauna collision). Anchoring risks/impacts on seabed habitat to secure booms. Oily waste from contaminated booms and response vessels. Potential impacts/risks to nearshore and shorelines habitats to which oil deflected.	Low winds, waves and surface currents needed for boom operations of booms in nearshore environments. Require minimum slick concentration of 10 g/m^2 in proximity to shoreline. Logistics, equipment and labour intensive.	No	Reject	Mobilisation time too long to implement containment and recovery response on oil of sufficient thickness due to natural dispersion after short spill release period. No predicted impacts/risks to nearshore and/or shoreline environmental sensitivities.
Shoreline Clean-up	Shoreline oil removal to reduce environmental impacts/risks. Reduce aesthetic impact. Reduce impacts/risks of oil re-entrainment from shoreline into marine environment.	Potential disturbance to shoreline habitats (e.g. turtle nesting) from operations (e.g. trampling by personnel and equipment) may outweigh environmental benefits in some circumstances, and natural passive reduction (e.g. biodegradation, photo-oxidation) preferred. Disposal of large volumes of oily sediment and water waste. Temporary storage of waste may contaminate areas not contacted by the spill. Response (personnel, equipment, staging areas) increase risk of cross contamination from impacted to non-impacted sites.	Logistics and labour intensive, including waste management considerations. Personnel management and coordination to reduce environmental and safety risks/impacts. Applicability influenced by shoreline characteristics (e.g. substrate type; exposure to wave action; biological, social, heritage or economic values), amount of oiling and site access.	No	Reject	No predicted impacts/risks to nearshore and/or shoreline environmental sensitivities.

Spill Response Strategy	Overview of Environmental Benefits	Associated Environmental Risks	Operational Constraints	Response Applicability	Primary or Secondary Response	Justification Note
Oiled Wildlife Response	Reduce impacts to wildlife (e.g. onshore exclusion barriers, hazing, pre-emptive capture). Collection and rehabilitation of oiled wildlife and return to similar suitable habitat.	Vessel-based impacts/risks (e.g. routine discharges, marine fauna collision). Hazing can accidentally drive wildlife into spills or separate groups/individuals (e.g. parents/ offspring pairs). Potential for fauna injury due to inappropriate collection/ handling during pre-emptive and post-oiled capture. Rehabilitation activities could result in inadequate/ inappropriate animal handling leading to stress/ injury/ death. Inappropriate fauna relocation leads to disorientation/ stress.	Logistics and labour intensive. Calm conditions necessary for capture operations. May require navigation of multiple vessels within a small area. Availability of suitable space/ location to handle rehabilitation and fauna treatment. Utilisation of skilled veterinarians for treatment of oiled wildlife.	Yes	Secondary	Applicable as a secondary response strategy if surveillance and tracking of the spill identifies oiled wildlife. Spill predicted to be solely in offshore waters, so seabirds at greatest risk for a short duration.
Scientific Monitoring	Determine extent, severity and persistence of environmental impacts and subsequent recovery of an oil spill.	Vessel-based impacts/risks (e.g. routine discharges, marine fauna collision).	For a Level 2 spill Monitor and Evaluate Plan to inform Scientific Monitoring design given nature of spill as a discrete slick from a short release duration incident.	Yes	Primary	Though the spill is predicted to occur solely in offshore waters, evaluation of marine water and sediment quality along the slick trajectory to be carried out, and impacts will be further characterised from hindcast modelling of the incident.

A3 ALARP Demonstration for Control Measures of Selected Response Strategies

The ALARP principle (**EP Section 6.6**) is applied to potential control measures of the selected spill response strategies from the preliminary NEBA in **Section A2**. An overview of the ALARP demonstration process of each potential response strategy's control measure is outlined in **Table A-2**, and a summary of the assessment is provided in **Table A-3**.

Table A-2 Overview of ALARP demonstration for potential control measures associated with response strategies

<table>
<tr><th>Column Title</th><th colspan="3">Description</th></tr>
<tr><td>Control Measures</td><td colspan="3">A potential control measure of the response strategy.</td></tr>
<tr><td>Hierarchy of Control (HOC)</td><td colspan="3">Hierarchy of control category of the control measure.</td></tr>
<tr><td>Rationale</td><td colspan="3">Why is the control measure for the response strategy under consideration?</td></tr>
<tr><td>Environmental Benefit</td><td colspan="3">What environmental benefit is derived from the control measure?</td></tr>
<tr><td rowspan="8">Effectiveness</td><td colspan="3">What is the effectiveness of the control measure in terms of functionality, availability, reliability, survivability, independence and compatibility?</td></tr>
<tr><td rowspan="2">Criteria</td><td colspan="2">Effectiveness Ranking</td></tr>
<tr><td>Low</td><td>High</td></tr>
<tr><td>Availability</td><td>SapuraOMV has no external arrangement or internal processes in place to expedite timely provision of equipment/ resources.</td><td>SapuraOMV has equipment/resources on standby, and/or contracts, arrangements, or MOU's in place for provision of equipment/resources.</td></tr>
<tr><td>Functionality</td><td>Control measure does not materially reduce risk/ impact.</td><td>Control measure does materially reduce risk/ impact.</td></tr>
<tr><td>Reliability</td><td>Control measure not tested in Australian waters and/or low assurance assigned to success rate.</td><td>Control measure has been tested in Australian waters and/or high assurance assigned to success rate.</td></tr>
<tr><td>Survivability</td><td>Control measure has low operational timeframe and will need to be replaced regularly to maintain effectiveness.</td><td>Control measure has a high operational timeframe and will not need to be replaced regularly to main effectiveness.</td></tr>
<tr><td>Independence/ Compatibility</td><td>Control measure is reliant on other control measures in place and/or is not compatible with other control measures in place.</td><td>Control measure is not reliant on other control measures in place and/or can be implemented with other control measures.</td></tr>
<tr><td>Implement Time</td><td colspan="3">How soon could the control measure be implemented?</td></tr>
<tr><td>Cost/ Effort</td><td colspan="3">What is the cost to implement the control measure during the Activity?</td></tr>
<tr><td>ALARP Summary</td><td colspan="3">Accept or reject control measure on basis of ALARP.</td></tr>
</table>

Table A-3 ALARP demonstration of potential control measures for selected response strategies

Key: A: Availability; F = Functionality, R: Reliability; S = Survivability; IC: Independence/ Capability.

Control Measures	HOC	Rationale	Environmental Benefit of Implementing Response	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
Source Control – Vessel Spill (Primary Strategy)							
No source control of vessel source.	N/A	Do nothing option.	None	N/A	N/A	Nil	**Reject** – Source control from Level 2 vessel spills required.
Spill response in accordance with vessel SOPEP.	Administrative	Legislative requirement of MARPOL Annex I (Prevention of Pollution by Oil).	Rapid vessel spill response	**A, F, R, S, IC:** High.	<2 hours	Minor	**Accept** – Control measure legislative requirement. Effective and minor cost implications.
Spill clean-up equipment tested, maintained and available on vessel.	Administrative	Legislative requirement of MARPOL Annex I (Prevention of Pollution by Oil).	Rapid vessel spill response	**A, F, R, S, IC:** High.	Immediate and ongoing	Minor	**Accept** – Control measure legislative requirement. Effective and minor cost implications.
Monitor and Evaluate (Operational Monitoring) (Primary Strategy)							
No monitoring and evaluation of the spill	N/A	Do nothing option.	None	N/A	N/A	Nil	**Reject** – Monitor and evaluate (operational monitoring) strategy required to inform response planning and to assess response effectiveness.
Monitor and evaluate operations managed by IMT through IAP process and guided by Operational and Scientific Monitoring Plan (OSMP).	Administrative	Information to plan and to monitor spill and response measures.	Knowledge of spill and evaluation of response measures to inform spill response.	**A, F, R, S, IC:** High.	Immediate and ongoing.	Minor	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.

Control Measures	HOC	Rationale	Environmental Benefit of Implementing Response	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
Quasi-real-time Oil Spill Trajectory Modelling (OSTM) predictions to support operational NEBA during IAP process.	Administrative	Predicted spill trajectory, response effectiveness and risks to environmental receptors.	Forecast spill behaviour to manage response and identify sensitive receptors at risk.	**A, F, R, S, IC:** High.	<2 hours to initiate.	Minor	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.
Initial observations and reporting by support vessel crew.	Administrative	Provision of basic information (location, weather and spill character) to inform initial response.	Early indication of spill direction to target immediate response and establish situational awareness.	**A, F, R, S:** High. **IC:** Low (dependent on safety considerations).	Immediate.	Minor	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.
Spill tracking buoy on support vessel.	Administrative	Tracking buoy deployed during Level 2 spill to track spill movement and gain situational awareness.	Track spill movement to target response and maintain situational awareness.	**A, F, R, S, IC:** High	Immediate	Minor	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.
Provision of satellite imagery.	Administrative	Quasi-real-time imagery to inform IMT of spill location and size.	Inform IMT IAP process to target response to yield greatest environmental benefit.	**A, F, R, S, IC:** High.	<24 hours for acquisition of first image.	Minor	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.
Aerial monitoring by trained observers (AMOSC) in AMSA NatPlan fixed-wing aircraft.	Administrative	Fixed-wing aircraft and trained observers improve spill surveillance.	Ongoing spill surveillance to inform spill response.	**A, F, R, S, IC:** High.	Subject to aircraft and personnel availability, but ~24 hours.	Minor	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.
Dedicated monitoring plant, equipment and personnel on call-off arrangement.	Administrative	Dedicated monitoring resources improve spill monitoring.	Ongoing spill monitoring to inform spill response.	**A, F, R, S, IC:** High.	Subject to vessel and personnel availability, but <2 days from call-off.	Minor	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.

Control Measures	HOC	Rationale	Environmental Benefit of Implementing Response	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
Trained observers, and dedicated equipment and plant on standby for aerial- and/or vessel-based surveillance.	Administrative	Decrease response time for plant (aircraft, vessels) and trained observers improve spill surveillance.	Ongoing spill monitoring to inform spill response.	**F, R, S, IC:** High. **A:** Low (trained observers [AMOSC] typically have fulltime jobs and may not be released for standby).	24 hours to get airborne or depart port with standby observers.	Standby costs of ~>$1M to maintain plant and trained observers.	**Reject** – Control measure costs grossly disproportionate to the limited environmental benefit.
Oiled Wildlife Response (Secondary Strategy)							
No oiled wildlife response (OWR).	N/A	Do nothing option.	None.	N/A	N/A	Nil	**Reject** – The OWR strategy is mandatory to mitigate impacts/risks to marine fauna.
OWR operations managed by IMT through IAP process.	Administrative	OWR operations directed to situations with a net environmental benefit.	Positive (greatest) environmental benefit from OWR to be based upon information (situational awareness) to inform wildlife collection.	**A, F, R, S, IC:** High.	Immediate and ongoing.	Minor	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.
AMOSC membership for OWR personnel.	Administrative	Access to range of oiled wildlife response personnel from AMOSC.	Ability to treat oiled wildlife with appropriate personnel and equipment.	**A, F, R, S, IC:** High.	<2 days	Moderate	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.
Equipment for OWR available Perth, Geelong and Broome via AMOSC.	Administrative	Wildlife treated on mainland or other site(s) where mobilised container(s) resides.	Ability to treat oiled wildlife, and triage when appropriate.	**A, F, R, S, IC:** High.	<24 hours for triage equipment. <2 days for Perth container with mobilisation.	Moderate	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.

Control Measures	HOC	Rationale	Environmental Benefit of Implementing Response	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
OWR implementation (e.g. establishing work areas) to follow pre-designated plans of WAOWRP and PROWRP.	Administrative	Reduce potential impacts to sensitive receptors be avoiding areas of environmental sensitivity.	Ability to treat oiled wildlife, and triage when appropriate.	**A, F, R, S, IC:** High.	Immediate and ongoing.	Minor	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.
Equipment for OWR (and triage) available (pre-positioned) at strategic locations.	Administrative	Wildlife treated at strategic locations where standby container(s) resides.	Ability to treat oiled wildlife in proximity to pre-positioned sites rapidly.	**F, R, S, IC:** High. **A:** Low (AMOSC cannot provide container on standby, must purchase with long lead times).	<1 day for equipment and personnel.	Not available through AMOSC. Procure and maintain container >$50,000.	**Reject** – Control measure grossly disproportionate to the limited environmental benefit.
Scientific Monitoring (Primary Strategy)							
No scientific monitoring of the spill.	N/A	Do nothing option.	None	N/A	N/A	Nil	**Reject** – Scientific monitoring response strategy required to quantify spill impacts and subsequent recovery.
Scientific monitoring managed by IMT through IAP process, guided by Operational and Scientific Monitoring Plan (OSMP) and the Scientific Advisory Group (SAG).	Administrative	Ensure monitoring information acquired to monitor effectiveness of spill response. Ensure scientific objectives (characterise impacts and subsequent recovery) are met.	Understand impacts to sensitive environmental receptors from the spill and response, and subsequent recovery.	**A, F, R, S, IC:** High.	Immediate and ongoing.	Minor	**Accept** – Control measure practicable and effective, and not disproportionate to environmental benefit.
Call-off arrangements in place for scientific monitoring.	Administrative	Readiness to implement scientific monitoring.	Ability to monitor spill impacts and recovery of	**A, F, R, S, IC**: High.	<1 day initiate mobilisation.	Minor	**Accept** – Control measure practicable and effective, and not

Control Measures	HOC	Rationale	Environmental Benefit of Implementing Response	Effectiveness	Implement Time	Cost/ Effort	ALARP Summary
			sensitive receptors.		<7 days monitoring implementation.		disproportionate to environmental benefit.
Scientific monitoring personnel, plant and equipment on standby.	Administrative	Reduce response time to initiate scientific monitoring.	Marginal increase in ability to monitor sensitive receptors prior to hydrocarbon contact relative to non-standby arrangement.	**A, F, R, S, IC:** High.	<6 hours initiate mobilisation. <3 days monitoring implementation	>$1M	**Reject** – Control measure is grossly disproportionate compared to limited environmental benefit.

Appendix B

OSTM Activation Form

RPS APASA

OIL SPILL TRAJECTORY MODELLING REQUEST	Email completed form to RPS APASA response staff response@apasa.com.au After sending this request, phone Duty Officer on telephone number provided.

Priority of Request: ☐ **Urgent** ☐ **Exercise** Date and Time of Request:

Incident Name	
Name of requesting person and position in response	Contact telephone number
Email address for model output (preferred method)	Fax number for receipt of model output

Surface or Subsurface spill?	If subsurface spill, describe the spill source.
Surface ☐	☐ Low Turbulence (eg. Low Pressure Pipeline Leak)
Subsurface ☐	☐ Medium Turbulence (eg. Intermediate Pressure Pipeline Leak)
Depth of spill (m)	☐ High Turbulence (eg. Well Blowout under pressure, or ruptured pipeline under pressure)

Spill Start Date			Spill start time (use 24 hour clock, state time zone – GMT or Local)	Requested Simulation Length (hrs)
Day	Month	Year		

Oil Name:	Oil Type: *Bunker C, Diesel Fuel, Crude, Condensate*

Spill location (select one format)	Latitude of spill (N)	Longitude of spill (E)
Degrees, minutes & seconds	° ' "	° ' "
Degrees, minutes & decimal minutes	° . '	° . '
Degrees, minutes & decimal minutes	. °	. °
Easting & Northing (Zone)	S/N	E/W

Instantaneous spill ☐	Amount	(select one)	☐ Tonnes ☐ Cubic Metres ☐ Litres ☐ Barrels
Continuous spill ☐	Duration (hours)	Amount (per hour)	☐ Tonnes ☐ Cubic Metres ☐ Litres ☐ Barrels

Present wind speed and directions, sea states and water temperatures (°C) at the site (if known):

NOTES (describe special details of the incident, special concerns, doubts about information etc.)

Appendix G – OSMIP

SapuraOMV Upstream (WA) Pty Ltd

Operational and Scientific Monitoring Implementation Plan for Kanga-1 Exploration Well

April 2021

SapuraOMV Upstream (WA) Pty Ltd
Level 2, 251 St Georges Terrace
Perth, WA 6000
T: +61 8 6118 4990 www.sapura-omv.com
ACN 629 043 518

Controlled Document

DOCUMENT INFORMATION

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Revision	Owner	Reviewer	Approver
	Senior HSE Specialist	Drilling Manager	Asset Manager
3.0	MC	RB	ZZ

REVISION HISTORY

Revision	Revision Date	Prepared By	Amendment
1.0	28 September 2020	GHD Pty Ltd	-
2.0	27 November 2020	GHD Pty Ltd	Update following release of NOPSEMA OSMP information paper 01/10/2020
3.0	23 April 2021	GHD Pty Ltd	Update to address NOPSEMA comments

Table of Contents

Table Index

Figure Index

LIST OF ACRONYMS

Abbreviation	Description
AMSA	Australian Maritime Safety Authority
AMOSC	Australian Marine Oil Spill Centre
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
DBCA	Department of Biodiversity, Conservation and Attractions
DoT	Department of Transport
CoC	Chain of Custody
EP	Environment Plan
EUL	Environmental Unit leader
FL	Field Lead
GIS	Geographic Information System
HSE	Health, Safety and Environment
IC	Incident Coordinator
IMT	Incident Management Team
L	Litre
LoR	Limits of Reporting
m	Metre
MC	Monitoring Coordinator
MDO	Marine Diesel Oil
MGO	Marine Gas Oil
MODU	Mobile Offshore Drilling Unit
MP	Monitoring Personnel
NA	Not Applicable
NATA	National Association of Testing Authorities
NEBA	Net Environmental Benefit Analysis
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
OPEP	Oil Pollution Emergency Plan
OS	Operational Study
OSMF	Operational and Scientific Monitoring Framework
OSMP	Operational and Scientific Monitoring Plan
OSMIP	Operational and Scientific Monitoring Implementation Plan
OSRL	Oil Spill Response Limited
PAH	Polycyclic Aromatic Hydrocarbons
PSC	Planning Section Chief
ROV	Remotely Operated Vehicle
SAG	Scientific Advisory Group
SAP	Sampling and Analysis Plan
SAT	Shoreline Assessment Team
SEA	SapuraOMV Senior Environmental Advisor
SM	Scientific Monitoring
TL	Technical Lead
TPH	Total Petroleum Hydrocarbons
TRH	Total Recoverable Hydrocarbons
WA	Western Australia

1. Introduction

1.1 Overview of Document Purpose

This Operational and Scientific Monitoring Implementation Plan (OSMIP) has been prepared to achieve operational and scientific monitoring 'readiness' in the event of a Level 2 marine diesel oil (MDO) or marine gas oil (MGO) (MODU refuelling incident, **EP Section 8.3** [AU-HSE-KG1-EX-PLN-036], **OPEP for MDO Spill** [AU-HSE-KG1-EX-PLN-039]) or a Level 2 or 3 crude oil (loss of well control, **EP Section 8.1** [AU-HSE-KG1-EX-PLN-036], **OPEP for Crude Oil Spill** [AU-HSE-KG1-EX-PLN-037]) spill during the Kanga-1 exploration well Activity in permit area WA-412-P. If the spill occurs from the MODU during the exploration drilling Activity (i.e. refuelling incident, crude oil spill), SapuraOMV Upstream (WA) Pty Ltd (SapuraOMV) is the Controlling Agency and will lead operational and scientific monitoring activities. If a vessel-based spill occurs during the Activity then AMSA is the Controlling Agency, and SapuraOMV will initiate/provide support if requested by AMSA.

This OSMIP provides:

- An overview of:
  - Roles and responsibilities.
  - Lines of communication.
  - Studies and their components.
  - Decision making processes.
  - Internal review procedures.
- Logistics and coordination details inclusive of:
  - Personnel names and contact information.
  - Nominated monitoring plant and contact information.
  - Study logistics.
- Operational and scientific monitoring strategy tables that outline the monitoring performance outcomes, monitoring standards, measurement criteria, and initiation triggers and termination criteria.
- Scientific monitoring specifications specific to the Activity.

1.2 OSMIP Structure

This OSMIP is structured in the following manner:

- Section 1: Introduction.
- Section 2: OSMIP Overview.
- Section 3: Logistics and Coordination.
- Section 4: Operational and Scientific Monitoring Strategies.
- Section 5: Scientific Monitoring Specifications.
- Section 6: References.

2. OSMIP Overview

2.1 Roles and Responsibilities

In the event of a Level 2 or 3 oil spill for which SapuraOMV is the Controlling Agency (i.e.MODU refuelling incident, crude oil spill), SapuraOMV will be responsible to implement this OSMIP. This OSMIP can also provide guidance if Sapura OMV is a Support Agency (i.e. vessel-based spill during drilling or site survey activity) and has been requested by AMSA to support OSMP tasks. **Table 2-1** identifies the key roles in this OSMIP and their primary responsibilities.

Table 2-1 Key roles and responsibilities

Position	Responsibilities
SapuraOMV Planning Section Chief (PSC)	• Overall responsibility for the OSMIP • Determines the requirements for operational and scientific monitoring in consultation with IMT and scientific monitoring external service providers • Initiates monitoring based on triggering of initiation criteria • Terminates studies where criteria met based on consultation with IMT, recommendations of MC and advice of SAG as relevant
SapuraOMV Senior HSE Specialist	• Ensures adequate resourcing of OSMIP through external service providers, SAG and SEA • Oversees HSE planning for scientific monitoring studies/activities • Ensures EUL, SEA and MC have undertaken OSMP/OSMIP induction prior to drilling campaign
SapuraOMV Environmental Unit Leader (EUL)	• Notifies service providers to implement study if initiation criteria triggered • Communicates to PSC monitoring outcomes, or other environmental issues as reported by MC, during incident response • Ensures operational monitoring results or other relevant spill/response information communicated to MC
SapuraOMV Senior Environmental Advisor (SEA)	• Assumes responsibility for scientific studies after IMT stand-down • Oversees initiation or refinements to studies triggered after IMT stand down (e.g. Hindcast Modelling) • Reviews and approves Annual and Final reports • Periodic internal review of conformance to OSMIP • Compliance interface with NOPSEMA Environment Division
Monitoring Coordinator (MC) (external service provider)	• Oversees all the scientific monitoring studies/activities • Ensures TL's have undertaken OSMP/OSMIP induction prior to drilling campaign • Scientific monitoring service providers' main focal point to EUL/SEA • Provides recommendations to SapuraOMV regarding scientific monitoring including whether termination criteria have been satisfactorily met
Technical Lead (TL) (external service provider)	• Oversees data collection and analysis of a specific monitoring study • Oversees mobilisation of Monitoring Personnel (MP), equipment and plant to site upon activation • Planning and coordination of monitoring study, including incorporation of relevant environmental controls from EP • QA/QC of field (or modelling) activities and data analyses • Review and approval of a study's reporting requirements • Advise SEA via the MC with respect to environmental issues as required • Coordinate demobilisation (MP, plant, equipment) and project close-out (Final Report, archiving data)
Field Lead (FL) (external service provider)	• Provides support to TL on the field work component • Leads the field MP during field surveys
Monitoring Personnel (MP) (external service provider)	• Undertake field monitoring (or modelling) activities as advised by FL/TL • Perform data analysis and reporting as advised by TL • Acquire and collate baseline data as advised by TL • Store and archive data • Report all environmental incidents during field monitoring activities
Scientific Advisory Group (SAG)	• External review of scientific monitoring reports • Provide guidance to SapuraOMV regarding scientific monitoring including whether termination criteria have been satisfactorily met

2.2 Training and Competencies

Table 2-2 details minimum training and experience levels to ensure appropriate competency of personnel fulfilling technical roles (see **Table 2-1**) for the OSMIP scientific monitoring studies. Personnel with designated responsibilities (i.e. SEA, MC, TL's) for each of the scientific studies (**Table 3-2**) will complete an OSMP/OSMIP induction prior to the commencement of the drilling campaign to ensure adequate familiarity with relevant studies. Oil spill incident training requirements for IMT members, including the PSC and EUL, are detailed in the OPEP.

Table 2-2 Key role competencies

Position	Minimum Competency Requirement
EUL/SEA	• Post-graduate qualification in relevant discipline, or Bachelor degree and >10 years experience in relevant discipline • >15 years professional environmental experience • Experience in planning and reporting of environmental monitoring programs
MC	• Post-graduate qualification in relevant discipline, or Bachelor degree and >15 years experience in relevant discipline • Demonstrated capability in coordinating multi-disciplinary scientific monitoring programs
TL	• Post-graduate qualification in relevant discipline, or Bachelor degree and >15 years experience in relevant discipline • >10 years professional environmental experience • Experience in planning and coordination of environmental monitoring programs
FL	• Bachelor degree in relevant discipline • >5 years professional environmental experience • Experience leading environmental field studies
MP	• Bachelor degree in relevant discipline • Environmental field study and/or data collation/analysis experience • Specific training/certification as applicable to assigned tasks (e.g. marine mammal identification)

2.3 Communications

In addition to operational monitoring, relevant scientific monitoring may provide useful information to inform response planning and net environmental benefit analysis (NEBA). This information will be used (if and as required) to consult with Australian Marine Oil Spill Centre (AMOSC), Australian Maritime Safety Authority (AMSA), NOPSEMA and the Western Australian (WA) Department of Transport (DoT). Lines of communication between key roles are summarised in **Figure 2-1.**

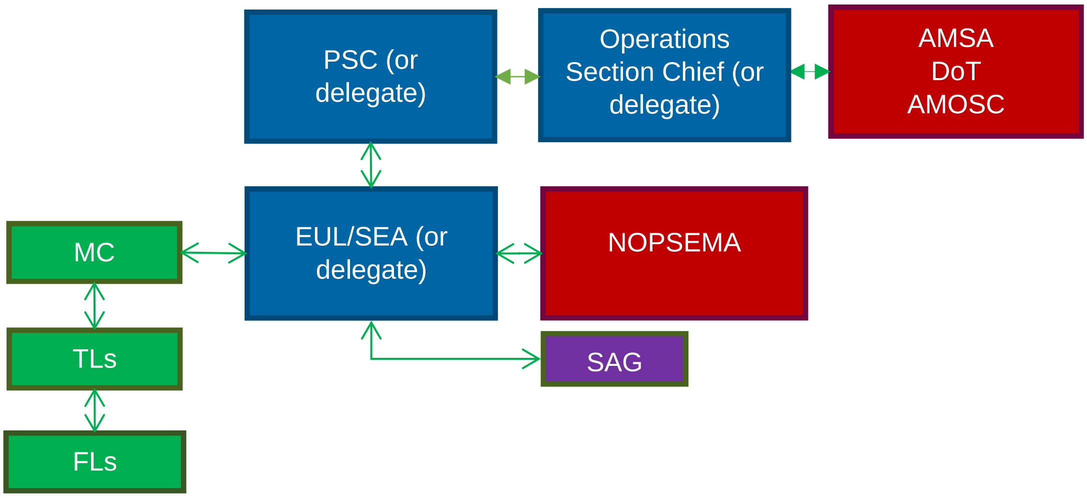

Figure 2-1 Lines of communications between key roles and external agencies

2.4 Summary of Monitoring Studies

Table 2-3 provides a high level summary of the operational and scientific monitoring studies (and their components) that would be initiated by the IMT in the event of a Level 2 or 3 spill in which SapuraOMV is the Control Agency. One operational study (OS1) and two scientific monitoring (SM04, SM05) studies will be initiated for all spill incidents. All three operational studies and twelve field-related scientific monitoring studies will be initiated immediately in the event of a Level 3 spill (i.e. loss of well control) or selectively where exposure from any spill to the relevant receptor is predicted by operational studies..

Table 2-3 Summary of monitoring studies and their components that will be implemented by the IMT (yellow shading for all spills, green shading where impact from any spill/spill response to the relevant receptor is predicted)

EP Study ID	Study Name	Strategy Selection	Implementation	Literature Baseline Data	Baseline Surveys	Reactive Baseline Survey (s)	Impact Survey (s)	Recovery Survey(s)
Operational Monitoring Studies								
OS1	Hydrocarbon Surveillance and Tracking	4.1	Yes	NA	NA	NA	NA	NA
OS2	Oil Spill Trajectory Modelling	4.2	Yes	NA	NA	NA	NA	NA
OS3	Shoreline Assessment	4.3	Yes	Yes	NA	NA	NA	NA
Scientific Monitoring Studies								
SM01	Weathering Assessment	4.4	Yes	Yes	No	Yes	Yes	Yes
SM02	Dispersant Effects on Subsurface Concentrations	4.5	Yes	Yes	No	Yes	Yes	Yes
SM03	Ecotoxicology	4.6	Yes	Yes	No	Yes	Yes	Yes
SM04	Marine Waters	4.7	Yes	Yes	No	Yes	Yes	Yes

EP Study ID	Study Name	Strategy Selection	Implementation	Literature Baseline Data	Baseline Surveys	Reactive Baseline Survey (s)	Impact Survey (s)	Recovery Survey(s)
SM05	Marine Sediments	4.8	Yes	Yes	No	Yes	Yes	Yes
SM06	Intertidal and Subtidal Habitats	4.9	Yes	Yes	No	Yes	Yes	Yes
SM07	Mangrove Habitat	4.10	Yes	Yes	No	Yes	Yes	Yes
SM08	Turtle Nesting	4.11	Yes	Yes	No	Yes	Yes	Yes
SM09	Marine Megafauna	4.12	Yes	Yes	No	Yes	Yes	Yes
SM10	Marine Avifauna	4.13	Yes	Yes	No	Yes	Yes	Yes
SM11	Hydrocarbons in Representative Commercial and Recreational Fish	4.14	Yes	Yes	No	Yes	Yes	Yes
SM12	Marine Invertebrates	4.15	Yes	Yes	No	Yes	Yes	Yes
SM13	Hindcast Modelling	4.16	Yes	No	No	No	No	No

2.5 Implementation Plan Flow

A schematic flow chart for the implementation of the OSMIP from initiation through termination of the operational and scientific studies is shown in **Figure 2-2**.

2.6 Internal Review

During OSMP implementation internal reviews of conformance to this OSMIP will be carried out routinely (every 6 months) by the SEA (or delegate). Any non-conformances will be rectified by the relevant TL and MC within 1 month of the finding. All internal reviews will be recorded and archived by the SEA (or delegate).

2.7 External Review

The Scientific Advisory Group (SAG) will be comprised of scientists from government (State and/or Commonwealth), academia, SapuraOMV and/or industry that collectively have expertise in sediment and water quality, benthic habitats, mangroves, invertebrates, fish, turtles, megafauna and avifauna. The primary role of the SAG will be to:

- Assist in the development of appropriate criteria for 'statistically significant impact' and 'recovery' between impact and reference sites for each relevant scientific monitoring study.
- Review scientific monitoring reports.
- Provide guidance to SapuraOMV whether scientific monitoring termination criteria have been satisfactorily met.

Terms of Reference will be provided to SAG members that outlines their responsibilities/ obligations. An induction meeting to be chaired by the SEA (or delegate) will provide SAG members with an overview of the spill response activities and scientific monitoring plans.

2.7.1 Stakeholder Input

Stakeholder input will be incorporated into the external review process through consultation by SapuraOMV in the event of a spill. This stakeholder input will feed through to the SAG via SapuraOMV's SAG representative. The SapuraOMV's SAG representative will be responsible for seeking feedback on the views of stakeholders not represented on the SAG (e.g. fishers via the

Department of Primary Industries and Regional Development). The view of stakeholders will be considered in determining when scientific monitoring will be terminated, along with advice and guidance from the SAG.

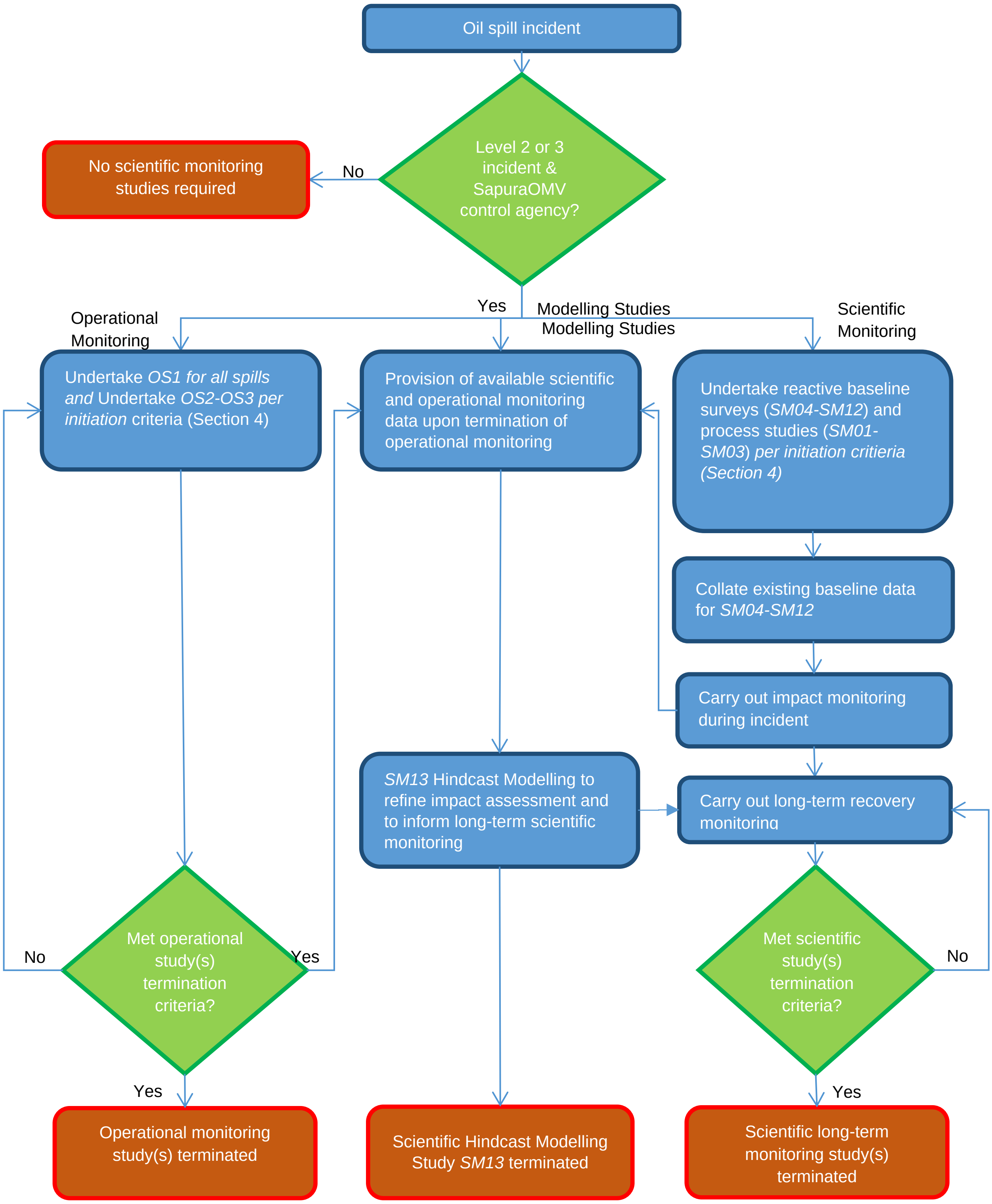

Figure 2-2 Overall OSMIP implementation flow chart

2.8 Reporting

Reporting requirements are detailed in the measurement criteria of the scientific monitoring strategy tables (**Section 4**) and generally comprise survey, annual and final reports. Generally, these reports are submitted to the SEA (or delegate) for approval and appropriate dissemination.

3. Logistics and Coordination

To expedite mobilisation this section provides:

- Personnel contact information (coordination personnel, primary and alternate monitoring personnel [TLs and MP], support personnel).
- Vessel and aircraft contact information.
- General logistics overview.

3.1 Personnel

3.1.1 Coordination

Personnel (and contact numbers) responsible for the OSMIP during an oil spill incident are summarised in **Table 3-1**.

Table 3-1 OSMIP coordination personnel

Position	Name	Mobile Number
IMT SapuraOMV Planning Section Chief (PSC)	Duty roster position	See duty roster
IMT SapuraOMV Environmental Unit Leader (EUL)	[redacted]	[redacted]
SapuraOMV Environment Advisor (SEA)[1]	[redacted]	[redacted]
Monitoring Coordinator (MC)	[redacted]	[redacted]

3.1.2 Technical Leads and Field Leads

Primary personnel (and contact numbers) responsible for each of the operational and scientific studies (i.e. TLs, FLs) are summarised in **Table 3-2**.

Table 3-2 Key OSMIP monitoring personnel

Field Study	Technical Lead	Field Lead
Operational Monitoring		
OS1 (Hydrocarbon Surveillance & Tracking)	Delegated by PSC	Delegated by PSC
OS2 (Oil Spill Trajectory Modelling, OSTM)	RPS APASA (via AMOSC)	N/A
OS3 (Shoreline Assessment)	Delegated by PSC	Delegated by PSC
Scientific Monitoring		
SM01 (Weathering Assessment) SM02 (Dispersant Effects on Subsurface Concentrations)	[redacted]	[redacted]
SM03 (Ecotoxicology)	[redacted]	
SM04 (Marine Waters)	[redacted]	[redacted]
SM05 (Marine Sediments)	[redacted]	[redacted]
SM06 (Intertidal and Subtidal Habitats)	[redacted]	[redacted]
SM07 (Mangrove Habitat)	[redacted]	[redacted]

[1] Depending on the scale of the incident, the SEA may delegate his responsibilities to another Environmental Advisor.

Field Study	Technical Lead	Field Lead
	[redacted]	[redacted]
SM08 (Turtle Nesting)	[redacted]	[redacted]
SM09 (Marine Megafauna)	[redacted]	[redacted]
SM10 (Marine Avifauna)	[redacted]	[redacted]
SM11 (Hydrocarbon in Representative Commercial and Recreational Fish)	[redacted]	[redacted]
SM12 (Marine Invertebrates)		[redacted]
SM13 (Hindcast Modelling)	RPS APASA	N/A

3.1.3 First Strike Scientific Monitoring Personnel

Additional monitoring personnel (and contact numbers) to those in **Table 3-2** for initial reactive (first strike) baseline surveys for scientific monitoring studies are summarised in **Table 3-3**. These personnel will also assist with office-based data analysis and reporting components. Operational monitoring personnel will be primarily sourced from external service providers (e.g. AMOSC, OSRL) and government agencies (e.g. DoT, AMSA).

Table 3-3 Additional first strike scientific monitoring personnel

Name	Mobile Number	Potential Roles	Studies
[redacted]	[redacted]	MP	SM04-SM08, SM13
[redacted]	[redacted]	FL, MP	SM01-SM05
[redacted]	[redacted]	TL, FL MP	SM01-SM13
[redacted]	[redacted]	TL, FL, MP	SM11
[redacted]	[redacted]	MP	SM01-SM06, SM13
[redacted]	[redacted]	MP	SM01-SM06, SM13
[redacted]	[redacted]	MP	SM01-SM07, SM13
[redacted]	[redacted]	FL, MP	SM01-SM05
[redacted]	[redacted]	MP	SM01-SM06, SM13
[redacted]	[redacted]	MP	SM01-SM06, SM13
[redacted]	[redacted]	MP	SM01-SM05
[redacted]	[redacted]	MP	SM01-SM05
[redacted]	[redacted]	MP	SM01-SM05
[redacted]	[redacted]	MP	SM07, SM10
[redacted]	[redacted]	MP	SM07, SM10

3.1.4 Scientific Monitoring Support Personnel

Support personnel (and mobile contact numbers) to assist in scientific field monitoring logistics, GIS services and project management/cost controls are summarised in **Table 3-4**. Operational monitoring will be managed via the IMT (refer to OPEP), whereas scientific monitoring will be managed by the MC through liaison with the EUL/SEA.

Table 3-4 Scientific monitoring support personnel roles, names and contact numbers

Name	Mobile Number	Support Roles
[redacted]	[redacted]	Project management, scheduling, cost control
[redacted]	[redacted]	HSE Manager
[redacted]	[redacted]	Travel arrangements
[redacted]	[redacted]	GIS
[redacted]	[redacted]	MP/FL- marine field personnel
[redacted]	[redacted]	MP/FL –coral specialist

3.2 Plant (Vessel and Aircraft)

All vessels, aircraft and vehicles required for operational and scientific monitoring will be sourced via the external resources contracting strategy in **Section 6.2** of the OPEPs. Generally, the recommended specifications for scientific vessels include:

- Accommodate a minimum of 8-11 MP.
- Provision of a small (2-3 m) tender to allow shoreline/nearshore sampling.
- GPS unit for locating the survey locations with 2 m accuracy.
- Minimum cruising speed of 15 knots.
- Minimum fuel capacity of 48 hours at 15 knots.
- Minimum freshwater capacity of 2,000 L.

The aircraft to be used for aerial surveys should be able to provide good downward visibility (e.g. fixed wing aircraft with an over-fuselage wing or helicopters).

3.3 Study Logistics

3.3.1 Overview

All field logistics in regards to survey timing, scheduling and scope are subject to safe operating conditions in accordance with SapuraOMV (and/or their contractors) HSE policies.

Survey scheduling (in terms of locations and sampling order) will be managed by the MC with appropriate discretion by the TLs and FLs to account for existing and predicted oil distributions in the marine environment, proximity to environmental sensitivities and forecasted weather/sea state conditions.

An indicative field plan in the event of a Level 3 loss of well control scenario is provided in Table 3-5 to facilitate implementation of this OSMIP in the event of such an incident.

3.3.2 Permit Requirements

In the event of a spill scenario that triggers this OSMIP, scientific monitoring that involves protected areas and/or species in Commonwealth and State jurisdictions is likely to be required. A number of permitting authorisations may be necessary to undertake these monitoring activities, with specific requirements dependent on the areas to be accessed, the type of investigation proposed, timing, species and numbers of animals involved, and the methodologies.

Table 3-6 identifies typical permits/licences that may be required to implement the scientific monitoring activities under this OSMIP. Specific permitting requirements and requests/notification for access to protected areas will be confirmed with relevant agencies/stakeholders in the event of OSMP activation, with applications progressed by the MC where necessary as part of field survey planning. It is anticipated the permitting process and/or associated exemptions will be expedited via consultation with relevant agencies in the event of a spill, but can normally take several weeks.

3.3.3 Environmental Impacts and Risks Management

EP Section 8.8 (AU-HSE-KG1-EX-PLN-036) describes the potential environmental impacts/risks and associated controls to be implemented in the event the OSMP is activated. Relevant controls will be incorporated into the survey planning for each field study by the respective TL.

3.3.4 Relevant Conservation Advice and Plans

Table 3-7 summarises the key environmental sensitivities and/or values in the EMBA that have associated conservation instruments (e.g. Conservation Advice, Recovery Plan, Management Plan) in place, and any relevant threats or management actions, along with the specific scientific monitoring studies that may be implemented. Where applicable, the management requirements in these instruments will be considered in field study planning by the TL for the relevant studies, including for establishing monitoring parameters/methods, such as selected indicator species, and/or for incorporating protection requirements, such as fauna separation distances.

Table 3-5 Indicative Field Plan during the first year after a Level 3 Incident

Study ID			OS1	SS1, SS2, SS3	SS4, SS5	OS3	SS4, SS5, SS6, SS7, SS8, SS10, SS12	OS3	SS4, SS5, SS6, SS7, SS8, SS10, SS12	OS3	SS4, SS5, SS6, SS7, SS8, SS10, SS12	SS9	SS11	SS13
Monitoring Programme			Surveillance & Tracking	Weathering, Dispersant Effect, Ecotoxicology	Water, Sediments	Shoreline Assessment	Water, Sediments, Intertidal & Subtidal, Mangroves, Turtle Nesting, Avifauna, Invertebrates	Shoreline Assessment	Water, Sediments, Intertidal & Subtidal, Mangroves, Turtle Nesting, Avifauna, Invertebrates	Shoreline Assessment	Water, Sediments, Intertidal & Subtidal, Mangroves, Turtle Nesting, Avifauna, Invertebrates	Megafauna	Commercial & Recreational Fish	Hindcast Modelling
# FL & MP			4	2	2	3	8	3	8	3	8	3	2	4
Monitoring Plant			Vessel 1			Vessel 2		Vessel 3		Vessel 4		Aircraft	Vehicle	
Location			Slick			Muiron Islands & Ningaloo Region during Response (only vessel after response)		Imperieuse Reef during Response		Barrow Island & Montebello Islands during Response				
Day	Week													
0	0	Loss of Well Control												
7	1													
14	2													
21	3													
28	4													
35	5													
42	6													
49	7													
56	8													
63	9													
70	10													
77	11													
84	12	Impact Surveys (Well Contained)												
91	13													
98	14													
105	15													
112	16													
119	17													
126	18													
133	19													
140	20													
147	21													
154	22													
161	23													
168	24													
175	25													
182	26													
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210	30													
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224	32													
231	33													
238	34													
245	35													
252	36													
259	37													
266	38													
273	39													
280	40													
287	41													
294	42													
301	43													
308	44													
315	45													
322	46													
329	47													
336	48													
343	49													
350	50													
357	51		RECOVERY SURVEYS											

Table 3-6 Typical permitting requirements for scientific monitoring

Permit type	Governing Act	Administering agency	Relevancy comments
Listed species and ecological communities permit	EPBC Act (Cth)	DAWE	Required for activities that may kill, injure, take or move a listed threatened species or community, a listed migratory species or a listed marine species in a Commonwealth area
Cetacean research permit	EPBC Act (Cth)	DAWE	Required to take, keep, move or interfere with a cetacean and to possess or treat (including sample) a cetacean in Commonwealth, international or foreign waters
Protected species permit (Cocos and Christmas Island)	EPBC Act (Cth)	DAWE	Required for activities which may cause death, injure, take, trade, keep or move a member of a protected species (as defined in Schedule 12 of the EPBC Regs) in Cocos or Christmas Island territorial waters
Access to biological resources in a Commonwealth area for non-commercial purposes	EPBC Act (Cth)	DAWE	Authorisation may be required in a Commonwealth area to: • enter and take samples from biological resources • remove samples from the area
Fauna or flora licence	BC Act (WA)	DBCA	Numerous licence types, including: • Fauna Taking • Fauna Disturbing • Fauna Possessing
Authority to undertake activities in WA conservation areas	Conservation and Land Management (CALM) Act (WA)	DBCA	Various licencing requirements, including for taking water, soil or biological samples, photography and filming in conservation areas.

Table 3-7 Conservation management plans and actions for key sensitivities relevant to monitoring studies

Sensitivity / Value	Conservation Advice / Recovery Plan /Management Plan	Relevant Requirements / Management Actions	Potential Monitoring Studies
EPBC Listed Species with Biologically Important Areas in the EMBA			
Marine Mammals			
Dugong	-	-	SMS03, SMS09
Blue Whale, Pygmy Blue Whale	Conservation Management Plan for the Blue Whale - A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999	• Main threats include: habitat modification, vessel disturbance. • Relevant management actions: - minimising vessel collisions (A.4) - measuring and monitoring population recovery (B.1).	
Humpback Whale	Conservation Advice *Megaptera novaeangliae* humpback whale	• Main threats include: habitat degradation, vessel disturbance or strike. • Relevant management actions: - minimise vessel collisions.	
Southern Right Whale	Conservation Management Plan for the Southern Right Whale. A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 2011-2021	• Main threats include: habitat modification, vessel disturbance. • Relevant management actions: - addressing vessel collisions (A.5) - measuring and monitoring population recovery (B.1).	
Sperm Whale	-	-	
Australian Sea Lion	Recovery Plan for the Australian Sea Lion (*Neophoca cinerea*)	• Other threats include: habitat degradation, pollution and oil spills. • Relevant management objective: Investigate and mitigate other potential threats to Australian sea lion population. • Relevant management actions: - improve the understanding of—and where necessary mitigate—the threat posed to Australian sea lion populations by illegal killings, vessel strike, pollution and oil spills (4.1).	

Sensitivity / Value	Conservation Advice / Recovery Plan /Management Plan	Relevant Requirements / Management Actions	Potential Monitoring Studies
Marine Reptiles			
Green Turtle Flatback Turtle Hawksbill Turtle Olive Ridley Turtle Loggerhead Turtle	Recovery Plan for Marine Turtles in Australia	• Main threats include: chemical and terrestrial discharge, vessel disturbance. • Relevant management actions: - minimise chemical and terrestrial discharge (A4).	SM03, SM08, SM09
Seabirds and Shorebirds			
Common Noddy	-	-	SM03, SM10
Australian Lesser Noddy	Conservation Advice *Anous tenuirostris melanops* Australian lesser noddy	• Pollution from oil spill events are identified as a threat • Relevant conservation actions include: - Houtman Albrolhos and its surrounds continue to be managed in such a way that human disturbance is minimised	
Flesh-footed Shearwater	-	-	
Wedge-tailed Shearwater	-	-	
Short-tailed Shearwater	-	-	
Lesser Frigatebird	-	-	
Greater Frigatebird	-	-	
White-tailed Tropicbird	-	-	
Soft-plumaged Petrel	Conservation Advice *Pterodroma Mollis* soft-plumaged petrel	• No relevant threat identified • No relevant management actions identified.	
Great-winged Petrel	-	-	
White-faced Storm Petrel	-	-	
Indian yellow-nosed albatross	National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016	• Marine pollution identified as a threat • No relevant management actions identified.	

Sensitivity / Value	Conservation Advice / Recovery Plan /Management Plan	Relevant Requirements / Management Actions	Potential Monitoring Studies
Bridled Tern	-	-	
Fairy Tern	Approved Conservation Advice for *Sternulanereis nereis* (Fairy Tern)	• Main threats include: disturbance causing destruction or desertion of nests; weeds rendering nest sites unsuitable for breeding. Oil spills identified as a potential threat • Relevant conservation actions include: - reduce disturbance during the breeding season - manage sites to prevent introduction of invasive weeds - ensure oil-spill contingency plans are in place for breeding sites vulnerable to oil spills	
Sooty Tern	-	-	
Caspian Tern	-	-	
Roseate Tern	-	-	
Little Tern	-	-	
Brown Booby	-	-	
Red-footed booby	-	-	
Fish and Sharks			
Great White Shark	Recovery Plan for the White Shark (*Carcharodon carcharias*)	• Relevant identified potential threats: habitat modification. • Relevant management objectives: - identify and protect habitat critical to the survival of the white shark and minimise the impact of threatening processes within these areas (Objective 7).	SM03, SM09
Whale Shark	Conservation Advice *Rhincodon typus* whale shark	No relevant threat or management actions identified	
Dwarf Sawfish	Approved Conservation Advice for *Pristis clavata* (Dwarf Sawfish)	• Main potential threats include: habitat degradation due to increasing human development in northern Australia. • No relevant management actions identified.	
Freshwater Sawfish	Approved Conservation Advice for *Pristis pristis* (largetooth sawfish)	• Main threats include: habitat degradation and modification. • No relevant management actions identified.	
Green Sawfish	Approved Conservation Advice for Green Sawfish	• Main threats include: habitat degradation through coastal development. • No relevant management actions identified.	

Sensitivity / Value	Conservation Advice / Recovery Plan /Management Plan	Relevant Requirements / Management Actions	Potential Monitoring Studies
Threatened Ecological Communities			
Subtropical and Temperate Coastal Saltmarsh	Conservation Advice for Subtropical and Coastal Saltmarsh	• Pollution from oil spill events are identified as a threat • Actions for this TEC include: - identifying coastal saltmarsh as important habitat in all oil spill contingency planning - monitor the application of protocols on the management of spills involving saltmarshes	SM03, SM04, SM05, SM06
Australian Marine Parks			
North Marine Region			
Oceanic Shoals Marine Park	North Marine Parks Network Management Plan 2018	• Identified pressures include: human presence, invasive species, habitat modification, marine pollution • Relevant management actions include: - park protection and management—timely and appropriate preventative and restorative actions to protect natural, cultural and heritage values from impacts	SM03, SM04, SM05, SM08, SM09, SM10
North-west Marine Region			
Argo-Rowley Terrace Ashmore Reef Carnarvon Canyon Cartier Island Dampier Eighty Mile Beach Gascoyne Kimberley Mermaid Reef Montebello	• North-west Marine Parks Network Management Plan 2018 • North-west Marine Parks Network Management Plan 2018-28, Implementation Plan 1, Foundation Phase 2018-2022	• Identified pressures include: human presence, invasive species, habitat modification, marine pollution • Relevant management actions include: - park protection and management—timely and appropriate preventative and restorative actions to protect natural, cultural and heritage values from impacts	SM03, SM04, SM05, SM06, SM07, SM08, SM09, SM10

Sensitivity / Value	Conservation Advice / Recovery Plan /Management Plan	Relevant Requirements / Management Actions	Potential Monitoring Studies
Ningaloo Roebuck Shark Bay			
South-west Marine Region			
Abrolhos Bremer Geographe	• South-west Marine Parks Network Management Plan 2018 • South-west Marine Parks Network Management Plan 2018-28, Implementation Plan 1, Foundation Phase 2018-2022	• Identified pressures include: human presence, invasive species, habitat modification, marine pollution • Relevant management actions include: - park protection and management—timely and appropriate preventative and restorative actions to protect natural, cultural and heritage values from impacts	SM03, SM04, SM05, SM06, SM09, SM10
Jurien Perth Canyon South-west Corner Two Rocks		• Relevant management actions include: - park protection and management—timely and appropriate preventative and restorative actions to protect natural, cultural and heritage values from impacts	
Ramsar Wetlands			
Ashmore Reef Commonwealth Marine Reserve	Ecological Character Description Ashmore Reef Commonwealth Marine Reserve Ramsar Site	• Main threats include energy production and mining, specifically, seismic surveys, drilling and oil spills • Limits of acceptable change to elements (component, process, service) of ecological character defined in Table 27 of ECD report	SM03, SM04, SM05, SM06, SM09, SM10
Eighty-mile Beach	Ecological Character Description of the Eighty-mile Beach Ramsar Site	• Offshore petroleum / gas extraction identified as a minor threatening activity, specifically, oil spills • Limits of acceptable change to elements (component, process, service) of ecological character defined in Table 21 and 22 of ECD report	
Hosnies Spring (Christmas Island)	Ecological Character Description of Hosnies Spring Ramsar Site	• No relevant threat identified • Limits of acceptable change to elements (component, process, service) of ecological character defined in Table 9 of ECD report	
The Dales (Christmas Island)	Ecological Character Description of The Dales Ramsar Site	• No relevant threat identified • Limits of acceptable change to elements (component, process, service) of ecological character defined in Table 13 of ECD report	
World Heritage Properties			

Sensitivity / Value	Conservation Advice / Recovery Plan /Management Plan	Relevant Requirements / Management Actions	Potential Monitoring Studies
Shark Bay	Shark Bay World Heritage Property Strategic Plan 20082020	• Potential pollution sources include: oil spills. • Relevant management objective: - minimise the impact of pollution and waste on World Heritage values and the overall integrity of the World Heritage Property.	SM03, SM04, SM05, SM06, SM07, SM08, SM09, SM10
Ningaloo Coast	Ningaloo Coast Strategic Management Framework	• Major potential threats include: resource development. • Management consistent with the objectives and underlying principles of the Ningaloo Coast management system, including Ningaloo Marine Park (Commonwealth), WA Ningaloo Marine Park and Muiron Islands Marine Management Area, Cape Range National Park, unallocated Crown land, freehold owners and leaseholders, Learmonth Air Weapons Range Facility.	

4. Operational and Scientific Monitoring Strategies

The strategy for each operational and scientific monitoring study is provided in this Section. Each strategy has a table with a consistent structure to facilitate familiarity and ease of reference as described in **Table 4-1**.

Table 4-1 Structure of scientific monitoring strategy tables

Performance Outcome	Goal(s) from the implementation of the monitoring program.
Performance Standard	**Measurement Criteria**
Systems, equipment, personnel and/or procedures used as the basis to manage achievement of the monitoring performance outcome.	Criteria to assess whether the monitoring performance standard(s) for the monitoring study have been achieved. Criteria are auditable.
Initiation Trigger	Criteria to initiate the monitoring study.
Termination Trigger	Criteria to terminate the monitoring study.
SAP	Reference to relevant document on the methods to implement a scientific study.
Study Specifications	Reference to OSMIP location with preliminary study specifications (e.g. frequency, areas).
Indicative Logistics	Reference to OSMIP location for indicative logistics plan (i.e. schedule of plant and personnel).
Baseline Data	Reference to OSMIP location with known existing baseline data.

4.1 OS1 Hydrocarbon Surveillance and Tracking

Table 4-2 OS1 Hydrocarbon Surveillance and Tracking

Study OS1 Hydrocarbon Surveillance and Tracking	
Performance Outcomes	• Provide IMT and regulatory authorities with reliable and timely tracking buoy location and surveillance observations to inform response planning and operations.
Performance Standards	**Measurement Criteria**
1: Readiness to implement OS1	1a: TL, MP, plant and equipment sourced from external services contracting strategy (Section 6.2 of the OPEPs).
2: Daily updates on spill distribution	2a: TL obtains (and archives) OS2 forecast modelling results to plan daily activities. 2b: TL updates spatial distribution of oil spill on basis of drogue tracks, satellite imagery, and vessel and aircraft surveys. 2c: All daily information archived appropriately by TL (or delegate).
3: Daily acquisition of hydrocarbon distribution data/information	3a: TL plans daily surveillance/tracking activities, which is stored and archived. 3b: TL submits plan to PSC for implementation. 3c: MP record vessel- and aerial observations as per the OS2 SAP and summarise observations in daily report. 3d: TL (or delegate) records next expected satellite image and drogue status.
4: Daily IMT spill update	4a: TL provides daily concise report/summary sheet that summarises spatial oil distribution (e.g. satellite images, drogue tracking, forecast trajectory(s), and/or vessel- and aerial-based observations) to the PSC to inform response planning and management.
5: Provision of Final Report and data	5a: TL (or delegate) collates relevant data (e.g. vessel- and aerial-based surveillance, drogue tracks, and satellite imagery) and prepares Final Report to inform planning for impact and recovery scientific monitoring and SM13 Hindcast Modelling within 1 month of the OS1 termination.
Initiation Trigger	Notification of a spill incident from a loss of well control or a Level 2 MDO spill.
Termination Criteria	Field Study Termination: • Oil source controlled. Surface water does not have an oiled appearance, specifically 'silver/grey' as per the Bonn Agreement Oil Appearance Code (BAOAC). Study Termination: OS1 Final Report describing outcomes of operational monitoring (ie spatial oil distribution observations) approved by the SEA (or delegate).
SAP	OS1 SAP (GHD 2019a).
Specifications	Not Applicable (NA)
Logistics	Refer to **Section 3.3** for indicative logistics (i.e. schedule of plant and personnel)
Baseline Data	NA

4.2 OS2 Oil Spill Trajectory Modelling (OSTM)

Table 4-3 OS2 Oil Spill trajectory Modelling (OSTM)

Study OS2 Oil Spill Trajectory Modelling (OSTM)	
Performance Outcomes	• Provide IMT and regulatory authorities with reliable and timely OSTM predictions to inform response planning, operations and environmental impact/risk assessment.
Performance Standards	**Measurement Criteria**
1: Readiness to implement OS2	1a: TL and MP sourced from external services contracting strategy (Section 6.2 of the OPEPs).
2: Provision of daily quasi-real-time spill forecasts	2a: PSC (or delegate) to provide external services modeller the following to improve oil spill model forecasts: - If ongoing release from loss of well control incident (rather than instantaneous/short duration release), then provide daily updates of oil flow rate. - Provide daily updates of implemented response strategies (e.g. dispersant application). 2b: PSC (or delegate) to provide relevant daily operational study information (e.g. OS1 and/or OS3) and scientific study information e.g. (SM02 and/or SM04) to external services modeller to improve short-term forecasts. 2c: At least daily oil spill forecasts by external services modelling provider available via secured web site to all authorised personnel. 2d: Predicted effectiveness of potential response measures (e.g. dispersant application) as requested *ad hoc* by the PSC (or delegate) within 24 hours by external services modeller after receipt of response scenario, and made available via secured web site to all authorised personnel. 2e: Availability of external services modelling personnel for advice and explanation of model results at any time (24 hour a day for 7 days a week).
Initiation Trigger	Notification of a spill incident from a loss of well control or if OS1 predicts exposure to sensitive areas/ receptors.
Termination Criteria	• Oil source is controlled, and OSTM and other Monitor and Evaluate Plan activities predict that no further regions will be affected by the spill.
SAP	OS2 SAP (GHD 2019b).
Specifications	NA
Logistics	NA
Baseline Data	NA

4.3 OS3 Shoreline Assessment

Table 4-4 OS3 Shoreline Assessment

Study OS3 Shoreline Assessment	
Performance Outcomes	• Provide IMT and regulatory authorities with reliable and timely shoreline assessments to support and to inform response planning and operations, and evaluate environmental impacts/risks from shoreline oiling of a Level 3 spill.
Performance Standards	**Measurement Criteria**
1: Readiness to implement OS3	1a: TL, MP, plant and equipment sourced from external services contracting strategy (Section 6.2 of the OPEPs).
2: Where possible, acquisition of baseline information prior to hydrocarbon exposure at priority shorelines	2a: EP and OPEP identify priority shorelines at Barrow Island, Montebello Islands, Imperieuse Reef, Ningaloo Region and Muiron Islands. Any re-prioritisation of shorelines by IMT to be on basis of OS1 (surveillance and tracking) and OS2 (OSTM). Priority shorelines recorded in IMT log and relevant Incident Action Plan (IAP). 2b: Target deployment of shoreline assessment team (SAT) within 72 hours to carry out baseline assessment (biological and physical characterisation) at target priority shoreline. SAT transfer field data records to TL (or delegate). 2c: All daily SAT information collated by TL (or delegate) and provided to PSC (or delegate) to inform IMT response and planning.
3: Acquisition of post-exposure information to inform effectiveness of response measures	3a: SAT carry out post-exposure shoreline assessments (substrate biological character, hydrocarbon distribution) at locations specified by the IMT. SAT transfer field data records to TL (or delegate). 3b: SAT evaluate and report effectiveness and impacts of response measures. SAT to provide sub-daily assessments to PSC (or delegate) to inform IMT response and planning (via NEBA). 3c: SAT to immediately notify PSC (or delegate) of oiled wildlife (e.g. shorebirds, turtles). 3d: All daily SAT information collated by TL (or delegate) and provided to PSC (or delegate) to inform IMT response and planning.
4: Provision of Final Report and Data	4a: TL (or delegate) collates relevant data (e.g. shoreline oiling volumes and distributions) and prepares Final Report to inform planning for impact and recovery scientific monitoring and SM13 Hindcast Modelling within 1 month of the OS1 termination.
Initiation Trigger	Notification of a spill incident from a loss of well control or if OS1 or OS2 predicts exposure to shorelines
Termination Criteria	Field Study Termination: • Oil source is controlled, and OSTM and other Monitor and Evaluate Plan activities predict that no shorelines will be affected by the spill. • SAT assessments cease once shoreline response measures are completed (if initiated) and no further shorelines will be affected by the spill. Study Termination: OS3 Final Report detailing outcomes of SAT assessments (eg shoreline oiling volumes and distributions) approved by the SEA (or delegate).
SAP	OS3 SAP (GHD 2019c).
Specifications	NA
Logistics	Refer to **Section 3.3** for indicative logistics (i.e. schedule of plant and personnel)
Baseline Data	NA

4.4 SM01 Weathering Assessment

Table 4-5 SM01 Weathering Assessment Strategy

Study SM01 Weathering Assessment	
Performance Outcomes	• To characterise the physical and chemical properties of oil as it weathers to allow assessment of potential impacts with 'age' of oil. • To inform response planning (e.g. potential toxicity of oil with 'age', improved OS02 hydrocarbon weathering) during the incident. • To provide validation data for SM13 hindcast modelling in regards to the weathering of oil
Performance Standards	**Measurement Criteria**
1: Readiness to implement SM01	1a: TL, MP, plant and equipment sourced from external services contracting strategy (Section 6.2 of the OPEPs). 1b: MC has arrangements with NATA laboratory(s) for weathering analysis (i.e. Intertek).
2: Acquisition of oil weathering samples	2a: TL plans survey on basis of operational monitoring (OS1, OS2) to identify sampling times and locations to collect weathered oil across a range of ‘age’.
3: Appropriate collection, storage, transport and analysis of water samples	3a: MP to collect, store and transport to laboratory(s) marine water samples as per SM01 SAP. Chain of custody (CoCs) and field records archived by MP. 3b: Laboratory Analysis Report issued by NATA accredited laboratory of SM01 SAP analyte/analysis list (archived by MP).
4: Characterise oil weathering to inform spill response after each survey	4a: Weathering characteristics with oil age documented in concise report within 1 week of receipt of Laboratory Analysis Report by TL. 4b: SEA and/or MC to provide reports to SAG for review and PSC to inform response planning.
5: Provision of SM01 dataset to SM13	5a: TL to provide SM01 dataset to SM13 TL to serve for hindcast modelling validation within 1 month of source control.
6: Oil weathering assessment	6a: TL/MP to characterise oil weathering during incident in Final Report (to SEA and MC within 2 months of final field survey). 6b: SEA to provide Final report to SAG for review. TL to incorporate SAG review comments as appropriate into Final report.
7: Regulatory compliance reporting	7a: SEA to provide regulator (NOPSEMA, potentially DBCA and/or DoT) with Annual Scientific Monitoring Report that includes a SM01 Chapter within 1 month of approval by the SAG (note only for 1st annual report).
Initiation Trigger	Immediately following a **Level 3 crude oil spill** or if operational monitoring predicts exposure to sensitive areas/ receptors;initiated by the PSC (or delegate).
Termination Criteria	Field Study Termination: • Laboratory confirms sufficient oil volume and age range collected to characterise weathering • OS2 (OSTM) weathering validation/calibration complete, or modelling ceased. Study Termination: Weathering properties of released oil characterised in SM01 Final Report approved by the SEA (or delegate).
SAP	SM01 SAP (GHD 2019d).
Specifications	Refer to **Section 5.2** for indicative study specifications
Logistics	Refer to **Section 3.3** for indicative study logistics (i.e. schedule of plant and personnel)
Baseline Data	Refer to **Section 5.3** for baseline data information

4.5 SM02 Dispersant Effects on Subsurface Concentrations

Table 4-6 SM02 Dispersent Effects on Subsurface Concentrations Strategy

Study SM02 Dispersant Effects on Subsurface Concentrations	
Performance Outcomes	• To characterise the degree that dispersant application increases subsurface hydrocarbon concentrations. • To inform response planning (i.e. effectiveness of dispersant use, resultant effect on dissolved and entrained levels) during the incident. • To provide validation data for SM13 hindcast modelling in regards to dispersant application.
Performance Standards	**Measurement Criteria**
1: Readiness to implement SM02	1a: TL, MP, plant and equipment sourced from external services contracting strategy (Section 6.2 of the OPEPs). 1b: MC has arrangements with NATA laboratory(s) for analyte analysis (e.g. Intertek, ALS).
2: Acquisition of samples and data	2a: MC coordinates provision of 'fresh' crude oil samples to laboratory(s) when available via SM03. 2b: TL plans field survey on basis of operational studies (OS1, OS2) to identify sampling times and locations to collect samples immediately prior to and subsequent to the application of dispersant. 2c: MP collect samples and profiles (e.g. fluorescence) as per survey plan.
3: Appropriate collection, storage, transport and analysis of dispersant and water samples	3a: MP to collect, store and transport to laboratory(s) dispersant(s) samples and marine water samples as per SM02 SAP. Chain of custody (CoCs) and field records archived by MP. 3b: Laboratory Analysis Report issued by NATA accredited laboratory of SM02 SAP analyte/analysis list (archived by MP). 3c: Dispersant Efficacy Report issued by industry-accepted laboratory as per SM02 SAP.
4: Characterise dispersant effectiveness and effect on subsurface oil concentrations to inform response after each survey	4a: Dispersant effectiveness and subsurface oil concentrations documented in concise report within 1 week of receipt of Laboratory Analysis Report by TL. 4b: SEA and/or MC to provide reports to SAG for review and PSC to inform response planning.
5: Provision of SM02 dataset to SM13	5a: TL to provide SM02 dataset to SM13 TL to serve for hindcast modelling validation within 1 month of source control.
6: Assess effectiveness of dispersant application on increased subsurface concentrations	6a: TL/MP to characterise dispersant effectiveness of increased subsurface oil concentrations during incident in Final Report (to SEA and MC within 2 months of final field survey). 6b: SEA to provide Final report to SAG for review. TL to incorporate SAG review comments as appropriate into Final report.
7: Regulatory compliance reporting	7a: SEA to provide regulators (NOPSEMA, potentially DBCA and/or DoT) with Annual Scientific Monitoring Report that includes a SM02 Chapter within 1 month of approval by the SAG (note only for 1st annual report).
Initiation Trigger	Immediately following the decision to utilise dispersant application as a response measure to combat a **Level 3 crude oil spill** that is initiated by the PSC (or delegate).
Termination Criteria	Field Study Termination: • Laboratory confirms receipt of adequate samples to characterise effects of dispersant on crude oil, or dispersant use ceased. Study Termination: Dispersant effects on subsurface concentrations characterised in SM02 Final Report approved by the SEA (or delegate)
SAP	SM02 SAP (GHD 2019e).
Specifications	Refer to **Section 5.2** for indicative study specifications
Logistics	Refer to **Section 3.3** for indicative study logistics (i.e. schedule of plant and personnel)
Baseline Data	Refer to **Section 5.3** for baseline data information

4.6 SM03 Ecotoxicology

Table 4-7 SM03 Ecotoxicology Strategy

Study SM03 Ecotoxicology	
Performance Outcomes	• To characterise oil exposure thresholds of sensitive biotic receptors to refine environmental impact assessment. • To characterise toxicity of dispersed oil to inform response planning and NEBA process • To provide impact assessment criteria for scientific studies SM04 and SM13.
Performance Standards	**Measurement Criteria**
1: Readiness to implement SM03	1a: TL, MP, plant and equipment sourced from external services contracting strategy (Section 6.2 of the OPEPs). 1b: MC has identified chemical and ecotoxicology laboratories (e.g. Intertek, CSIRO, ALS).
2: Appropriate collection, storage, transport and analysis of water samples	2a: Ideally, oil samples acquired during drilling operations when the reservoir was intersected prior to the incident. If not, then when safe to do so, MP to collect oil samples from the sea surface in proximity to the well with appropriate storage and transport to the laboratory as per SM03 SAP. CoCs and field records archived by MP. 2b: MC arranges with TL for SM02 to collect, store and transport to laboratory(s) dispersed oil samples (or dispersant(s) samples) as per SM02 SAP. CoCs and field records archived by SM02 MP. 2c: MP to collect, store and transport to laboratory(s) marine water samples as per SM03 SAP. CoCs and field records archived by MP.
3: Characterise hydrocarbon composition	3a: Laboratory Analysis Report of the oil chemical properties issued by the chemical laboratory of SM03 SAP analyte list. 3b: TL documents in concise report within 1 week of receipt of Laboratory Analysis Report the oil's chemistry. 3b: SEA and/or MC provide report to SAG for external review and PSC to inform response planning.
4: Characterise hydrocarbon /dispersed hydrocarbon exposure thresholds	4a: Laboratory Ecotoxicology Report issued by the ecotoxicology laboratory (see SM03 SAP for guidance on indicator species list), archived by MP. 4b: TL documents in concise report within 1 week of receipt of Ecotoxicology Report the exposure thresholds for a 95% and 99% level of species protection. 4b: SEA and/or MC provide report to SAG for review and PSC to inform response planning.
5: Provision of SM03 thresholds to SM04 and SM13	5a: TL to provide SM03 thresholds to SM13 TL for hindcast modelling impact assessment and to SM04 TL for water quality impact assessment within 1 month of source control.
6: Regulatory compliance reporting	6a: SEA to provide regulators (NOPSEMA, potentially DBCA and/or DoT) with Annual Scientific Monitoring Report that includes a SM03 Chapter within 1 month of approval by the SAG (note only for 1st annual report).
Initiation Trigger	Immediately following a **Level 3 crude oil spill** or if operational monitoring predicts exposure to sensitive areas/ receptors; initiated by the PSC (or delegate).
Termination Criteria	Field Study Termination: • Laboratory confirms receipt of adequate samples to characterise toxicity of crude oil and dispersed oil. Study Termination: Ecotoxicological exposure thresholds for crude and dispersed oil characterised in SM03 Final Report approved by the SEA (or delegate).
SAP	SM03 SAP (GHD 2019f).
Specifications	Refer to **Section 5.2** for indicative study specifications
Logistics	Refer to **Section 3.3** for indicative study logistics (i.e. schedule of plant and personnel)
Baseline Data	Refer to **Section 5.3** for baseline data information

4.7 SM04 Marine Waters

Table 4-8 SM04 Marine Waters Strategy

Study SM04 Marine Waters	
Performance Outcomes	• To monitor hydrocarbons in marine waters at representative pelagic, subtidal and intertidal sites to support assessments of impacts and recovery of environmental sensitivities. • To inform response planning (i.e. oil in marine waters for NEBA) during the incident. • To provide validation data for SM13 hindcast modelling of the fate and transport of spilled entrained and dissolved hydrocarbons.
Performance Standards	**Measurement Criteria**
1: Readiness to implement SM04	1a: TL, MP, plant and equipment sourced from external services contracting strategy (Section 6.2 of the OPEPs). 1b: MC has identified NATA accredited laboratory(s) (e.g. ALS, Eurofinns) for hydrocarbon analysis (i.e. TPH, TRH, PAH, BTEX) in marine waters.
2: Acquisition of reactive baseline data	2a: TL plans reactive baseline survey on basis of operational monitoring (OS1, OS2) to identify 'impacted', 'potentially impacted' and 'potential reference' sites within 3 days of incident. Monitoring methods/parameters established considering requirements of relevant conservation instruments for areas and/or receptors predicted to be impacted. 2b: MP collect reactive baseline water samples within 1 week of incident at the Montebello Islands and Barrow Island and 2 weeks at other nominated sites. 2c: TL issues SM04 Reactive Baseline Survey Report within 1 week of receipt of Laboratory Analysis Report to SEA (or delegate) and MC. SEA (or delegate) approves and distributes to PSC and other TLs within 1 week of submission.
3: Appropriate collection, storage, transport and analysis of water samples	3a: MP to collect, store and transport to laboratory(s) marine water samples as per SM04. CoCs and field records archived by MP. 3b: Laboratory Analysis Report by NATA laboratory of SM04 SAP analyte list (archived by MP).
4: Collation of existing baseline data	4a: TL responsible for collation of existing data to establish baseline within 6 weeks of incident. 4b: If adopted baseline values greater than Limit of Reporting (LoR) then TL to submit SM04 Existing Baseline Report within 8 weeks of incident to SEA (or delegate) and MC for approval and subsequent distribution to PSC and other TLs within 2 weeks of submission. Otherwise, a baseline value of LoR adopted, and no SM04 Existing Baseline Report required.
5: Monitoring of marine waters during impact and recovery surveys	5a: TL evaluates suitability of established monitoring sites/methods on basis of operational monitoring and other scientific studies. Sites/methods modified as necessary with approval of MC and SEA prior to relevant survey. 5b: MP collect water samples during impact and recovery surveys. 5c: TL to provide concise Survey Reports within 1 week of receipt of Laboratory Analysis Report to SEA (or appropriate delegate) and MC for approval within 1 week of submission. SEA (or delegate) to distribute approved Survey Reports to PSC and other TLs.
6: Provision of SM04 dataset to SM13	6a: TL to provide relevant SM04 data to SM13 TL to serve for hindcast modelling validation within 1 month of source control.
7: Assess impact and recovery of marine waters	7a: TL/MP to assess impact and recovery of marine waters from incident in Final report to SEA and MC within 2 months of final field survey completion. 7b: SEA to provide Final report to SAG for review. TL to incorporate SAG review comments as appropriate into Final report.
8: Regulatory compliance reporting	8a: SEA to provide regulators (NOPSEMA, potentially DBCA and/or DoT) with Annual Scientific Monitoring Reports that includes a SM04 Chapter within 1 month of approval by the SAG (note for Level 2 spill only first annual report).
Initiation Trigger	Immediately following a **Level 2 or 3** spill or if operational monitoring predicts exposure to sensitive areas/ receptors; initiated by the PSC (or delegate).

Termination Criteria	<u>Field Study Termination</u>: • Oil in marine waters within natural variability of baseline conditions or no longer pose unacceptable environmental risk (below criteria derived by SM03 or laboratory LOR). • MC recommendation to terminate monitoring following SAG consultation. • IMT operational NEBA recommends termination. <u>Study Termination</u>: SM04 Final Report developed following field study termination (see above) and approved by the SEA (or delegate).
SAP	SM04 SAP (GHD 2019g).
Specifications	Refer to **Section 5.2** for indicative study specifications
Logistics	Refer to **Section 3.3** for indicative study logistics (i.e. schedule of plant and personnel)
Baseline Data	Refer to **Section 5.3** for baseline data information

4.8 SM05 Marine Sediments

Table 4-9 SM05 Marine Sediments Strategy

Study SM05 Marine Sediments	
Performance Outcomes	• To monitor oil in marine sediments at representative pelagic, subtidal, intertidal and shoreline sites to support assessments of impacts and recovery of environmental sensitivities. • To inform response planning (i.e. oil in marine sediments for NEBA) during the incident. • To provide validation data for SM13 hindcast modelling of the distribution of oil in sediments.
Performance Standards	**Measurement Criteria**
1: Readiness to implement SM05	1a: TL, MP, plant and equipment sourced from external services contracting strategy (Section 6.2 of the OPEPs). 1b: MC has identified NATA accredited laboratory(s) (e.g. ALS, Eurofinns) for hydrocarbon analysis (i.e. TPH, TRH, PAH, BTEX) in marine sediments.
2: Acquisition of reactive baseline data	2a: TL plans reactive baseline survey on basis of operational monitoring (OS1, OS2) to identify 'impacted', 'potentially impacted' and 'potential reference' sites within 3 days of incident. Monitoring methods/parameters established considering requirements of relevant conservation instruments for areas and/or receptors predicted to be impacted. 2b: MP collect reactive baseline sediment samples within 1 week of incident at the Montebello Islands and Barrow Island and 2 weeks at other nominated sites. 2c: TL issues SM05 Reactive Baseline Survey Report within 1 week of receipt of Laboratory Analysis Report to SEA (or delegate) and MC. SEA (or delegate) approves and distributes to PSC and other TLs within 1 week of submission.
3: Appropriate collection, storage, transport and analysis of sediment samples	3a: MP to collect, store and transport to laboratory(s) marine sediment samples as per SM05. CoCs and field records archived by MP. 3b: Laboratory Analysis Report by NATA laboratory of SM05 SAP analyte list (archived by MP).
4: Collation of existing baseline data	4a: TL responsible for collation of existing data to establish baseline within 6 weeks of incident. 4b: If adopted baseline values greater than LoR then TL to submit SM05 Existing Baseline Report within 8 weeks of incident to SEA (or delegate) and MC for approval and subsequent distribution to PSC and other TLs within 2 weeks of submission. Otherwise, a baseline value of LoR adopted, and no SM05 Existing Baseline Report required.
5: Monitoring of marine sediments during impact and recovery surveys	5a: TL evaluates suitability of established monitoring sites/methods on basis of operational monitoring and other scientific studies. Sites/methods modified as necessary with approval of MC and SEA prior to relevant survey. 5b: MP collect sediment samples during impact and recovery surveys. 5c: TL to provide concise Survey Reports within 1 week of receipt of Laboratory Analysis Report to SEA (or appropriate delegate) and MC for approval within 1 week of submission. SEA (or delegate) to distribute approved Survey Reports to PSC and other TLs.
6: Provision of SM05 dataset to SM13	6a: TL to provide relevant SM05 data to SM13 TL to serve for hindcast modelling validation within 1 month of source control.
7: Assess impact and recovery of marine sediments	7a: TL/MP to assess impact and recovery of marine sediments from incident in Final report to SEA and MC within 2 months of final field survey completion. 7b: SEA to provide Final report to SAG for review. TL to incorporate SAG review comments as appropriate into Final report.
8: Regulatory compliance reporting	8a: SEA to provide regulators (NOPSEMA, potentially DBCA and/or DoT) with Annual Scientific Monitoring Reports that includes a SM05 Chapter within 1 month of approval by the SAG (note for Level 2 spill only first annual report).
Initiation Trigger	Immediately following a **Level 2 or 3 spill** or if operational monitoring predicts exposure to sensitive areas/ receptors; initiated by the PSC (or delegate).
Termination Criteria	Field Study Termination:

	• Oil in marine sediments within natural variability of baseline conditions or no longer pose unacceptable environmental risk (i.e. below ANZG sediment quality guideline values (DGVs) for biological disturbance or laboratory LOR). • MC recommendation to terminate monitoring following SAG consultation. • IMT operational NEBA recommends termination. Study Termination: SM05 Final Report developed following field study termination (see above) and approved by the SEA (or delegate).
SAP	SM05 SAP (GHD 2019h).
Specifications	Refer to **Section 5.2** for indicative study specifications
Logistics	Refer to **Section 3.3** for indicative study logistics (i.e. schedule of plant and personnel)
Baseline Data	Refer to **Section 5.3** for baseline data information

4.9 SM06 Intertidal and Subtidal Habitats

Table 4-10 SM06 Intertidal and Subtidal Habitats Strategy

Study SM06 Intertidal and Subtidal Habitats	
Performance Outcomes	• To monitor impacts and recovery to intertidal and subtidal benthic communities to support assessments of impacts and recovery of these environmental sensitivities from an oil spill incident (including response activities).
Performance Standards	**Measurement Criteria**
1: Readiness to implement SM06	1a: TL, MP, plant and equipment sourced from external services contracting strategy (Section 6.2 of the OPEPs). 1b: MC has arrangements for specialised monitoring equipment (e.g. video/drop cameras, side-scan sonar, ROVs).
2: Acquisition of reactive baseline data	2a: TL plans reactive baseline survey on basis of operational monitoring (OS1, OS2, OS3) to identify 'impacted', 'potentially impacted' and 'potential reference' sites within 3 days of incident. Monitoring methods/parameters established considering requirements of relevant conservation instruments for areas and/or receptors predicted to be impacted. 2b: MP initiate reactive baseline surveys within ~1 week of incident at Montebello Islands and Barrow Island and ~2 weeks at other nominated sites. 2c: TL issues SM06 Reactive Baseline Survey Report within 2 weeks of reactive baseline survey completion to SEA (or delegate) and MC. SEA (or delegate) approves and distributes other TLs within 1 week of submission.
3: Collation of existing baseline data	3a: TL responsible for collation of existing data to establish baseline within 6 weeks of incident. 3b: TL to submit SM06 Existing Baseline Report within 8 weeks of incident to SEA (or delegate) and MC for approval and subsequent distribution to other TLs within 2 weeks of submission.
4: Monitoring of subtidal and intertidal benthic communities during impact and recovery surveys	4a: TL evaluates suitability of established monitoring sites/methods on basis of operational monitoring and other scientific studies. Sites/methods modified as necessary with approval of MC and SEA prior to relevant survey. 4b: MP carry out impact and recovery surveys. 4c: TL to provide concise Survey Reports within 2 weeks of survey completion to SEA (or appropriate delegate) and MC for approval within 1 week of submission. SEA (or delegate) to distribute approved Survey Reports to other TLs.
5: Assess impact and recovery of subtidal and intertidal benthic communities	5a: TL/MP to assess impact and recovery of intertidal and subtidal benthic communities from incident in Final report to SEA and MC within 2 months of final field survey completion. 5b: SEA to provide Final report to SAG for review. TL to incorporate SAG review comments as appropriate into Final report.
6: Regulatory compliance reporting	6a: SEA to provide regulators (NOPSEMA, potentially DBCA and/or DoT) with Annual Scientific Monitoring Reports that includes a SM06 Chapter within 1 month of approval by the SAG.
Initiation Trigger	Immediately following a **Level 3 spill** or if operational monitoring predicts exposure to sensitive areas/ receptors; initiated by the PSC (or delegate).
Termination Criteria	<u>Field Study Termination</u>: • Impact surveys determine 'no statistically significant impact' 12 months after the incident between impact and reference sites. Recovery surveys not required. • Recovery of impact sites relative to reference sites has been determined over 2 consecutive years. If after 2 years of consecutive monitoring, sensitive receptors have not recovered from the effects of oil impacts, SapuraOMV will review the requirement for ongoing monitoring and alternative termination criteria will be considered through SAG endorsement. • MC recommendation to terminate monitoring following SAG consultation. • IMT operational NEBA recommends termination. <u>Study Termination</u>: SM06 Final Report developed following field study termination (see above) and approved by the SEA (or delegate).
SAP	SM06 SAP (GHD 2019i).
Specifications	Refer to **Section 5.2** for indicative study specifications

Logistics	Refer to **Section 3.3** for indicative study logistics (i.e. schedule of plant and personnel)
Baseline Data	Refer to **Section 5.3** for baseline data information

4.10 SM07 Mangrove Habitat

Table 4-11 SM07 Mangrove Habitat Strategy

Study SM07 Mangrove Habitat	
Performance Outcomes	• To monitor impacts and recovery to mangrove habitats to support assessments of impacts and recovery of these environmental sensitivities from an oil spill incident (including response activities).
Performance Standards	**Measurement Criteria**
1: Readiness to implement SM07	1a: TL, MP, plant and equipment sourced from external services contracting strategy (Section 6.2 of the OPEPs).
2: Acquisition of reactive baseline data	2a: TL plans reactive baseline survey on basis of operational monitoring (OS1, OS2, OS3) to identify 'impacted', 'potentially impacted' and 'potential reference' sites within 3 days of incident. Monitoring methods/parameters established considering requirements of relevant conservation instruments for areas and/or receptors predicted to be impacted. 2b: MP initiate reactive baseline surveys within 1 week of incident at Ningaloo Region and Montebello Islands, and 2 weeks at other nominated sites. 2c: TL issues SM07 Reactive Baseline Survey Report within 2 weeks of reactive baseline survey completion to SEA (or delegate) and MC. SEA (or delegate) approves and distributes other TLs within 1 week of submission.
3: Collation of existing baseline data	3a: TL responsible for collation of existing data to establish baseline within 6 weeks of incident. 3b: TL to submit SM07 Existing Baseline Report within 8 weeks of incident to SEA (or delegate) and MC for approval and subsequent distribution to other TLs within 2 weeks of submission.
4: Monitoring of mangrove habitat during impact and recovery surveys	4a: TL evaluates suitability of established monitoring sites/methods on basis of operational monitoring and other scientific studies. Sites/methods modified as necessary with approval of MC and SEA prior to relevant survey. 4b: MP carry out impact and recovery surveys. 4c: TL to provide concise Survey Reports within 2 weeks of survey completion to SEA (or appropriate delegate) and MC for approval within 1 week of submission. SEA (or delegate) to distribute approved Survey Reports to other TLs.
5: Assess impact and recovery of mangrove habitats	5a: TL/MP to assess impact and recovery of mangrove habitats from incident in Final report to SEA and MC within 2 months of final field survey completion. 5b: SEA to provide Final report to SAG for review. TL to incorporate SAG review comments as appropriate into Final report.
6: Regulatory compliance reporting	6a: SEA to provide regulators (NOPSEMA, potentially DBCA and/or DoT) with Annual Scientific Monitoring Reports that includes a SM07 Chapter within 1 month of approval by the SAG.
Initiation Trigger	Immediately following a **Level 3 spill** or if operational monitoring predicts exposure to mangrove areas; initiated by the PSC (or delegate).
Termination Criteria	Field Study Termination: • Impact surveys determine 'no statistically significant impact' 12 months after the incident between impact and reference sites. Recovery surveys not required. • Recovery of impact sites relative to reference sites has been determined over 2 consecutive years. If after 2 years of consecutive monitoring, sensitive receptors have not recovered from the effects of oil impacts, SapuraOMV will review the requirement for ongoing monitoring and alternative termination criteria will be considered through SAG endorsement. • MC recommendation to terminate monitoring following SAG consultation. • IMT operational NEBA recommends termination. Study Termination: SM07 Final Report developed following field study termination (see above) and approved by the SEA (or delegate).
SAP	SM07 SAP (GHD 2019j).
Specifications	Refer to **Section 5.2** for indicative study specifications
Logistics	Refer to **Section 3.3** for indicative study logistics (i.e. schedule of plant and personnel)
Baseline Data	Refer to **Section 5.3** for baseline data information

4.11 SM08 Turtle Nesting

Table 4-12 SM08 Turtle Nesting Strategy

Study SM08 Turtle Nesting	
Performance Outcomes	• To monitor impacts and recovery to marine turtle nesting sites to support assessments of impacts and recovery of these environmental sensitivities from an oil spill incident (including response activities).
Performance Standards	**Measurement Criteria**
1: Readiness to implement SM08	1a: TL, MP, plant and equipment sourced from external services contracting strategy (Section 6.2 of the OPEPs).
2: Collation of existing baseline data	2a: TL responsible for collation of existing data to establish baseline within 6 weeks of incident. 2b: TL to submit SM08 Existing Baseline Report within 8 weeks of incident to SEA (or delegate) and MC for approval and subsequent distribution to other TLs within 2 weeks of submission.
3: Monitoring turtle nesting habitat during impact and recovery surveys	3a: TL plans survey design on basis of operational monitoring (OS1, OS2, OS3) to identify 'impacted', 'potentially impacted' and 'potential reference' sites within 3 days of incident. Monitoring methods/parameters established considering requirements of relevant conservation instruments for areas and/or receptors predicted to be impacted. 3b: MP carry out impact and recovery surveys. 3c: TL to provide concise Survey Reports within 2 weeks of survey completion to SEA (or appropriate delegate) and MC for approval within 1 week of submission. SEA (or delegate) to distribute approved Survey Reports to other TLs.
4: Assess impact and recovery of turtle nesting habitat	4a: TL/MP to assess impact and recovery of turtle nesting habitats from incident in Final report to SEA and MC within 2 months of final field survey completion. 4b: SEA to provide Final report to SAG for review. TL to incorporate SAG review comments as appropriate into Final report.
5: Regulatory compliance reporting	5a: SEA to provide regulators (NOPSEMA, potentially DBCA and/or DoT) with Annual Scientific Monitoring Reports that includes a SM08 Chapter within 1 month of approval by the SAG.
Initiation Trigger	Immediately following a **Level 3 spill** or if operational monitoring predicts exposure to turtle nesting sites; initiated by the PSC (or delegate).
Termination Criteria	<u>Field Study Termination</u>: • In consultation with NOPSEMA and DBCA deem that potential impacts to turtle nesting habitat have been captured and subsequent recovery within natural variability. • Recovery of impact sites relative to reference sites has been determined over 2 consecutive years. If after 2 years of consecutive monitoring, sensitive receptors have not recovered from the effects of oil impacts, SapuraOMV will review the requirement for ongoing monitoring and alternative termination criteria will be considered through SAG endorsement. • MC recommendation to terminate monitoring following SAG consultation. • IMT operational NEBA recommends termination. <u>Study Termination</u>: SM08 Final Report developed following field study termination (see above) and approved by the SEA (or delegate).
SAP	SM08 SAP (GHD 2019k).
Specifications	Refer to **Section 5.2** for indicative study specifications
Logistics	Refer to **Section 3.3** for indicative study logistics (i.e. schedule of plant and personnel)
Baseline Data	Refer to **Section 5.3** for baseline data information

4.12 SM09 Marine Megafauna

Table 4-13 SM09 Marine Megafauna Strategy

Study SM09 Marine Megafauna	
Performance Outcomes	• To carry out marine megafauna surveys (cetaceans, whale sharks, marine turtles and dugongs) to assess disturbance impacts and recovery from an oil spill incident (including response activities).
Performance Standards	**Measurement Criteria**
1: Readiness to implement SM09	1a: TL, MP, plant and equipment sourced from external services contracting strategy (Section 6.2 of the OPEPs).
2: Acquisition of reactive aerial baseline data	2a: TL plans reactive aerial baseline survey on basis of operational monitoring (OS1, OS2, OS3) to identify 'impacted', 'potentially impacted' and 'potential reference' sites within 3 days of incident. Monitoring methods/parameters established considering requirements of relevant conservation instruments for areas and/or receptors predicted to be impacted. 2b: MP initiate reactive aerial baseline survey within ~1 week of incident. 2c: TL issues SM09 Reactive Baseline Survey Report within 2 weeks of reactive baseline survey completion to SEA (or delegate) and MC. SEA (or delegate) approves and distributes other TLs within 1 week of submission.
3: Collation of existing baseline data	3a: TL responsible for collation of existing data to establish baseline within 6 weeks of incident. 3b: TL to submit SM09 Existing Baseline Report within 8 weeks of incident to SEA (or delegate) and MC for approval and subsequent distribution to other TLs within 2 weeks of submission.
4: Monitoring marine megafauna during impact and recovery surveys, and incidental vessel-based observations	4a: MP carry out impact and recovery surveys. 4b: TLs of other scientific and operational studies to report incidental vessel-based observations of marine megafauna to SM09 TL. 4c: TL to provide concise Survey Reports within 2 weeks of survey completion to SEA (or appropriate delegate) and MC for approval within 1 week of submission. SEA (or delegate) to distribute approved Survey Reports to other TLs.
5: Assess impact and recovery of marine megafauna	5a: TL/MP to assess impact and recovery of marine megafauna from incident in Final report to SEA and MC within 2 months of final field survey completion. 5b: SEA to provide Final report to SAG for review. TL to incorporate SAG review comments as appropriate into Final report.
6: Regulatory compliance reporting	6a: SEA to provide regulators (NOPSEMA, potentially DBCA and/or DoT) with Annual Scientific Monitoring Reports that includes a SM09 Chapter within 1 month of approval by the SAG.
Initiation Trigger	Immediately following a **Level 3 spill** or if operational monitoring predicts exposure to sensitive areas/ receptors; initiated by the PSC (or delegate).
Termination Criteria	Field Study Termination: • Impact surveys determine 'no statistically significant impact' 12 months after the incident between impact and reference sites. Recovery surveys not required. • Recovery of impact sites relative to reference sites has been determined over 2 consecutive years. If after 2 years of consecutive monitoring, sensitive receptors have not recovered from the effects of oil impacts, SapuraOMV will review the requirement for ongoing monitoring and alternative termination criteria will be considered through SAG consultation. • MC recommendation to terminate monitoring following SAG consultation. • IMT operational NEBA recommends termination. Study Termination: SM09 Final Report developed following field study termination (see above) and approved by the SEA (or delegate).
SAP	SM09 SAP (GHD 2019l).
Specifications	Refer to **Section 5.2** for indicative study specifications
Logistics	Refer to **Section 3.3** for indicative study logistics (i.e. schedule of plant and personnel)
Baseline Data	Refer to **Section 5.3** for baseline data information

4.13 SM10 Marine Avifauna

Table 4-14 SM10 Marine Avifauna Strategy

Study SM10 Marine Avifauna	
Performance Outcomes	• To carry out shorebird and seabird surveys to assess impacts and recovery from an oil spill incident (including response activities).
Performance Standards	**Measurement Criteria**
1: Readiness to implement SM10	1a: TL, MP, plant and equipment sourced from external services contracting strategy (Section 6.2 of the OPEPs).
2: Acquisition of reactive baseline data	2a: TL plans reactive baseline survey on basis of operational monitoring (OS1, OS2, OS3) to identify 'impacted', 'potentially impacted' and 'potential reference' sites within 3 days of incident. Monitoring methods/parameters established considering requirements of relevant conservation instruments for areas and/or receptors predicted to be impacted. 2b: MP initiate reactive baseline survey within ~1 week of incident. 2c: TL issues SM10 Reactive Baseline Survey Report within 2 weeks of reactive baseline survey completion to SEA (or delegate) and MC. SEA (or delegate) approves and distributes other TLs within 1 week of submission.
3: Collation of existing baseline data	3a: TL responsible for collation of existing data to establish baseline within 6 weeks of incident. 3b: TL to submit SM10 Existing Baseline Report within 8 weeks of incident to SEA (or delegate) and MC for approval and subsequent distribution to other TLs within 2 weeks of submission.
4: Monitoring marine avifauna during impact and recovery surveys	4a: MP carry out impact and recovery surveys. 4b: TL to provide concise Survey Reports within 2 weeks of survey completion to SEA (or appropriate delegate) and MC for approval within 1 week of submission. SEA (or delegate) to distribute approved Survey Reports to other TLs.
5: Assess impact and recovery of marine avifauna	5a: TL/MP to assess impact and recovery of marine avifauna from incident in Final report to SEA and MC within 2 months of final field survey completion. 5b: SEA to provide Final report to SAG for review. TL to incorporate SAG review comments as appropriate into Final report.
6: Regulatory compliance reporting	6a: SEA to provide regulators (NOPSEMA, potentially DBCA and/or DoT) with Annual Scientific Monitoring Reports that includes a SM10 Chapter within 1 month of approval by the SAG.
Initiation Trigger	Immediately following a **Level 3 spill** or if operational monitoring predicts exposure to sensitive areas/ receptors; initiated by the PSC (or delegate).
Termination Criteria	Field Study Termination: • Impact surveys determine 'no statistically significant impact' 12 months after the incident between impact and reference sites. Recovery surveys not required. • Recovery of impact sites relative to reference sites has been determined over 2 consecutive years. If after 2 years of consecutive monitoring, sensitive receptors have not recovered from the effects of oil impacts, SapuraOMV will review the requirement for ongoing monitoring and alternative termination criteria will be considered through SAG endorsement. • MC recommendation to terminate monitoring following SAG consultation. • IMT operational NEBA recommends termination. Study Termination: SM10 Final Report developed following field study termination (see above) and approved by the SEA (or delegate).
SAP	SM10 SAP (GHD 2019m).
Specifications	Refer to **Section 5.2** for indicative study specifications
Logistics	Refer to **Section 3.3** for indicative study logistics (i.e. schedule of plant and personnel)
Baseline Data	Refer to **Section 5.3** for baseline data information

4.14 SM11 Hydrocarbons in Representative Commercial and Recreational Fish

Table 4-15 SM11 Hydrocarbons in Representative Commercial and Recreational Fish Strategy

Study SM11 Hydrocarbons in Representative Commercial and Recreational Fish	
Performance Outcomes	• To monitor hydrocarbons in representative commercial and recreational fish and shellfish species to assess impacts and recovery in terms of human consumption risks from an oil spill.
Performance Standards	**Measurement Criteria**
1: Readiness to implement SM11	1a: TL, MP, plant and equipment sourced from external services contracting strategy (Section 6.2 of the OPEPs). 1b: MC has identified laboratory(s) for hydrocarbon analysis (i.e. TPH, TRH, PAH, BTEX) of fish/shellfish tissue samples.
2: Acquisition of reactive baseline data	2a: TL plans reactive baseline survey on basis of operational monitoring (OS1, OS2, OS3) to identify 'impacted', 'potentially impacted' and 'potential reference' sites within 3 days of incident. Monitoring methods/parameters established considering requirements of relevant conservation instruments for areas and/or receptors predicted to be impacted. 2b: MP initiate reactive baseline survey at identified landings and commercial lease areas within ~1 week of incident. 2c: TL issues SM11 Reactive Baseline Survey Report within 1 week of receipt of Laboratory Analysis Report to SEA (or delegate) and MC. SEA (or delegate) approves and distributes other TLs within 1 week of submission.
3: Collation of existing baseline data	3a: TL responsible for collation of existing data to establish baseline within 6 weeks of incident. 3b: TL to submit SM11 Existing Baseline Report within 8 weeks of incident to SEA (or delegate) and MC for approval and subsequent distribution to other TLs within 2 weeks of submission.
4: Monitoring hydrocarbons in fish tissue during impact and recovery surveys	4a: MP carry out impact and recovery surveys. 4b: TL to provide concise Survey Reports within 1 week of receipt of Laboratory Analysis Report to SEA (or appropriate delegate) and MC for approval within 1 week of submission. SEA (or delegate) to distribute approved Survey Reports to other TLs.
5: Assess impact and recovery of any oiling of fish tissue	5a: TL/MP to assess impact and recovery of oiling of fish tissue from incident in Final report to SEA and MC within 2 months of final field survey completion. 5b: SEA to provide Final report to SAG for review. TL to incorporate SAG review comments as appropriate into Final report.
6: Regulatory compliance reporting	6a: SEA to provide regulators (NOPSEMA, DPIRD, AFMA, and potentially DBCA and DoT) with Annual Scientific Monitoring Reports that includes a SM11 Chapter within 1 month of approval by the SAG.
Initiation Trigger	Immediately following a **Level 3 spill** or if operational monitoring predicts exposure to sensitive areas/ receptors; initiated by the PSC (or delegate).
Termination Criteria	<u>Field Study Termination</u>: • Impact surveys determine 'no statistically significant' oil tainting of fish tissue that poses a seafood risk for human consumption over 12 months after the incident. Recovery surveys not required. • Recovery of any oil tainting of fish tissue from the incident has reduced to no longer pose a seafood consumption risk over 2 consecutive years. • MC recommendation to terminate monitoring following SAG consultation. <u>Study Termination</u>: SM11 Final Report developed following field study termination (see above) and approved by the SEA (or delegate).
SAP	SM11 SAP (GHD 2019n).
Specifications	Refer to **Section 5.2** for indicative study specifications
Logistics	Refer to **Section 3.3** for indicative study logistics (i.e. schedule of plant and personnel)
Baseline Data	Refer to **Section 5.3** for baseline data information

4.15 SM12 Marine Invertebrates

Table 4-16 SM12 Marine Invertebrates Strategy

Study SM12 Marine Invertebrates	
Performance Outcomes	• To monitor impacts and recovery to invertebrate communities to support assessments of impacts and recovery of these environmental sensitivities.
Performance Standards	**Measurement Criteria**
1: Readiness to implement SM12	1a: TL, MP, plant and equipment sourced from external services contracting strategy (Section 6.2 of the OPEPs).
2: Acquisition of reactive baseline data	2a: TL plans reactive baseline survey on basis of operational monitoring (OS1, OS2, OS3) to identify 'impacted', 'potentially impacted' and 'potential reference' sites within 3 days of incident. Monitoring methods/parameters established considering requirements of relevant conservation instruments for areas and/or receptors predicted to be impacted. 2b: MP initiate reactive baseline surveys within 1 week. 2c: TL issues SM12 Reactive Baseline Survey Report within 2 weeks of reactive baseline survey completion to SEA (or delegate) and MC. SEA (or delegate) approves and distributes to other TLs within 1 week of submission.
3: Collation of existing baseline data	3a: TL responsible for collation of existing data to establish baseline within 6 weeks of incident. 3b: TL to submit SM12 Existing Baseline Report within 8 weeks of incident to SEA (or delegate) and MC for approval and subsequent distribution to other TLs within 2 weeks of submission.
4: Monitoring of invertebrates during impact and recovery surveys	4a: TL evaluates suitability of established monitoring sites/methods on basis of operational monitoring and other scientific studies. Sites/methods modified as necessary with approval of MC and SEA prior to relevant survey. 4b: MP carry out impact and recovery surveys. 4c: TL to provide concise Survey Reports within 2 weeks of survey completion to SEA (or appropriate delegate) and MC for approval within 1 week of submission. SEA (or delegate) to distribute approved Survey Reports to other TLs.
5: Assess impact and recovery of invertebrate communities	5a: TL/MP to assess impact and recovery of invertebrate communities from incident in Final report to SEA and MC within 2 months of final field survey completion. 5b: SEA to provide Final report to SAG for review. TL to incorporate SAG review comments as appropriate into Final report.
6: Regulatory compliance reporting	6a: SEA to provide regulators (NOPSEMA, potentially DBCA and/or DoT) with Annual Scientific Monitoring Reports that includes a SM12 Chapter within 1 month of approval by the SAG.
Initiation Trigger	Immediately following a **Level 3 spill** or if operational monitoring predicts exposure to sensitive areas/ receptors; initiated by the PSC (or delegate).
Termination Criteria	Field Study Termination: • Impact surveys determine 'no statistically significant impact' 12 months after the incident between impact and reference sites. Recovery surveys not required. • Recovery of impact sites relative to reference sites has been determined over 2 consecutive years. If after 2 years of consecutive monitoring, sensitive receptors have not recovered from the effects of oil impacts, SapuraOMV will review the requirement for ongoing monitoring and alternative termination criteria will be considered through SAG endorsement. • MC recommendation to terminate monitoring following SAG consultation. • IMT operational NEBA recommends termination. Study Termination: SM12 Final Report developed following field study termination (see above) and approved by the SEA (or delegate).
SAP	SM12 SAP (GHD 2019o).
Specifications	Refer to **Section 5.2** for indicative study specifications
Logistics	Refer to **Section 3.3** for indicative study logistics (i.e. schedule of plant and personnel)
Baseline Data	Refer to **Section 5.3** for baseline data information

4.16 SM13 Hindcast Modelling

Table 4-17 SM13 Hindcast Modelling Strategy

Study SM13 Hindcast Modelling	
Performance Outcomes	• To conduct hindcast modelling after the incident with information/data from operational and scientific monitoring studies, and implemented response measures information, to refine post-incident impact assessment and to inform long-term scientific monitoring specifications of environmental sensitivities.
Performance Standards	**Measurement Criteria**
1: Readiness to implement SM13	1a: Modelling services provider sourced from external services contracting strategy (Section 6.2 of the OPEPs).
2: Conduct hindcast simulations to inform post-incident impact assessment	2a: TLs of relevant studies provide SM13 TL with pertinent information/data for model validation purposes (e.g. water and sediment quality) within 1 month after the cessation of response measures. 2b: PSC (or delegate) to provide SM13 TL with pertinent information/data regarding response measures implemented during the incident (e.g. dispersant application) and stranded shoreline estimates within 1 month after the cessation of response measures. 2c: SM13 TL to provide the Final Report on predicted environmental impacts in terms of spatial and temporal hydrocarbon distributions of surface slicks, entrained and dissolved oil; and shoreline accumulation from a Level 2 or 3 incident within 6 months of the cessation of the response measures.
Initiation Trigger	After cessation of response to a spill; initiated by the SEA (or delegate).
Termination Criteria	• SM13 Final Report documenting spatial and temporal hydrocarbon distributions (surface slicks, entrained and dissolved oil, and shoreline accumulations) based on hindcast modelling approved by SEA (or delegate).
SAP	SM13 SAP (GHD 2019p).
Specifications	NA
Logistics	NA
Baseline Data	NA

5. Scientific Monitoring Specifications

5.1 Overview of Scientific Study Phases

The scientific studies will be progressed in phases with the initiation of different component activities planned to link to the status of the potential spill event and optimise the ability to obtain sufficiently robust data to determine the impacts of the spill. Broadly, each of the studies will aim to define a baseline, measure impact and assess recovery from impact. To address the timing constraints presented by an actual spill, field and desktop activities for a given component (e.g. to establish baseline conditions) may be initiated separately and progressed concurrently.

Generally, three field survey types are implemented for scientific monitoring, namely:

- A ‘reactive baseline survey’ initiated within 1-2 weeks of the start of an oil spill incident.
- ‘Impact surveys’ on a quarterly basis until ~12 months after the start of an oil spill incident unless field termination criteria are met beforehand.
- ‘Recovery surveys’ at a reduced frequency (semi-annual to annual) after ~12 months after the start of an oil spill incident.

This phased approach to scientific monitoring is summarised in **Table 5-1**.

Table 5-1 Scientific monitoring implementation phases

Phase	Timing	Activity	Purpose	Output
Readiness	Prior to drilling	OSMP finalised. Monitoring service providers, plant and equipment arrangements in place through external services contracting strategy (OPEP Section 6.2).	‘Readiness’ for timely implementation of OSMP.	Timely mobilisation of reactive monitoring in event of an oil spill incident
Monitoring	Upon notification of spill	Mobilisation of scientific monitoring teams and implementation of studies.	Collection of reactive baseline data. Inform response planning and management of hydrocarbon spill.	Information (communications, data, reports) to IMT.
	During spill	Continued implementation of scientific monitoring	Monitor impact to environmental sensitivities and to inform response.	Information to IMT.
		Collate and assess existing baseline data of key sensitivities	Establish baseline condition of environmental sensitivities and identify baseline data gaps.	Baseline data reports for each scientific study.
	Post spill monitoring	Continued implementation of scientific monitoring	Scientific monitoring studies to monitor impact/recovery of environmental sensitivities.	Reports of impacts to and subsequent recovery of environmental sensitivities.
		Cease scientific monitoring when termination criteria met.	Cessation of monitoring because environmental sensitivities completely/sufficiently recovered from hydrocarbon impacts.	Final Reports.

5.2 Study Design Specifications of Scientific Monitoring Studies

There are study design elements in some of the SAPs that reference the OSMIP for specifications (e.g. sampling frequency), which are provided in **Table 5-2** along with priority sensitive areas that are listed in Section 1.5 of both OPEPs.

In general, scientific studies to determine impacts will preferentially rely on a multiple Before After Control Impact (M-BACI) type approach. The 'Before' being characterised via existing baseline information, informed to a greater or lesser extent by reactive baseline data collected (where practicable) following a spill.

Requirements for collation and review of the adequacy of baseline information as part of study planning are described for each of the scientific studies in Section 4. A literature-based catalogue of available baseline data for relevant scientific monitoring studies is provided in Section 5.3.

Consideration of natural temporal and spatial variation in the environmental element subject to monitoring, and of the nature and scale of the particular spill event, will be integral to each final study design. Reactive baseline surveys are planned for most scientific monitoring studies (Table 2-3) to augment existing baseline data and characterise immediate pre-impact conditions at a given location, with prioritisation of sensitive areas predicted to have potential exposure in short timeframes. However, reactive baseline surveys cannot capture longer-term temporal variation and may not always be practicable at all priority locations prior to impact.

Where available baseline data (including from reactive surveys) is considered by the TL to be inadequate to support robust statistical analyses of potential impacts via a BACI method, alternative approaches to post-impact assessment will be incorporated into study design, including (but not necessarily limited to) techniques such as Impact–Control (IC), Gradient of Impacts, Lines of Evidence, Control Charts etc.

Table 5-2 Specifications of scientific monitoring studies

SAP ID	Scientific Monitoring	Typically Implement	Monitoring Environments	Nominal Sampling Depths	Priority Sensitive Areas	Impact Phase Survey Frequency	Recovery Phase Survey Frequency
SM01	Weathering Assessment	Level 3 spill	Pelagic waters	Transect Sampling through slick 0 and 20 m below surface	NA	3 surveys at ~2, ~4 and ~8 weeks after the start of the incident.	NA
SM02	Dispersant Effects	Level 3 spill If dispersant used	Pelagic waters	Transect Sampling through axis of slick 0, 1, 5 and 10 m below surface	NA	3 surveys at ~1, ~3 and ~5 weeks after the start of the incident.	NA
SM03	Ecotoxicology	Level 3 spill	Pelagic waters	NA	NA	ASAP if oil available that was collected prior to incident, or immediately after sample acquisition	NA
SM04	Marine Waters	Level 2 or 3 spill	Pelagic, Subtidal, Intertidal waters	Reference and Impact Sites: **Pelagic:** 0.5, 5 m below surface, mid-depth and 2 m above bottom (or alternative mid-water depth for deep waters that is predicted to be the vertical extent of subsurface oiling) **Subtidal:** 0.5 m below surface, mid-depth and 0.5 m above bottom **Intertidal:** 0.5 m Cardinal Transect Sampling in proximity to the slick during Level 3 spill with 1st 5 stations at 2 km spacing and 2nd 5 stations at 5 km spacing	Barrow Island, Montebello Islands, Imperieuse Reef, Ningaloo Region, Muiron Islands In the locale of the spill.	Reactive Baseline Quarterly thereafter	Semi-Annual
SM05	Marine Sediments	Level 2 or 3 spill	Pelagic, Subtidal, Intertidal and Supratidal sediments	Reference and Impact Sites: Surficial sediments Cardinal Transect Sampling in proximity to the slick during Level 3 spill with 1st 5 stations at 4 km spacing and 2nd 5 stations at 10 km spacing			

SAP ID	Scientific Monitoring	Typically Implement	Monitoring Environments	Nominal Sampling Depths	Priority Sensitive Areas	Impact Phase Survey Frequency	Recovery Phase Survey Frequency
SM06	Subtidal and Intertidal Habitats	Level 3 spill	Subtidal and Intertidal habitats	Reference and Impact Sites: Seabed	Barrow Island, Montebello Islands, Imperieuse Reef, Ningaloo Region, Muiron Islands		
SM07	Mangrove Habitat	Level 3 spill	Intertidal mangrove habitat	NA	Barrow Island, Montebello Islands, Ningaloo Region		
SM08	Turtle Nesting	Level 3 spill	Supratidal turtle nesting sites	NA	Barrow Island, Montebello Islands, Ningaloo Region, Muiron Islands		
SM09	Marine Megafauna	Level 3 spill	Offshore and nearshore waters	NA	Migration, nesting and foraging areas		
SM10	Marine Avifauna	Level 3 spill	Offshore and nearshore waters Shorelines	NA			
SM11	Commercial and Recreational Fish	Level 3 spill	Commercial and recreational fish landings Aquaculture facilities Sea Farms	NA	Recent fishing areas		
SM12	Marine Invertebrates	Level 3 spill	Pelagic, Subtidal and Intertidal sediments Pelagic and Subtidal waters	Reference and Impact Sites: Sediment acquisition for benthic infauna, monitoring of seabed for benthic epifauna and collection of pelagic fauna	Barrow Island, Montebello Islands, Imperieuse Reef, Ningaloo Region, Muiron Islands		
SM13	Hindcast Modelling	Level 2 or 3 spill	NA	NA	NA	NA	No

5.2.1 Ecotoxicity Bioassay Test Organisms and Endpoints

Ecotoxicology study SM03 requires the identification of test organisms and endpoints to be specified. In order to adhere to the recommendations provided in Batley et al. (2014) and Warne et al (2015) for deriving Australian and New Zealand water quality guideline values, bioassay test organisms for SM03 were selected according to the following criteria:

- At least eight bioassays (end points).
- A range of both acute and chronic endpoints, with a preference for chronic tests where available.
- Representative of, or surrogate to, locally occurring species.
- Test comparable to the previous round/s of testing to enable long term trends to be established.
- Test battery sensitive to a broad range of contaminants.

Indicative toxicity bioassays for this scientific study are provided in **Table 5-3**. All of the listed tests provide information on type of toxicity (acute, chronic) including the test endpoints.

Table 5-3 Indicative SM03 ecotoxicology bioassays

Type	Species	Duration	Endpoint	Method Reference
Acute	*Vibrio fischeri* (copepod)	5, 15 minute	Luminescence	Azur Environmental (1998)
Chronic	*Nitzschia cloisterium* (microalgae)	72 hour	Growth (cell division) inhibition	OECD Test Guideline 201 (2002) Stauber et al. (1994) Franklin et al (2005)
Acute	*Acartia sinjiensis* (copepod)	48 hour	Immobilsation	Gissi et al. (2013)
Chronic	*Gladioferens imparipes* (copepod)	7 day	Larval development	OECD (2005)
Chronic	*Echinometra mathaei* (sea urchin)	72 hour	Larval devleopment	Byrne et al. (2008)
Chronic	*Heliocidaris tuberculata* (sea urchin)	1 hour	Fertilisation	Simon and Laginestra (1997) USEPA (2002a)
Chronic	*Saccostrea echinata* (oyster)	48 hour	Larval devleopment	APHA (1998) Krassoi (1995)
Acute	*Lates calcarifer* (fish)	96 hour	Imbalance	USEPA (2002b)

5.3 Catalogue of Literature-Based Baseline Data

The SAPs reference the OSMIP for the catalogue of baseline data for each of the studies. The literature-based catalogue of baseline data for relevant scientific monitoring studies is provided in **Table 5-4**. In the event of an unplanned hydrocarbon Level 2 or 3 oil spill incident the following will occur:

- Data custodians will be contacted and the datasets requested.
- Data will be collated as it arrives.
- As a contingency, ‘data mining’ from publicly available information will occur simultaneously for literature-based baseline database establishment.

Table 5-4 Catalogue of literature-based monitoring data

Study ID	Study	Reference	Project	Contact / Organisation	Methodology	Site(s)	Description	Survey Dates / Frequency
SM04	Marine Waters	Hanson C., Waite A., Thompson P. A., & Pattiaratchi C. 2007. Deep Sea Research Part II: Topical Studies in Oceanography, 54(8-10), 902-924.	Phytoplankton community structure and nitrogen nutrition in Leeuwin Current and coastal waters off the Gascoyne region of Western Australia.	C. Hanson	Light microscopy and chemotaxonomic methods	Leeuwin Current and offshore surface waters, Western Australia	Assessment of phytoplankton species composition and abundance.	2005
SM05 SM12	Marine Sediments Marine Invertebrates	SapuraOMV Kanga-1 Geophysical & Geotechnical Survey	Kanga-1	SapuraOMV		Kanga-1 operational area	Geophysical data acquired in 2021 describes baseline benthic fauna and physio-chemical characteristics of sediment within operational area	2021
SM05 SM06 SM12	Marine Sediments Intertidal and Subtidal Habitat Marine Invertebrates	Przeslawski, R., McArthur, M. A., & Anderson, T. J. 2013.. Marine and Freshwater Research, 64(6), 573-583.	Infaunal biodiversity patterns from Carnarvon shelf (Ningaloo reef), Western Australia	Geoscience Australia	Sediment samples using a Smith-MacIntyre grab	Mandu, Point Cloates, Gnaraloo along the Carnarvon Shelf	Quantify infaunal biodiversity over three environmentally distinct areas with various shelf widths, geomorphology and latitudes, adjacent to Ningaloo Reef. Contribute to understanding of ecosystem processes and biodiversity I the region.	2011
SM06 M07 SM08 SM11 SM12	Subtidal Benthic Habitat Mangrove Habitat Turtle Nesting Hydrocarbons in Representative Commercial and Recreational Fish Marine Invertebrates	DBCA Marine Monitoring Program. 2016 PMCP Presentation.	DBCA Marine Monitoring	Tom Holmes (Marine Science Program, DBCA)	- Corals (community composition, recruitment, *Drupella* predation) - Fish (shallow water stereo-DOV, deeper water stereo-BRUV, recruitment) - Water temperature (NOAA satellite, in situ loggers) - Mangroves (remote sensing, mangrove extent, foliage condition)	Ningaloo Marine Reserve, Montebello/Barrow Marine Reserves		Active monitoring programs in coral, fish, mangroves, turtles and water temperatures

Study ID	Study	Reference	Project	Contact / Organisation	Methodology	Site(s)	Description	Survey Dates / Frequency
SM04 SM05 SM06 SM10	Marine Waters Marine Sediment Subtidal Benthic Habitat Marine Avifauna	Ramsar Site Ecological Charter Descriptions (https://www.environment.gov.au/water/wetlands/publications)	Ramsar Site Ecological Charter Descriptions	DAWE	National Framework and Guidance for Describing the Ecological Character of Australia's Ramsar Wetlands (DEWHA 2008)	Ashmore Reef Commonwealth Marine Reserve Eighty Mile Beach Hosnies Spring The Dales		
SM06 SM11 SM12	Subtidal Benthic Habitat Hydrocarbons in Representative Commercial and Recreational Fish Marine Invertebrates	Pitcher CR et al (2016) Pilbara Marine Conservation Partnership – Environmental Pressures: Regional Biodi versity — Environmental pressures: regional biodiversity – Pilbara Seabed Biodiversity Mapping & Characterisation. Final report, CSIRO Oceans & Atmosphere, Published Br isbane, March 2016, 62 p ages	Pilbara Marine Conservation Partnership	Contact: Dr Roland Pitcher (CSIRO) (M) +61 418 195 955 (O) +61 7 3833 5954	- Seabed biodiversity survey @ 125 sites (125 towed video, 111 benthic sled, 43 trawls) - Reef habitats, biodiversity and characterisation: habitat surveys ~0.5 m photos on short transects-point analysis, Algal weights extractions from quadrats on long transects, underwater visual census of coral-algae seagrass cover along long transects, macroinvertebrate counts along 25 m x 1 m transects, fish UVC of larger fish on long transects (100 m x 10 m) and smaller fish on small transects (25 m x 25 m)	Ningaloo to Burrup	- Seabed biodiversity survey: 1943 samples from 14 taxonomic groups - Reef habitats, biodiversity and characterisation: Algal coverage at 71 sites with 21 species, algal weight at 75 sites with 74 species, coral coverage at 71 sites with 10 species, Long fish transects at 92 sites with 236 species, Short fish transects @ 92 sites with 236 species, habitat species at 85 sites with 209 species, habitat broad group @ 85 sites with 8 species, macroinvertebrate family @ 70 sites with 22 species, macroinvertebrate species at 70 sites with 46 species.	- Seabed biodiversity survey in June 2013 - Reef habitats, biodiversity and characterisation (3x trips in 2013-2014 for habitat surveys, 4x trips in 2013-2014 for algal weights, 2x trips in 2014 for algal-coral-seagrass cover along transects, 2x trips 2013-2014 for macroinvertebrates, 6x trips in 2013-2014 for fish UVC)
SM06 SM11 SM12	Subtidal Benthic Habitat Hydrocarbons in Representative Commercial and Recreational Fish Marine Invertebrates	Babcock R et al (2017). Pilbara Marine Conservation Partnership – Final Report – Volume 2 (Part III: Coral Reef Health). CSIRO Oceans & Atmosphere, Published Br isbane.	Pilbara Marine Conservation Partnership	Contact: Dr Russ Babcock (CSIRO) (O) +61 7 3833 5904	- Seabed biodiversity survey @ 125 sites (125 towed video, 111 benthic sled, 43 trawls) - Reef habitats, biodiversity and characterisation: fish UVC of larger fish on long transects (100 m x 10 m) and smaller fish on small transects (25 m x 25 m)	Ningaloo to Burrup	- Coral bleaching, northern Ningaloo 10 year monitoring, flood effects on corals, larval settling, coral reef fish, bleaching, grazing effects, starfish predation - Macrophytes abundance and richness	- Seabed biodiversity survey in June 2013 - Reef habitats, biodiversity and characterisation (3x trips in 2013-2014 for habitat surveys, 4x trips in 2013-2014 for algal weights, 2x trips in 2014 for algal-coral-seagrass cover along transects, 2x trips 2013-2014 for macroinvertebrates, 6x trips in 2013-2014 for fish UVC)

Study ID	Study	Reference	Project	Contact / Organisation	Methodology	Site(s)	Description	Survey Dates / Frequency
SM06 SM11 SM12	Subtidal Benthic Habitat Hydrocarbons in Representative Commercial and Recreational Fish Marine Invertebrates	Babcock R et al (2017). Pilbara Marine Conservation Partnership – Final Report – Volume 1 (Part 1: Overview & Part II: Environmental Pressures). CSIRO Oceans & Atmosphere, Published Brisbane.	Pilbara Marine Conservation Partnership	Contact: Dr Russ Babcock (CSIRO) (O) +61 7 3833 5904	Regional Scale Assessment	Ningaloo to Burrup	-Connectivity: circulation patterns and coral recruitment, larval connectivity - Oceanographic drivers (cyclones, interannual thermal heat pressure, pathways to Ningaloo)	2007 to 2016
SM06	Subtidal Benthic Habitat	Gorgon Gas Development and Jansz Feed Gas Pipeline: Coastal and Marine Baseline State and Environmental Impact Report Supplement: Area of Coral Assemblages -- DOC NO: G1-NT-REPX0002539	Gorgon	Chevron Australia	Mapping dredge impacts on corals	Gorgon Monitoring Sites	- BPPH Monitoring sites, distribution and abundance maps for eastern Barrow Island and southern Montebellos - Proportion of corals assemblages in region - Calculated loss from dredging effects	Pre- and post- surveys
SM06	Subtidal Benthic Habitat	Gorgon Gas Development and Jansz Feed Gas Pipeline: Dredging and Spoil Disposal Management and Monitoring Plan -- DOC NO: G1-NT-REPX0000373	Gorgon	Chevron Australia	Methodology for tagged coral colonies	Locations of 26 coral health monitoring sites	Detailed methods on coral health monitoring	As frequent as fortnightly
SM06	Subtidal Benthic Habitat	Wheatstone Project: Technical Appendix N7 (Baseline Coral Community Description) -- DOC NO: MSA134R2	Wheatstone	MScience	Coral cover and composition via belt transects	16 sites	Baseline coral survey and methods	NA
SM06	Subtidal Benthic Habitat	Coral Health Monitoring Interim Review Sept 2008 -- DOC NO: MSA93R55	Pluto	MScience	Coral health	24 sites	Coral health monitoring	1-Nov-07 to 8-Sep-08

Study ID	Study	Reference	Project	Contact / Organisation	Methodology	Site(s)	Description	Survey Dates / Frequency
SM06	Subtidal Benthic Habitat	Patterns of mortality from natural and anthropogenic influences in Dampier corals: 2004 cyclone and dredging impacts -- DOC NO: Conference paper	Pluto	MScience	Coral health	18 Sites	Coral health monitoring	Jan.-Oct. 2004
SM06	Subtidal Benthic Habitat	Cape Lambert Port B Development: BPPH Monitoring Report (Subtidal) -- DOC NO: NA	Cape Lambert / Anketell	SKM	Coral health BPPH cover	13 sites	Baseline coral monitoring data	Jul 08 - May 09
SM06	Subtidal Benthic Habitat	Cape Lambert Magnetite Project: Coral Health Baseline Studies -- DOC NO: 61/24602/105608	Cape Lambert / Anketell	GHD	Coral health BPPH cover	6 sites	Baseline coral monitoring data	Nov 09 - Oct 10
SM06	Subtidal Benthic Habitat	West Pilbara Iron Ore Project: Twelve-Month Baseline Monitoring Report -- DOC NO: 61/26565/119969	Cape Lambert / Anketell	GHD	Coral health BPPH cover	12 sites	Baseline coral monitoring data	Jan 11 - Mar 12
SM06 SM11 SM12	Intertidal and Subtidal Habitat Hydrocarbons in Representative Commercial and Recreational Fish Marine Invertebrates	Mclean, Dianne & Vaughan, B.I. & Malseed, B.E. & Taylor, Michael. (2019) Marine Environmental Research. 153. 104813. 10.1016/j.marenvres.2019.104813.	Fish-habitat associations on a subsea pipeline within an Australian Marine Park	AIMS	ROV video	Montebello Marine Park	Industry-collected remotely operated vehicle (ROV) video to assess fish species richness and abundance, and marine growth type, extent and complexity along sections of a subsea gas pipeline	-
SM06 SM12	Intertidal and Subtidal Habitat Marine Invertebrates	Kobryn HT, Wouters K, Beckley LE, Heege T (2013). PLoS ONE 8(7):e70105.https://doi.org/10.1371/journal.pone.0070105	Ningaloo Reef: Shallow Marine Habitats Mapped Using a Hyperspectral Sensor.	CSIRO Murdoch University	HyMap airborne hyperspectral imagery	Ningaloo Marine Park (including Muiron Islands)	Habitat maps	Apr-May 2006

Study ID	Study	Reference	Project	Contact / Organisation	Methodology	Site(s)	Description	Survey Dates / Frequency
SM06	Subtidal Benthic Habitat	Gorgon Gas Development and Jansz Feed Gas Pipeline: Coastal and Marine Baseline State and Environmental Impact Report Appendices -- DOC NO: G1-NT-REPX0001838	Gorgon	Chevron Australia	Species list for: - Coral - Macroalgae - Seagrass	NA	Coral, Macroalgae, Seagrass species list	NA
SM06	Subtidal Benthic Habitat	Gorgon Development on Barrow Island Technical Report Marine Benthic Habitats -- DOC NO: R03207	Gorgon	RPS	Mapping baseline BPPH	Gorgon Monitoring Sites	BPPH distribution	Pre- surveys
SM06	Subtidal Benthic Habitat	Gorgon Gas Development and Jansz Feed Gas Pipeline: Coastal and Marine Baseline State and Environmental Impact Report Scope Of Works -- DOC NO: G1-NT-REPX0001838	Gorgon	Chevron Australia	- Tagged coral colonies - Macroalgae quadrats biomass - Seagrass quadrats biomass - Vegetation surveys	- 12 coral - 8-12 macroalgae - 5-15 seagrass - 8 mangrove	BPPH distribution and abundance maps for eastern Barrow Island and southern Montebellos	- Coral May 08-Jul 09 - Macro Nov 08, Jan 09, Jul 09 - Seagrass Nov 08, Jan 09, Jul 09 -Mangroves Nov 09
SM06	Intertidal and Subtidal Habitat	UNEP-WCMC, Short FT (2020). Global distribution of seagrasses (version 7.0). Seventh update to the data layer used in Green and Short (2003). Cambridge (UK): UN Environment World Conservation Monitoring Centre. URL: http://data.unep-wcmc.org/datasets/7	Global Distribution of Seagrasses	UN Environment World Conservation Monitoring Centre – Ocean Data Viewer	-	Western Australia	Point and polygon occurrence data	NA
SM06 SM12	Subtidal Benthic Habitat Marine Invertebrates	Keesing, J.K. (Ed.) 2019. Benthic habitats and biodiversity of Dampier and Montebello Marine Parks. Report to the Director of National Parks. CSIRO, Australia.	Benthic habitats and biodiversity of Dampier and Montebello Marine Parks	Marine Parks	- Depth mapping, sub-bottom profiling to determine seabed structure, multibeam acoustic swathing (bathymetry and backscatter [seabed hardness/softness]) and by interpreting imagery of the seabed.	Dampier Marine Park and Montebello Marine Park	- Physical and biohabitat types - Biodiversity assessment - Bathymetry and physical attributes of the seabed - Substrate and biohabitat types	Dampier MP - 2017 Montebello MP– 1987 to 1997, 2013 and 2017

Study ID	Study	Reference	Project	Contact / Organisation	Methodology	Site(s)	Description	Survey Dates / Frequency
SM06 SM12	Subtidal Benthic Habitat Marine Invertebrates	Reef Life Survey Assessment of Coral Reef Biodiversity in the North-West Commonwealth Network, 2017	Reef Life Survey Assessment of Coral Reef Biodiversity in the North-West Commonwealth Network	Marine Parks	- Underwater visual census method	- 172 transects at 94 sites across the North-west Marine Bioregion	Coral health monitoring	2009 - 2016
SM06 SM12	Subtidal Benthic Habitat Marine Invertebrates	Reef Life Survey Assessment of Coral Reef Biodiversity in the North-West Commonwealth Network, 2020	Reef Life Survey Assessment of Coral Reef Biodiversity in the North-West Commonwealth Network	Marine Parks	- Underwater visual census method	- 174 transects at 88 sites across the North-west Marine Bioregion	Coral health monitoring	2018-2019
SM06 SM12	Intertidal and Subtidal Habitat Marine Invertebrates	Cassata, L. and Collins, L. (2004). Final Report: MMS/NIN/NMP -78/2004. December 2004. Marine Conservation Branch, Department of Conservation and Land Management, Perth, Western Australia.	Coral Reef Communities, Habitats and Substrates in the Near Sanctuary Zones of Ningaloo Marine Park.	DBCA	Video transects, satellite images and aerial photography	Ningaloo Marine Park	Habitat types were identified and mapped regionally	Mar-July 2004
SM07	Mangrove Habitat	Giri C, Ochieng E, Tieszen LL, Zhu Z, Singh A, Loveland T, Masek J, Duke N (2011). Status and distribution of mangrove forests of the world using earth observation satellite data (version 1.3, updated by UNEP-WCMC). Global Ecology and Biogeography 20: 154-159. doi: 10.1111/j.1466-8238.2010.00584.x . Data URL: http://data.unep-wcmc.org/datasets/4	Global Distribution of Mangroves	UN Environment World Conservation Monitoring Centre – Ocean Data Viewer	Remote sensing study of global mangrove coverage	Western Australia	Global mangrove distribution as mapped by the USGS	NA

Study ID	Study	Reference	Project	Contact / Organisation	Methodology	Site(s)	Description	Survey Dates / Frequency
SM06 SM07	Subtidal Benthic Habitat Mangrove Habitat	Gorgon Gas Development and Jansz Feed Gas Pipeline: Post-Development Coastal and Marine State and Environmental Impact Survey Report, Year 1: 2011/2012 -- DOC NO: G1-NT-PLNX0004461	Gorgon	Chevron Australia	- Coral survival via CPCe of 0.25 m^2 quadrats - % abundance, biomass and identification macroalgae & seagrass - Mangrove composition, cover, seedling, adults	- 12 coral - 14 macroalgae - 16 seagrass - 8 mangrove	Survey results of corals, seagrass, macroalgae and mangroves	- Nov 11-Feb 12 (coral) - Dec 11-Feb 12 (macro/seagrass) - 11-16 Dec 11 (mangroves)
SM06 SM07	Subtidal Benthic Habitat Mangrove Habitat	Gorgon Gas Development and Jansz Feed Gas Pipeline: Post-Development Coastal and Marine State and Environmental Impact Survey Report, Year 2: 2013 -- DOC NO: NA	Gorgon	Chevron Australia	- Coral survival via CPCe of 0.25 m^2 quadrats - % abundance, biomass and identification macroalgae & seagrass - Mangrove composition, cover, seedling, adults	- 12 coral - 14 macroalgae - 16 seagrass - 8 mangrove	Survey results of corals, seagrass, macroalgae and mangroves	NA
SM06 SM07	Subtidal Benthic Habitat Mangrove Habitat	Dampier Operations Marine Management Program -- DOC NO: NA	Dampier	Pilbara Iron	- Coral (area, abundance, diversity) - Mangroves (area, abundance)	- Coral sites unknown - 2 mangal areas	Overview of compliance monitoring for contaminants in tissues and biological (coral, mangroves) surveys	Unknown
SM06 SM07	Subtidal Benthic Habitat Mangrove Habitat	Wheatstone Project: Dredging and Dredge Spoil Placement Environmental Monitoring and Management Plan -- DOC NO: WS0-0000-HES-RPT-CVX-000-00086-000	Wheatstone	Chevron Australia	- Overview of methodologies for coral, Macroalgae, seagrass, mangroves	- overview of site descriptions, benthic communities, and % cover	Detailed methods and locations of monitoring in the Southern Group of islands	NA
SM07	Mangrove Habitat	Wheatstone Project: Mangrove, Algal Mat and Tidal Creek Management Plan -- DOC NO: WS0-0000-HES-PLN-CVX-000-00066-000	Wheatstone	Chevron Australia	- Overview of methodologies for mangrove community structure and tree health	~12 sites on mainland coast	Mangrove health methods Potential reference sites on WA coast	NA

Study ID	Study	Reference	Project	Contact / Organisation	Methodology	Site(s)	Description	Survey Dates / Frequency
SM08	Turtle Nesting	Gorgon Development on Barrow Island Technical Report Sea Turtles -- DOC NO: R03211	Gorgon	Pendoley and RPS	Line census count	- 11 beaches (Nov 03-Jan 04) - 13 beaches (Nov 04-Feb 05)	- Surveyed turtle nesting beaches around Barrow Island - Turtle nesting monitoring Nov. 03-Jan. 04 and Nov. 04-Feb. 05 - Light surveys and effects on hatchlings	- 3-5 days
SM08	Turtle Nesting	Gorgon Gas Development and Jansz Feed Gas Pipeline: Long-Term Marine Turtle Management Plan -- DOC NO: G1-NT-PLNX0000296	Gorgon	Chevron Australia	- Turtle track census - Hatchling orientation - Turtle nest success	- Turtle track (7 Flatback, 7 Green) - Hatchling orientation (4-6 Flatback, 5-9 Green)	- Baseline data summary - Detailed assessment methodology for long-term monitoring	- 2004/5 - 2007/08 baseline data (track/hatchling) - 2006/7 - 2008/9 baseline (nest)
SM08	Turtle Nesting	Wheatstone Project: Technical Appendix O8 (Marine Turtle Beach Survey: Onslow Mainland Area and Nearby Islands 25 January - 6 February 2009) -- DOC NO: R-J03008	Wheatstone	Pendoley Environmenta l	-Track census and nest counts - Hatchling emergence fan	- Census: Ashburton Is, Thevenard Is, Bessieres Is, Mainland - Snapshot: Thevenard Is (west), Direction Is, Tortoise Is, NE Twin Is, Serrurier Is, Table Is, Round Is, Flat Is, Locker, Ultra/Locker Pt, Onslow Back Beach, Coolgara/Beadon Ck, SW Twin Is	Nesting and hatchling surveys on coastline and islands	- 'Snapshot' surveys over 1 day - 'Census' over 4 days
SM08	Turtle Nesting	Wheatstone Project: Technical Appendix O11 (Marine Turtles Technical Report) -- DOC NO: M09601:7	Wheatstone	RPS	- Vessel-based track counts (mainland) - Beach transects (Ashburton Island)	- Mainland beaches near Project area - Ashburton Island	Establishment of baseline data of marine turtles (lit review, Pendoley and RPS field studies)	Sub-daily snapshot surveys
SM08	Turtle Nesting	Pluto LNG Project Sea Turtle Management Plan Operations and Expansion -- DOC NO: DRIMS 7006136	Pluto	Woodside	Turtle tracks	Holden Beach	Turtle nesting beaches and aggregation areas in Dampier (reference site)	5 years (until 2016)

Study ID	Study	Reference	Project	Contact / Organisation	Methodology	Site(s)	Description	Survey Dates / Frequency
SM08	Turtle Nesting	Turtle Monitoring at Bells Beach and Selected Rookeries of the Dampier Archipelago: 2008/09 Season -- DOC NO: 495	Cape Lambert / Anketell	Biota Environmenta l Services	- Turtle nesting activity - Hatchling activity	6 beaches	Baseline data in the region of Cape Lambert for turtle nesting	~2 weeks - 24 Nov-6 Dec 2008 - 7-19 Jan 2009
SM08	Turtle Nesting	Ningaloo Turtle Program. Reports available at: http://www.ningalooturtles.org.au/media_reports.html	Ningaloo Turtle Program	Cape Conservation Group, DEC and WWF-Australia.	Beach surveys, track counts, best location, mortality counts.	Ningaloo Coast	1. Determine the abundance of nests on specific sections of beach over specified time intervals for each species; 2. Identify the relative significance of specific nesting beaches to each species;	Annual
SM08	Turtle Nesting	Rob D, Barnes P, Whiting S, Fossette S, Tucker T and Mongan T (2019) Turtle activity and nesting on the Muiron Islands and Ningaloo Coast: Final Report 2018, Ningaloo Turtle Program. Report prepared for Woodside Energy Limited. Department of Biodiversity, Conservation and Attractions, Exmouth, pp.51.	Turtle activity and nesting on the Muiron Islands and Ningaloo Coast: Final Report	DBCA	On beach monitoring and aerial surveys	Muiron Islands North Wset Cape Bungelup	Understand the distribution of turtle activity and nesting along the Ningaloo Coast and southern Pilbara Islands	2016/2018
SM08	Turtle Nesting	Tucker, Anton & Fossette, Sabrina & Whiting, Scott & Rob, Dani & Barnes, Peter. (2020).	Inter-nesting and migrations by marine turtles of the Muiron Islands and Ningaloo Coast.	DBCA	Satellite tags deployed on 13 green turtles and 12 loggerhead turtles	Muiron Islands Ningaloo Coast	1. To identify marine turtle inter-nesting habitats, duration of residence, and reproductive outputs. 2. To determine marine turtle migration routes, migration timing, and identify post-reproductive foraging grounds.	2018

Study ID	Study	Reference	Project	Contact / Organisation	Methodology	Site(s)	Description	Survey Dates / Frequency
SM09	Marine Megafauna	Wheatstone Project: Dugong Research Plan -- DOC NO: WS0-0000-HES-PLN-CVX-000-00065-000	Wheatstone	Chevron Australia	Aerial surveys	Area from Montebellos to Exmouth Gulf	Dugong survey methodology and area plan	NA
SM09	Marine Megafauna	Wheatstone Project: Final EIS Technical Appendix FE (Dugong Aerial Survey Report) -- DOC NO: M10612	Wheatstone	RPS	Aerial survey for dugongs	Exmouth Gulf to Barrow Island area	Baseline dugong aerial surveys	7-8 Aug 2010
SM09	Marine Megafauna	Wheatstone Project: Technical Appendices O3 & O4 (A Description of the Megafauna Distribution and Abundance in the SW Pilbara Using Aerial and Acoustic Surveys: August and December 2009) -- DOC NO: NA	Wheatstone	CWR and CMST	Aerial surveys for humpbacks	Exmouth Gulf to Barrow Island area	Marine megafauna distribution in Southern Group of islands	mid-May to late-Dec
SM09	Marine Megafauna	Wheatstone Project: Technical Appendix O12 (Marine Mammals Technical Report) -- DOC NO: N09476	Wheatstone	RPS	Lit review	NA	Establishment of baseline data of marine mammals (lit review, CWR and CMST field studies)	NA
SM09	Marine Megafauna	Wheatstone Project: Final EIS Technical Appendix FD (A Description of Megafauna Distribution and Abundance SW Pilbara Using Aerial and Acoustic Surveys Final Report 2010) -- DOC NO: NA	Wheatstone	CWR and CMST	Aerial surveys for megafauna	Exmouth Gulf to Barrow Island area	Marine megafauna distribution in Southern Group of islands	Mid-May 2009 to late Apr 2010

Study ID	Study	Reference	Project	Contact / Organisation	Methodology	Site(s)	Description	Survey Dates / Frequency
SM09	Marine Megafauna	Distribution and Abundance of Dugongs, Turtles, Dolphins and other Megafauna in Shark Bay, Ningaloo Reef and Exmouth Gulf, Western Australia -- DOC NO: Wildlife Research 1997: (24) 185-208	Ningaloo	JCU	Aerial surveys	Shark Bay Ningaloo Reef / Exmouth Gulf	Marine megafauna distribution at baseline regions	~ 10 days per survey - 4-13 Jul 1989 (Shark Bay) - 21-30 Jun 1994 (Ningaloo/Exmouth)
SM09	Marine Megafauna	Aerial Survey of the Abundance and Distribution of Dugong and Associated Macrovertebrate Fauna - Pilbara Coastal and Offshore Region -- DOC NO: 020344	Pilbara - Dampier to Exmouth Gulf	CALM (now DEC)	Aerial surveys	Pilbara coastal waters	Aerial surveys from Dampier to Exmouth Gulf to 25 m isobath with 5 km transect spacings	7-15 April 2000
SM09	Marine Megafauna	Gales, N. I. C. K., Double, M. C., Robinson, S. A. R. A. H., Jenner, C., Jenner, M., King, E. & Paton, D. 2010. White paper presented to the Scientific Committee of the International Whaling Commission.	Satellite tracking of Australian humpback (*Megaptera novaeangliae*) and pygmy blue whales (*Balaenoptera musculus brevicauda*).	IWC	Satellite tracking	South-western Australia Kimberley coast	Define the spatial and temporal migratory behaviour of these whales in Australian waters	2009
SM09	Marine Megafauna	J.D. Stevens, P.R. Last, W.T. White, R.B. McAuley, M.G. Meekan (2009). Final report to Western Australian Marine Science Institute.	Diversity, abundance and habitat utilisation of sharks and rays	WAMSI	Snorkel and SCUBA surveys in the lagoon and at the reef edge, and longline surveys outside the reef.	Ningaloo Marine Park	Investigate the elasmobranch faunal composition of the Ningaloo Marine Park, determine the distribution and abundance of species, and examine the habitat utilisation, movement patterns and activity space of selected key species.	June 2007 Aug/Dec 2008

Study ID	Study	Reference	Project	Contact / Organisation	Methodology	Site(s)	Description	Survey Dates / Frequency
SM09	Marine Megafauna	Marine Mammal Research Wheatstone Offset C. 2016 PMCP Presentation.	DBCA Marine Monitoring	Holly Raudino & Kelly Waples (DBCA)	- Broadscale aerial survey for distribution and abundance, habitat use characterisation - Fine-scale vessel survey for behaviour and abundance, habitat use characterisation	Ningaloo to Eighty Mile Beach		-Broadscale aerial survey in May/June 2015 from between Onslow-Karratha to Eighty-Mile Beach - Target aerial survey in May/June 2016 in Exmouth Gulf, Onslow Region, Montebellos, Karratha Region, Cape Keraudren
SM10	Marine Avifauna	Wheatstone Project: Technical Appendix K1 (Survey for Migratory Waterbirds in the Wheatstone LNG Area, November 2008 and April 2009) -- DOC NO: NA	Wheatstone	M.J. & A.R. Bamford Consulting Ecologists	- Ground survey (Nov. 08 & Mar. 09) - Aerial survey (Mar. 09)	Several areas within 30 km of project area	Waterbird survey methods and results	3-5 days
SM10 SM12	Marine Avifauna Marine Invertebrates	Berry, P.F. and Wells, F.E. 2000. Records of the Western Australian Museum, Supplement, 59. 1–63.	Fauna and Bird Survey of the Montebello Islands Scleractinian corals of the Montebello Islands Crustacea of the Montebello Islands	Western Australian Museum	Visual surveys SCUBA Visual observations on bottom type, dominant fauna and estimates of live coral coverage	Montebello Islands	Multiple surveys to describe flora and fauna of the Montebello Islands	Updated 2017
SM10	Marine Avifauna	Gorgon Gas Development and Jansz Feed Gas Pipeline: Terrestrial and Subterranean Baseline State and Environmental Impact Report (2014).	Baseline State of Ecological Elements on Barrow Island	Chevron	Summary of quantitative surveys from 1978 – 2007.	Barrow Island	Surveys of avifauna using the island.	1978 – 2007

Study ID	Study	Reference	Project	Contact / Organisation	Methodology	Site(s)	Description	Survey Dates / Frequency
SM10	Marine Avifauna	Cannell, B., Hamilton, S and Driessen, J (2019) Wedge-tailed shearwater foraging behaviour in the Exmouth region. Report for Woodside Energy Ltd. University of Western Australia and Birdlife Australia, 36pp	Wedge-tailed Shearwater foraging behaviour in the Exmouth region	UWA	Satellite or GPS tagging	Muiron Islands	Foraging habitat of Wedge-tailed Shearwaters at the Muiron Islands was investigated.	Nov-Dec 2018
SM10	Marine Avifauna	Migratory Shorebird Program Data extraction: https://birdlife.org.au/projects/shorebirds/extractions	National Shorebird Monitoring	Birdlife Australia	Visual monitoring and identification.	Australia-wide	Identification of critical areas for shorebirds	Annual
SM11	Hydrocarbons in Representative Commercial and Recreational Fish	Babcock R et al (2017). Pilbara Marine Conservation Partnership – Final Report – Volume 3 (Part IV: Fish & Sharks). CSIRO Oceans & Atmosphere, Published Brisbane.	Pilbara Marine Conservation Partnership	Contact: Dr Russ Babcock (CSIRO) (O) +61 7 3833 5904	- Seabed biodiversity survey @ 125 sites (125 towed video, 111 benthic sled, 43 trawls) - Reef habitats, biodiversity and characterisation: fish UVC of larger fish on long transects (100 m x 10 m) and smaller fish on small transects (25 m x 25 m)	Ningaloo to Burrup	- Effectiveness of stereo-video method for benthic coral reef communities, fish-habitat relationships - Distribution of fishes - Baited video detection of target species in no take areas - Quantifying shark predation in recreational fishery of Ningaloo and Exmouth Gulf	- Seabed biodiversity survey in June 2013 - Reef habitats, biodiversity and characterisation (6x trips in 2013-2014 for fish UVC)
SM11	Hydrocarbons in Representative Commercial and Recreational Fish	Fitzpatrick BM, Harvey ES, Heyward AJ, Twiggs EJ, Colquhoun J (2012) PLoS ONE 7(6):e39634.https://doi.org/10.1371/journal.pone.0039634	Habitat Specialization in Tropical Continental Shelf Demersal Fish Assemblages	UWA AIMS	Baited remote underwater stereo-video samples	Continental shelf at Ningaloo Reef	1. Investigate the structure of the demersal fish assemblages from the inner lagoon to outer shelf across a range of benthic habitats, 2. Determine whether the abundance and length of demersal fishes differed across the shelf, 3. Identify fish and fish-habitat relationships for key species and families of interest to assess whether existing shallow water MPA’s are representing the fish assemblages of adjacent deeper habitats.	Apr-July 2006

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