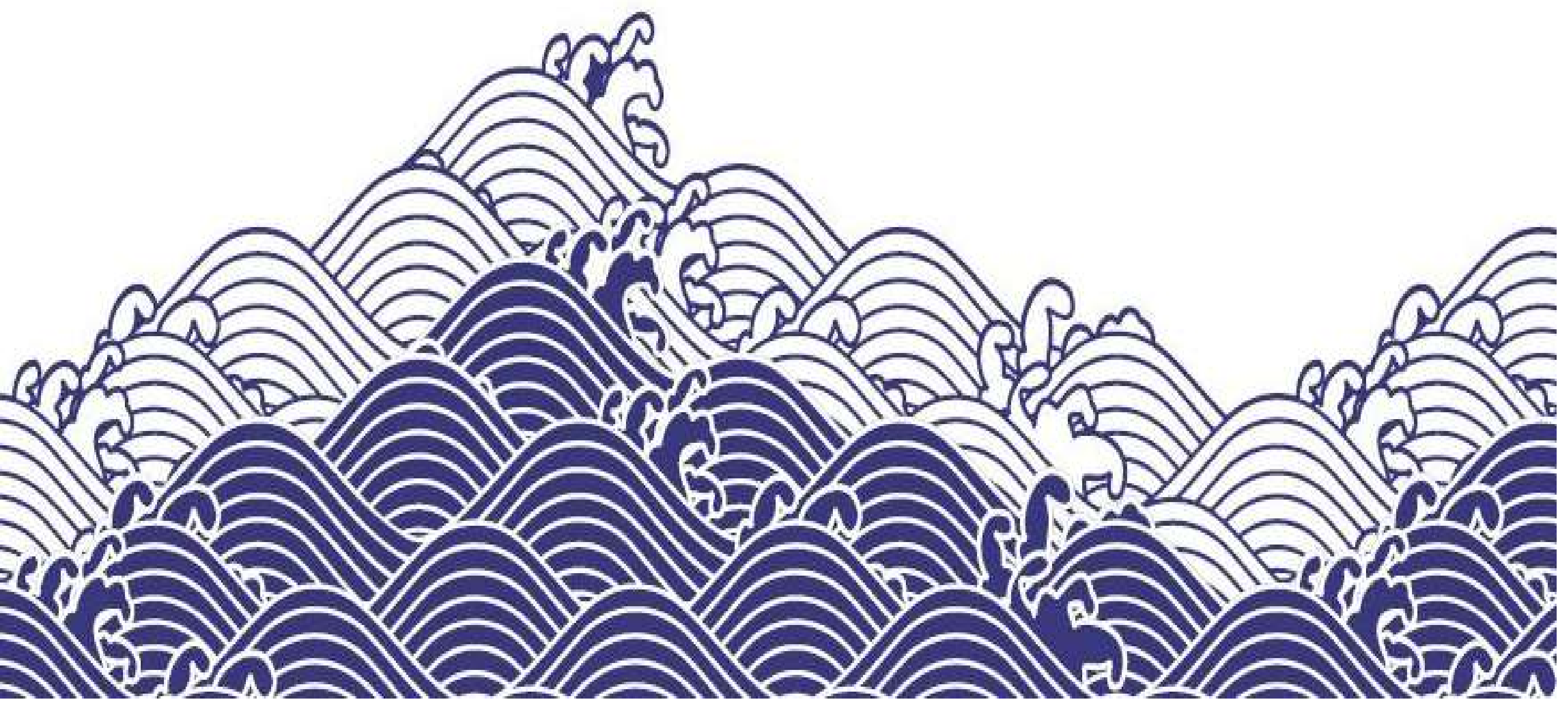
Exploration Drilling WA-285-P & WA-343-P Environment Plan



Environment plan summary

This environment plan summary has been prepared from material provided in this environment plan (EP). The summary consists of the following as required by Regulation 11(4) of the OPGGS (E) Regulations 2009:

EP summary and material requirement	Relevant section of EP containing EP summary material
The location of the activity	Section 3.1
A description of the receiving environment	Section 4
A description of the activity	Section 3
Details of the environmental impacts and risks	Sections 7 and 8
The control measures for the activity	Sections 7 and 8
The arrangements for ongoing monitoring of the titleholders environmental performance	Sections 9.11, 9.12 and 9.13
Response arrangements in the oil pollution emergency plan	Sections 8.4, 8.5 and INPEX Browse Regional OPEP
Consultation already undertaken and plans for ongoing consultation	Sections 5 and 9.8.3
Details of the titleholders nominated liaison person for the activity	Section 1.4

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Terms, abbreviations and acronyms

Term, abbreviation or acronym	Meaning
%	percent
°C	degrees Celsius
ACMA	Australian Communications and Media Authority
AFMA	Australian Fisheries Management Authority (Cwlth)
AHO	Australian Hydrographic Office
AHSV(s)	anchor-handling supply vessel(s)
AIMS	Australian Institute of Marine Science
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 (Cwlth)
APPEA	Australian Petroleum Production and Exploration Association
AR-AFFF	alcohol resistant aqueous film-forming foam concentrates
ARMA	Aquatic Resources Management Act 2016 (WA)
ARP	applied research program
BAT	best available technique
BIA	Biologically Important Area
BMS	business management system
BOCP	Blowout contingency plan
BOM	Bureau of Meteorology
BOP	blowout preventer
Bq/l	becquerels per litre
BROPEP	Browse Regional Oil Pollution Emergency Plan
BROPEP – BOD/FCA	Browse Regional Oil Pollution Emergency Plan - Basis of Design/Field Capability Assessment
BROPEP - IMTCA	Browse Regional Oil Pollution Emergency Plan – Incident Management Team Capability Assessment

Term, abbreviation or acronym	Meaning
BTEX	benzene, toluene, ethylbenzene, xylenes
BWM	ballast water management
CAMBA	China-Australia Migratory Bird Agreement
Cd	cadmium
CHARM	chemical hazard assessment and risk management
COLREGs	International Regulations for Preventing Collisions at Sea 1972
CPF	central processing facility (*Ichthys explorer*)
CRWG	community relations working group
CTS	craft tracking system
CW	Cooling water
Cwlth	Commonwealth
dB	decibel
DBCA	Department of Biodiversity, Conservation and Attractions (WA)
DAWE	Department of Agriculture, Water and the Environment (Cwlth)
DMIRS	Department of Mines, Industry Regulation and Safety WA (formerly Department of Mines and Petroleum)
DNP	Director of National Parks (Cwlth)
DP	dynamically positioned
DPIRD	Department of Primary Industries and Regional Development (WA)
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
DST	drill stem test
EAA	East Asian–Australasian
EEZ	exclusive economic zone
EHS	environment, health and safety
EIAPP	Engine International Air Pollution Prevention
EIS	environmental impact statement
EMBA	environment that may be affected

Term, abbreviation or acronym	Meaning
EP	environment plan
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cwlth)
EPBC regulations	Environment Protection and Biodiversity Conservation Regulations 2000
EPO	environmental performance outcome
EPS	environmental performance standard
ESD	ecological sustainable development
FFFP	film forming fluoro protein foam
FLNG	floating liquified natural gas
FPSO	Floating, production, storage and offloading (*Ichthys venturer*)
g/m^2	grams per square metre
g/m^3	grams per cubic metre
GHG	greenhouse gas (such as carbon dioxide and methane)
GT	gross tonnes
Hg	mercury
HQ	hazard quotient
HSE	health, safety and environment
Hz	hertz
IAPP	International Air Pollution Prevention
IBA	important bird area
IEE	International Energy Efficiency
IFC	International Finance Corporation
IMO	International Maritime Organization
IMS	invasive marine species
IMT	incident management team
INPEX	INPEX Browse E&P Pty Ltd
IOGP	International Association of Oil and Gas Producers
IOPP	International Oil Pollution Prevention

Term, abbreviation or acronym	Meaning
IPA	Indigenous protected area
ISPPC	International Sewage Pollution Prevention Certificate
ISO	International Organization for Standardization
ITOPF	International Tanker Owners Pollution Federation Limited
IUCN	International Union for Conservation of Nature
JAMBA	Japan–Australia Migratory Bird Agreement
JRCC	joint rescue coordination centre
KEF	key ecological feature
kg/m^3	kilograms per cubic metre
kHz	kilohertz
km	kilometre(s)
km^2	square kilometres
L	litre(s)
LAT	lowest astronomical tide
LC_{50}	Lethal concentration 50. Lethal concentration in which 50% of the population will be killed in a given period of time
LLR	lower limits of reporting
LNG	liquefied natural gas
LOR	limit of reporting
LPG	liquified petroleum gas
LWD	logging while drilling
m	metre
m^2	square metres
m^3	cubic metres
m^3/d	cubic metres per day
m/m	mass-for-mass
m/s	metres per second

Term, abbreviation or acronym	Meaning
MARPOL	International Convention for the Prevention of Pollution from Ships, 1973/1978
MBES	multi beam echo sounder
MDRT	measured depth below the rotary table
mg/L	milligrams per litre
MGO	marine gas oil
MMscf	million standard cubic feet
mm/h	millimetres per hour
MMO	marine mammal observer
MNES	Matters of National Environmental Significance
MNP	marine national park
MoC	management of change
MODU	mobile offshore drilling unit
MoU	memorandum of understanding
MP	marine park
MSI	Maritime Safety Information
NatPlan	National Plan for Maritime Environmental Emergencies
nm	nautical mile
NMR	north marine region
non-GHG	Non-GHG such as sulphur oxides and nitrogen oxides
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOPTA	National Offshore Petroleum Titles Administrator
NORMs	Naturally occurring radioactive materials
NOx	mono-nitrogen oxides
NRSMPA	National Representative System of Marine Protected Areas
NT	Northern Territory
NT DIPL	Northern Territory Department of Infrastructure, Planning and Logistics

Term, abbreviation or acronym	Meaning
NT DITT	Northern Territory Department of Industry, Trade and Tourism
NTG	Northern Territory Government
NTSC	Northern Territory Seafood Council
NWCS	North west cable system
NWMR	North west marine region
NWS	North west shelf
OCNS	Offshore Chemical Notification Scheme
ODS(s)	ozone-depleting substance(s)
OEM	original equipment manufacturer
OIM	offshore installation manager
OIW	Oil in water
OoC	oil-on-cuttings
OPEP	oil pollution emergency plan
OPGGS Act	*Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cwlth)
OPGGS (E) Regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cwlth)
OSMP	operational and scientific monitoring program
OSPAR	The 1992 OSPAR Convention ("Convention for the protection of the marine environment of the north-east Atlantic")
OWD	oil-in-water dispersions
OWS	oil-water separator
PAH(s)	polycyclic aromatic hydrocarbon(s)
PDCA	plan, do check, act
PEZ	potential exposure zone (the area exposed to hydrocarbons in the event of a worst-case credible oil spill, established using low exposure thresholds)
PLONOR	pose little or no risk (to the environment)
POB	personnel on board
POTS Act	*Protection of the Sea (Prevention of Pollution from Ships) Act 1983*

Term, abbreviation or acronym	Meaning
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand
PSD	particle size distribution
PSV	platform supply vessel
PSZ	petroleum safety zone
PTS	permanent threshold shift
PTW	permit to work
PW	produced water
Ramsar Convention	The Convention on Wetlands of International Importance, especially as Waterfowl Habitat (the Ramsar Convention)
RMR	riserless mud return
RO	reverse osmosis
ROKAMBA	Republic of Korea- Australia Migratory Bird Agreement
ROV	remotely operated (underwater) vehicle
SBM	synthetic-based mud
SCE	solids control equipment
SCERP	source control emergency response plan
SEEMP	ship energy efficiency management plan
SIMA	spill impact mitigation assessment
SMPEP	shipboard marine pollution emergency plan
SOLAS	International Convention for the Safety of Life at Sea
SOPEP	shipboard oil pollution emergency plan
SPL	sound pressure level
SPRAT	species profile and threats (DAWE database)
STP	sewage treatment plant
SWASP	State-wide array surveillance program
T	tonne

Term, abbreviation or acronym	Meaning
TD	total depth
TSS	total suspended solids
TTS	temporary threshold shift
UNEP	United Nations Environment Programme
VOC(s)	volatile organic compound(s)
VSP	vertical seismic profiling
WA	Western Australia
WA-285-P	Exploration permit area within the Browse basin
WA-343-P	Exploration permit area within the Browse basin
WA DoT	Department of Transport (WA)
WAFIC	Western Australian Fishing Industry Council
WBM	water-based mud
WCSS	worst-case spill scenario
WOMP	well operations management plan
Worst credible discharge	The worst-case credible discharge from a loss of containment scenario used to inform the blowout modelling (OLGA model) in this EP assumes the wellbore is free from all restrictions, there are no restrictions at the wellhead and the hole section is fully drilled.
WSF	water-soluble fraction
wt/wt	weight per weight
μPa	micropascal
μg/l	micrograms per litre

1 INTRODUCTION

1.1 Scope

INPEX Browse E&P Pty Ltd. (hereafter referred to as INPEX) is proposing to drill two exploration wells in the Browse Basin: one in exploration permit area WA-285-P and one in WA-343-P (Figure 1-1).

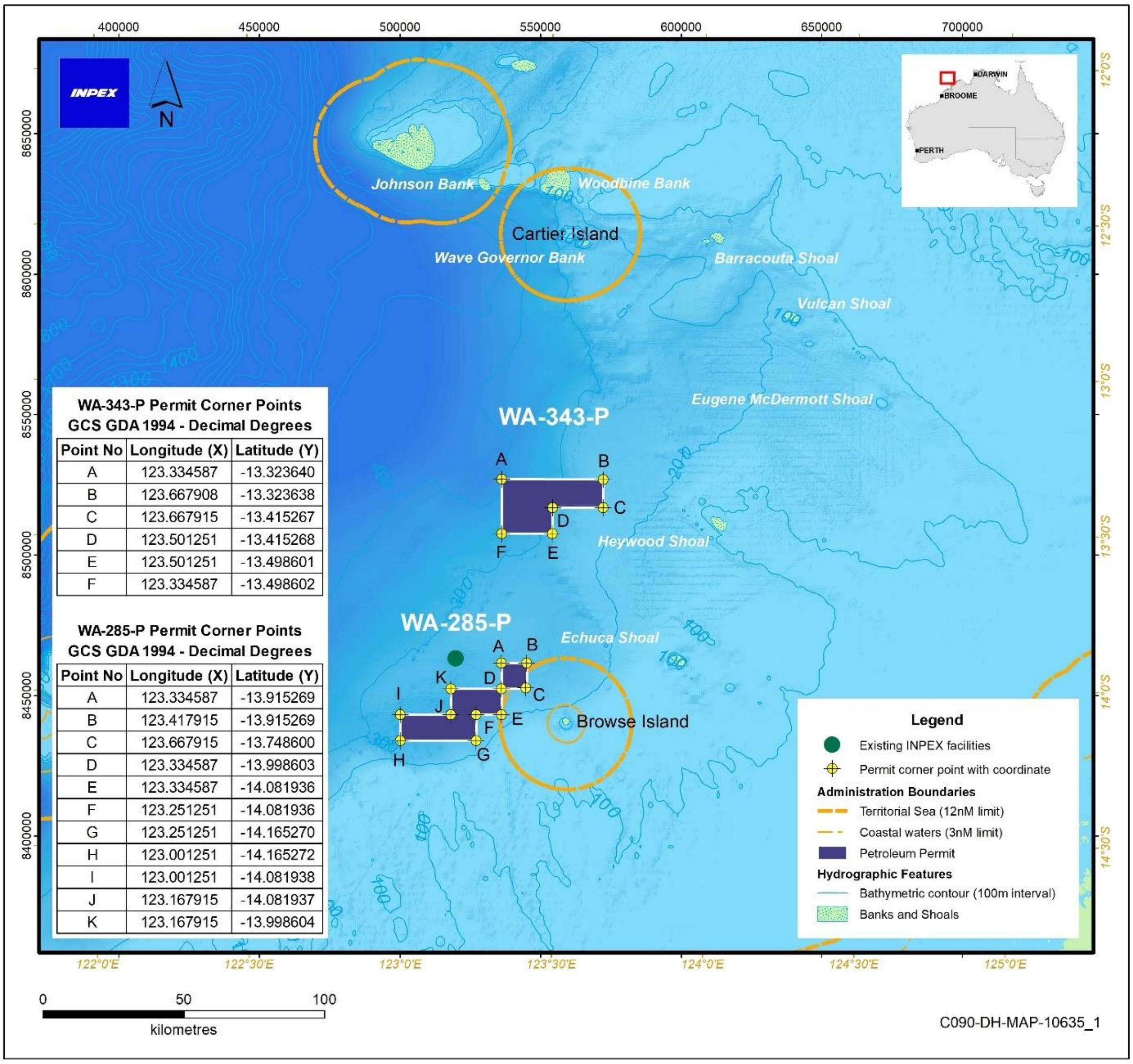

Figure 1-1: Location of exploration permits WA-285-P and WA-343-P

The WA-285-P and WA-343-P exploration permit areas are located wholly within Commonwealth waters approximately 230 km from the Kimberley coastline, Western Australia (WA), in water depths of approximately 290 m and 350 m respectively. The proposed petroleum activity covered by this environment plan (EP) will consist of a pre-drill site survey, and the drilling and evaluation of an exploration well in each of WA-285-P and WA-343-P.

Within each exploration permit area, following a pre-drill site survey, drilling will be conducted using a semi-submersible mobile offshore drilling unit (MODU) which will be either physically anchored to the seabed or dynamically positioned (DP). It is anticipated that two anchor handling supply vessels (AHSVs) and one platform supply vessel (PSV) will be needed to provide support for the drilling activity. Personnel transfers to and from the MODU will be by helicopter several times per week.

The pre-drill site surveys are expected to be conducted in the first half of 2023, with drilling scheduled to commence in the second half of 2023. However, for contingency purposes subject to MODU availability, operational efficiencies, weather and analysis of geophysical data collected during the pre-drill site survey, this EP allows for activities to occur anytime between calendar years 2023 and 2025.

The scope of this EP does not include the movement of vessels, helicopters or MODUs outside of the exploration permit areas (e.g. travel to and from WA-285-P and WA-343-P). These activities will be undertaken in accordance with other relevant maritime and aviation legislation; most notably, the *Navigation Act 2012* (Cwlth) and *Civil Aviation Act 1988* (Cwlth).

1.2 Objectives

The objectives of this EP are to:

- demonstrate that the environmental impacts and risks associated with the petroleum activity have been reduced to 'as low as reasonably practicable' (ALARP) and are of an acceptable level
- establish appropriate environmental performance outcomes, environmental performance standards and measurement criteria in relation to the operation of the facility
- define an appropriate implementation strategy and monitoring, recording and reporting arrangements, whereby compliance with this EP, the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cwlth) (OPGGS (E) Regulations), and other relevant legislative requirements, can be demonstrated
- demonstrate that INPEX has carried out the consultations required by the OPGGS (E) Regulations
- demonstrate that the measures adopted by INPEX, arising from the consultation process, are appropriate
- demonstrate that the petroleum activity complies with the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGS Act) and the OPGGS (E) Regulations.

1.3 Overview of activity description

Table 1-1 provides an overview of the exploration drilling activities to be undertaken under this EP.

Table 1-1: Overview of the activity description

Item	Description
Exploration permit area WA-285-P	
Basin	Browse
Reservoirs	Primary: Upper Brewster Member and Plover Formation

Item	Description
	Secondary: Tithonian Sandstone
Activity location	Wholly located within Commonwealth waters approximately 360 km north of Derby, Western Australia in the North-West Marine Region (NWMR) of the Timor Sea. Approximately 45 km south of exploration permit WA-343-P at its closest point. The exact location of the exploration well is yet to be finalised; however, it will be located within the south western portion of the WA-285-P permit area.
Well type	Exploration
Hydrocarbon type	Gas and condensate
Water depth	Approximately 290 m at Lowest Astronomical Tide (LAT).
MODU and vessels	Survey vessel, MODU (semi-submersible either moored or DP), AHSVs, PSVs and other support vessels.
Activities	Pre-drill site survey and drilling & evaluation of an exploration well targeting the Brewster and Plover reservoirs in the WA-285-P permit area.
Earliest activity commencement	Pre-drill site survey in WA-285-P: H1 2023 Drilling activities: H2 2023
Duration	Continual operations, 24 hours a day Pre-drill site survey: approximately 10 days Drilling activities: approximately 95 days.
Exploration permit area WA-343-P	
Basin	Browse
Reservoirs	Plover formation
Activity location	Wholly located within Commonwealth waters, approximately 425 km north of Derby, Western Australia in the NWMR of the Timor Sea. Approximately 45 km north of exploration permit WA-285-P at its closest point. The exact location of the exploration well is yet to be finalised; however, it will fall within the boundaries of the WA-343-P permit area.
Well type	Exploration
Hydrocarbon type	Gas and condensate
Water depth	Approximately 350 m LAT.
MODU and vessels	Survey vessel, MODU (semi-submersible either moored or DP), AHSVs, PSVs and other support vessels.

Item	Description
Activities	Pre-drill site survey and drilling & evaluation of an exploration well targeting the Plover reservoir in the WA-343-P permit area.
Earliest activity commencement	Pre-drill site survey in WA-343-P: H1 2023 Drilling activities: H2 2023
Duration	Continual operations, 24 hours a day Pre-drill site survey: approximately 10 days Drilling activities: approximately 150 days.

1.4 Titleholder details

INPEX Browse E&P Pty Ltd is the sole titleholder for exploration permit WA-343-P. INPEX Browse E&P Pty Ltd is a joint titleholder of exploration permit area WA-285-P and has been nominated as the single titleholder for the purposes of taking eligible voluntary actions under subsection 775B of the OPGGS Act, such as making submissions.

In accordance with Regulation 15(1) of the OPGGS (E) Regulations, details of the titleholder are described in Table 1-2. INPEX will be responsible for ensuring that activities covered in this EP are carried out in accordance with the OPGGS (E) Regulations, this EP and other applicable Australian legislation.

In accordance with Regulation 15(2) of the OPGGS (E) Regulations, details of the titleholder's nominated liaison person are provided in Table 1-3.

Table 1-2: Titleholder details

Name	INPEX Browse E&P Pty Ltd (INPEX)
Business address	Level 22, 100 St Georges Tce, Perth, WA 6000
Telephone number	+61 8 6213 6000
Fax number	+61 8 6213 6455
Email address	enquiries@inpex.com.au
ABN	65 165 711 017

Table 1-3: Titleholder nominated liaison person

Name	Jake Prout
Position	Environmental Operations Team Lead
Business address	Level 22, 100 St Georges Tce, Perth, WA 6000
Telephone number	+61 8 6213 6000
Email address	jake.prout@inpex.com.au

1.4.1 Notification arrangements

In the event that the titleholder, nominated liaison person or contact details for the nominated liaison person change, INPEX will notify the regulator in accordance with Regulation 15(3) of the OPGGS (E) Regulations.

1.5 Financial assurance

Financial assurance for the titleholder's liabilities for cleaning up, remediating and monitoring the impact of a petroleum release has been calculated using the APPEA (2018) methodology for estimating levels of financial assurance based on the maximum credible loss scenario from a loss of well containment.

Declarations of financial assurance will be provided in relation to both titles prior to acceptance of this EP by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).

2 ENVIRONMENTAL MANAGEMENT FRAMEWORK

2.1 Corporate framework

INPEX's Business Management System (BMS) is a comprehensive, integrated system that includes standards and procedures necessary for the management of health, safety and environment (HSE) risks.

The INPEX environmental policy sets the direction and minimum expectations for environmental performance and is implemented through the standards and procedures of the BMS. The BMS and environmental policy are further described in Section 9 in accordance with Regulation 16(a) of the OPGGS (E) Regulations.

2.2 Legislative framework

In accordance with Regulation 13(4) of the OPGGS (E) Regulations, the legislative framework relevant to the activity is listed in Table 2-1. A summary of applicable industry standards and guidelines is also presented in Table 2-2. Ongoing management of legislative and other requirements is described further in in Section 9.8.1.

Table 2-1: Summary of applicable legislation

Legislation	Description	Requirements	Demonstration of how requirements are met in EP
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act; Cwlth) and Environment Protection and Biodiversity Conservation Regulations 2000 (EPBC Regulations)	Provides for the protection and management of nationally and internationally important flora, fauna, ecological communities, and heritage places.	The OPGGS (E) Regulations were revised in February 2014 to include the requirement that matters protected under Part 3 of the EPBC Act are considered and any impacts are at acceptable levels. Part 8 of the EPBC Regulations outlines requirements for vessels when interacting with cetaceans. EPBC Act Policy Statement 2.1 provides a framework for minimising the risk of injury to whales by outlining requirements for vertical seismic profiling. The EPBC Act provides for protection of 'matters of national environmental significance' including not only listed species but also heritage properties and Ramsar wetlands. There are exemptions covering provisions of Part 3 and 13 of the EPBC Act, for the undertaking of activities when responding to maritime environmental emergencies, in accordance with the National Plan for Marine Environmental Emergencies (NatPlan). Australian Marine Parks (AMPs) are proclaimed under this Act and associated management plans are enacted under this legislation.	Section 4.3 – Australian marine parks Section 7.6.1 – Physical presence of vessels and Section 7.4.2 interaction with marine fauna Section 7.3 – Noise and vibration Section 8 – Emergency conditions INPEX Browse Regional Oil Pollution Emergency Plan (OPEP) A demonstration of how this EP addresses the relevant conservation management documents related to EPBC Act listed species has been presented in Appendix A.
OPGGS Act and OPGGS (E) Regulations (Cwlth)	The OPGGS Act provides the regulatory framework for petroleum exploration, production and greenhouse gas activities in Commonwealth waters.	The OPGGS Act (Section 616) details the requirement for a Petroleum Safety Zone (PSZ). The PSZ is in place for the purposes of protecting a well, structure or any equipment, in an offshore area, by notice published in the Gazette, administered by NOPSEMA.	Section 3.3.2 – Well abandonment Section 7.6.1 – Physical presence – disruption to other marine users Section 8.3 - Vessel collision Implementation of the BMS.

Legislation	Description	Requirements	Demonstration of how requirements are met in EP
	The OPGGS (E) Regulations under the OPGGS Act require a titleholder to have an accepted plan in place for an activity.	Section 572(2) and (3) of the OPGGS Act requires titleholders to maintain all structures, equipment and property in a title area in good condition and repair, and to remove all structures, equipment and property when it is neither used nor to be used in connection with operations authorised by the title. The OPGGS (E) Regulations require that the activity is undertaken in an ecologically sustainable manner, and in accordance with an accepted EP.	
Navigation Act 2012 (Cwlth)	The primary legislation that regulates ship and seafarer safety, shipboard aspects of protection of the marine environment, and employment conditions for Australian seafarers.	The *Navigation Act 2012* includes specific requirements for safe navigation, including systems, equipment and practices consistent with the International Convention for the Safety of Life at Sea (SOLAS) and the International Regulations for Preventing Collisions at Sea (COLREGS), as implemented as maritime law in Australia through a series of Marine Orders, including Marine Order 21 – Safety of navigation and emergency procedures and Marine Order 30 – Prevention of collisions. The *Navigation Act 2012*, in conjunction with the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* and through legislative Marine Orders, also requires vessels to have pollution prevention certificates (see below).	Section 7.6.1 – Physical presence – disruption to other marine users Section 8.3 - Vessel collision Implementation of the BMS.
Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (POTS Act; Cwlth)	The POTS Act provides for the prevention of pollution from vessels, including pollution by oil, noxious liquid substances, packaged harmful substances, sewage, garbage, and air pollution.	The requirements of the POTS Act are implemented as maritime law in Australia through a series of Marine Orders and legislative instruments, made and administered by the Australian Maritime Safety Authority (AMSA). The requirements of each Marine Order made under the POTS Act and their relevance to the activity are outlined separately below.	Section 7 and Section 8 Implementation of the BMS.

Legislation	Description	Requirements	Demonstration of how requirements are met in EP
	In conjunction with Chapter 4 of the *Navigation Act 2012*, the POTS Act gives effect to relevant requirements of the International Convention for the Prevention of Pollution from Ships, 1973/1978 (MARPOL) in Australia.		
Marine Order 91 – Marine pollution prevention — oil	Marine Order 91 implements Part II of the POTS Act, Chapter 4 of the *Navigation Act 2012*, and Annex I of MARPOL (oil pollution). The Marine Order provides standards for the discharge of certain oily mixtures or oily residues and associated equipment and include duties to manage bunkering and transfers of oil between vessels; to maintain Oil Record Books and Shipboard Oil Pollution Emergency Plans (SOPEPs); and to report oil pollution.	The MODU and support vessels ≥400 gross tonnes (GT) are required to maintain: • International Oil Pollution Prevention (IOPP) certificates to demonstrate that the vessel or facility and onboard equipment comply with the requirements of Annex I of MARPOL (as applicable to vessel size, type and class). • oil Record Books to record activities, such as fuel/oil bunkering and discharges of oil, oily water, mixtures and residues. • SOPEPs outlining the procedures to be followed during an oil pollution incident. Discharges must also comply with Annex I of MARPOL, and oil pollution incidents must also be reported to the Australian Maritime Safety Authority (AMSA).	Section 7.1.3– Routine discharges Section 7.7.1– Accidental release Section 8 - Emergency Conditions INPEX Browse Regional OPEP Implementation of the BMS.

Legislation	Description	Requirements	Demonstration of how requirements are met in EP
Marine Order 93 – Marine pollution prevention – noxious liquid substances	Marine Order 93 - Marine pollution prevention – noxious liquid substances (made under the *Navigation Act 2012* and the POTS Act and Annex II of MARPOL) specifies the requirements for the prevention of contaminating liquids and chemicals entering the marine environment. It also sets out guidelines for developing a Shipboard Marine Pollution Emergency Plan (SMPEP).	Requirements of Marine Order 93 include: • International pollution prevention certificates • reporting requirements • emergency plans, record books and tank cleaning. INPEX and MODU/vessel contractors will comply with Marine Order 93 as appropriate to vessel class, in relation to the discharge to sea of any noxious liquid substances. Marine vessels >150 GT will carry SMPEPs approved under MARPOL Annex II, Regulation 17 if the vessel is carrying noxious liquid substances in bulk (noting that the vessels SOPEP and SMPEP may be combined into a single document).	Section 7.7.1– Accidental release Implementation of the BMS.
Marine Order 94 – Marine pollution prevention — packaged harmful substances	Marine Order 94, – Marine pollution prevention — packaged harmful substances, and the POTS Act relating to packaged harmful substances as defined by Annex III of MARPOL.	Requirements of Marine Order 94 include: • management of harmful substances in packaged form • considerations prior to washing substances overboard • notifying and reporting incidents. INPEX and MODU/vessel contractors will comply Marine Order 94 as appropriate to vessel class, in relation to the loss or discharge to sea of any harmful materials.	Section 7.2 – Waste management.
Marine Order 95 – Marine pollution prevention — garbage	Marine Order 95 – Marine pollution prevention — garbage implements Part IIIC of the POTS Act, Chapter 4 of the *Navigation Act 2012*, and Annex V of MARPOL (garbage).	MODU and support vessels ≥100 GT, or vessels certified to carry 15 persons or more, are required to maintain a Garbage Management Plan. MODU and support vessels ≥400 GT are required to maintain a Garbage Record Book. The requirements will apply to the MODU and vessels (as appropriate to their size, type and class) at all times.	Section 7.2 – Waste Management Implementation of the BMS.

Legislation	Description	Requirements	Demonstration of how requirements are met in EP
	The Marine Order provides for the discharge of certain types of garbage at sea, waste storage, waste incineration, and the comminution and discharge of food waste. It also sets out requirements for garbage management and recording.		
Marine Order 96 – Marine pollution prevention — sewage	Marine Order 96 – Marine pollution prevention — sewage implements Part IIIB of the POTS Act, Chapter 4 of the *Navigation Act 2012*, and Annex IV of MARPOL (sewage). The Marine Order includes requirements for the treatment, storage and discharge of sewage and associated sewage systems, and for an International Sewage Pollution Prevention Certificate (ISPPC) to be maintained on board.	MODU and support vessels ≥400 GT are required to maintain an ISPPC to demonstrate that vessels and their onboard sewage systems comply with the requirements of Annex IV of MARPOL. Discharges of sewage must also comply with Annex I of MARPOL, and oil pollution incidents must also be reported to AMSA.	Section 7.1.3 – Routine discharges Implementation of the BMS.
Marine Order 97 – Marine pollution prevention — air pollution	Marine Order 97 – Marine pollution prevention — air pollution implements Part IIID of the POTS Act, Chapter 4 of the *Navigation Act 2012*, and Annex VI of MARPOL (air pollution).	MODU and support vessels ≥400 GT are required to have International Air Pollution Prevention (IAPP) certificates and Engine International Air Pollution Prevention (EIAPP) certificates to demonstrate that the vessel or facility and onboard marine diesel engines comply with the requirements of Annex VI of MARPOL.	Section 7.1.2– Atmospheric emissions. Implementation of the BMS.

Legislation	Description	Requirements	Demonstration of how requirements are met in EP
	The Marine Order sets requirements for marine diesel engines and associated emissions, waste incineration on board vessels, engine fuel quality, and equipment and systems containing ozone-depleting substances (ODS).	Low-sulphur fuel oil / marine diesel with 0.5% mass-for-mass (m/m) sulphur content is required to be used in engines after 31 December 2019. In accordance with Annex VI of MARPOL, the requirements do not apply to the following: • emissions resulting from the incineration of substances that are solely and directly the result of the exploitation and offshore processing of seabed mineral resources (i.e. hydrocarbons), including but not limited to flaring during well completion and testing operations and flaring arising from upset conditions • emissions associated solely and directly with the treatment, handling, or storage of seabed minerals (i.e. hydrocarbons) • emissions from marine diesel engines that are solely dedicated to the exploration, exploitation and associated offshore processing of seabed mineral resources (i.e. hydrocarbons). MODU/vessels ≥400 GT are required to have an International Maritime Organization (IMO)-approved waste incinerator, as confirmed by the IAPP certificate. MODU/vessels ≥400 GT with rechargeable systems containing ODS to maintain an ODS Record Book. MODU/vessels ≥400 GT to have an International Energy Efficiency (IEE) certificate (as applicable to the vessel and engine size, type and class). MODU/vessels ≥400 GT to have a Ship Energy Efficiency Management Plan (SEEMP) (as applicable to the vessel and engine size, type and class).	

Legislation	Description	Requirements	Demonstration of how requirements are met in EP
Biosecurity Act 2015 (Cwlth)	The *Biosecurity Act 2015 (Cwlth)* and its supporting legislation are the primary legislative means for managing risk of pests and diseases entering into Australian territory and causing harm to animal, plant and human health, the environment and/or the economy.	Of specific relevance to this EP, the *Biosecurity Act 2015 (Cwlth)* requires that ballast is managed within Australian seas. The *Biosecurity Act 2015* now defines Australian seas as: • for domestic and international vessels whose Flag State Administration is party to the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention) (IMO 2009)– the waters (including the internal waters of Australia) that are within the outer limits of the exclusive economic zone (EEZ) of Australia (all waters within 200 nm) or • for all other international vessels – the Australian territorial seas (all waters within 12 nm). INPEX understands that new requirements for managing biofouling on international vessels arriving in Australia will begin on 15 June 2022. Operators of vessels will be required to provide information on how biofouling has been managed prior to arrival in Australian territorial seas. Requirements may include a biofouling management plan; or cleaning within 30 days prior to arrival; or implementation of alternative biofouling management methods.	Section 7.4.1- Invasive marine species Implementation of the BMS.
Biodiversity Conservation Act 2016 (WA) *Animal Welfare Act 2002* (WA) Biodiversity Conservation Regulations 2018	Ensures the protection of biodiversity and humane treatment of native fauna. Ensures appropriate treatment and management of wildlife in the event of a potential hydrocarbon spill and response activities.	Consult with WA Department of Biodiversity, Conservation and Attractions (DBCA) and obtain relevant permit(s) before a wildlife hazing and post-contact wildlife response.	Section 8 – Emergency conditions INPEX Browse Regional OPEP.

Legislation	Description	Requirements	Demonstration of how requirements are met in EP
Fish Resources Management Act 1994 (WA)	The *Fish Resources Management Act* is administered by the WA Department of Primary Industry and Regional Development (DPIRD) that has powers to deal with incursions of marine pests.	INPEX will manage its operations in accordance with the Act and the associated Fish Resources Management Regulations (1995) with respect to managing potential invasive marine species (IMS) risks.	Section 7.4.1- Invasive marine species Implementation of the BMS.
Aquatic Resources Management Act 2016 (ARMA) WA	The ARMA will become the primary legislation used to manage fishing, aquaculture, pearling and aquatic resources in WA.	At the time of submission of this EP, only certain sections of the ARMA have taken effect, with most Sections not yet commenced. While this is the case, the *Fish Resources Management Act 1994* (WA) remains in effect until the transitional provisions for the ARMA are in operation. Once in operation the ARMA will provide new management methods in a flexible framework. This EP will be updated to reflect this once the ARMA comes into effect, expected within the duration of this EP.	Section 7.4.1- Invasive marine species Implementation of the BMS.

Table 2-2: Summary of applicable conventions, agreements, industry standards and guidelines

Guideline	**Description**
Australian and New Zealand guidelines for fresh and marine water quality (ANZG 2018)	These guidelines provide a framework for water resource management and state specific water quality guidelines for environmental values, and the context within which they should be applied.
International Convention for the Prevention of Pollution from Ships, 1973/1978 (MARPOL)	This convention is designed to reduce pollution of the seas, including dumping, oil and exhaust pollution. MARPOL currently includes six technical annexes. Special areas with strict controls on operational discharges are included in most annexes.
International Convention on the Control of Harmful Anti-fouling Systems	This convention prohibits the use of harmful organotins in anti-fouling paints used on ships and establishes a mechanism to prevent the potential future use of other harmful substances in anti-fouling systems.
International Convention for the Safety of Life at Sea (SOLAS) 1974	In the event of an offshore emergency event that endangers the life of personnel, the International Convention for the Safety of Life at Sea (SOLAS) 1974 may take precedence over environmental management.
Bonn Agreement for Cooperation in Dealing with Pollution of the North Sea by Oil and other harmful substances (Bonn Agreement)	The Bonn Agreement is the mechanism by which the North Sea states, and the European Union (the Contracting Parties), work together to help each other in combating pollution in the North Sea area from maritime disasters and chronic pollution from ships and offshore installations; and to carry out surveillance as an aid to detecting and combating pollution at sea. The Bonn Agreement Oil Appearance Code may be used during spill response activities.
The Australian Petroleum Production and Exploration Association (APPEA) *Code of Environmental Practice* (APPEA 2008)	Recognising the need to avoid or minimise and manage impacts to the environment, this code of environmental practice includes four basic recommendations to APPEA members undertaking activities: • Assess the risks to, and impacts on, the environment as an integral part of the planning process. • Reduce the impact of operations on the environment, public health and safety to ALARP and to an acceptable level by using the best available technology and management practices. • Consult with stakeholders regarding industry activities. • Develop and maintain a corporate culture of environmental awareness and commitment that supports the necessary management practices and technology, and their continuous improvement.

Guideline	Description
Australian Ballast Water Requirements, Version 8 (DAWE 2020)	Australian Ballast Water Management (BWM) Requirements outline the mandatory ballast water management requirements to reduce the risk of introducing harmful aquatic organisms into Australia's marine environment through ballast water from international vessels. These requirements are enforceable under the *Biosecurity Act 2015*.
National Biofouling Management Guidelines for the Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee 2018)	A voluntary biofouling management guidance document developed under the National System for the Prevention and management of Marine Pest Incursions. Its purpose is to provide tools to operators to minimise the amount of biofouling accumulating on their vessels, infrastructure and submersible equipment and thereby to minimise the risk of spreading marine pests.
International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention) (IMO 2009)	All vessels are required to manage their ballast water and sediments in accordance with the BWM Convention and *Biosecurity Act 2015*. The convention came into force on 8 September 2017 and Australia's ballast water policy and legislation align with the convention.
Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species (IMO 2012)	The guidelines provide a globally consistent approach to the management of biofouling. They aim to reduce the risk of translocation of marine pests from biofouling present on immersed areas of vessels. It was adopted by IMO marine environment committee in the form of Resolution MEPC.207 (62) in 2011.
National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (DEE 2020)	The guidelines provide best-practice industry standard for managing potential impacts of light pollution on marine fauna.
Minamata Convention on Mercury	The Convention covers all aspects of the life cycle of mercury, controlling and reducing mercury across a range of products, processes and industries. This includes controls on mercury mining, manufacture and trade of mercury and products containing mercury, disposal of mercury waste and emissions of mercury from industrial facilities. Australia ratified the Minamata Convention on 7 December 2021. Countries that have ratified the Convention are bound by international law to put controls in place to manage emissions, releases and disposal of mercury and mercury compounds.

3 ACTIVITY DESCRIPTION

3.1 Location and timing

Exploration permits, WA-285-P and WA-343-P are both located within the Browse Basin in Commonwealth waters within WA (Figure 1-1). They are situated approximately 230 km north-west of the Kimberley coastline and the closest major town is Derby, located approximately 360 km and 425 km south of the southern boundary of the permit areas respectively. The two exploration permits are approximately 45 km apart at the closest point (Figure 1-1).

The exact location of the proposed exploration well within each permit area is yet to be finalised; however, they will fall within the boundaries of permit areas. It is known that the well in WA-285-P will be located in the south-west of the permit area.

As a pre-cursor to the drilling activities, a pre-drill site survey, lasting approximately 10 days, will be undertaken at the proposed well location within each permit. The objective of each survey is to evaluate the environment at the planned drilling locations and confirm mooring suitability for a semi-submersible MODU. The site survey is provisionally planned to be undertaken in the first half of 2023; however, start dates are subject to vessel availability.

It is expected that the earliest commencement date for drilling and evaluation activities will be in the second half of 2023. All activities will be completed within 12 months, noting that the exact timing for completion will be dependent upon INPEX obtaining all approvals, and MODU availability. However, for contingency purposes, this EP allows for the activities to occur anytime between calendar years 2023 and 2025. It is possible that within these timeframes concurrent drilling operations may occur.

Water depths at the permit areas range from approximately 290 m (LAT) in WA-285-P to approximately 350 m (LAT) in WA-343-P.

3.2 Pre-drill site surveys

The scope of the pre-drill site surveys is to obtain a range of geophysical data for both the proposed well locations and contingency blowout relief well locations to enable the identification of any geohazards and allow completion of the required anchoring capacity assessments. The surveys may be performed across an area of up to approximately 50 km^2 centred on multiple well locations i.e. the proposed exploration well location and up to four possible relief well locations (surveyed as a precaution) within each permit area.

The survey vessel contractor is yet to be confirmed; however, they will be selected in accordance with the INPEX contractor management requirements described in Section 9.9.

The surveys will be undertaken using a multi-purpose, DP survey vessel that will use marine diesel fuel. Vessel speeds during survey data acquisition are expected to be low (typically < 5 knots). Due to the short duration of the survey (approximately 10 days per permit), vessel refuelling, crew changes or anchoring are not anticipated to be required. The survey vessel is expected to be mobilised from either Broome, Darwin or Dampier.

3.2.1 Survey methodology

Multibeam echo sounder (MBES)

Echo sounder surveys will enable the collection of bathymetry data and the correlation of depth information. This type of survey uses a sonar system to transmit short pulses of sound energy, analysing the return signal from the seafloor or other objects.

A multibeam echo sounder transmits at frequencies between 200 kHz and 400 kHz with pulse lengths from 10 to 500 µs. Indicative sound output at source is equipment dependent and may range from 163 to 190 dB re 1 µPa@1m.

Side-scan sonar

Use of side-scan sonar methods will enable INPEX to identify seabed obstructions or features. This type of survey is a hydro-acoustic technique, comprising a set of transducers mounted on either side of a towed vehicle. The transducers produce high frequency pulses (either 120 kHz or 410 kHz) which reflect seabed features. Indicative sound output at source may range from 137 to 200 dB re 1 µPa@1m.

Sub-bottom profiler

Acoustic sub-bottom profiling systems are based on 'ping and chirp' type equipment, used to determine the physical properties of the sea floor and to image and characterize the geological formations below the sea floor.

This equipment is low frequency (1-16 kHz) with an indicative sound output at source ranging from 142 to 200 dB re 1 µPa@1m.

Seabed grab sampling

Samples of seabed sediments will be collected to validate and ground truth the geophysical survey data. Grab samples (approximately 16 depending on the variability of the seabed within the permit areas) will be collected using a Shipek (or similar) grab sampler deployed using either a crane or winch on board the survey vessel. The grab sampler will be lowered to the seabed where it will trigger shut upon making contact with the seabed. Upon triggering it retains approximately 0.13 m^3 of sediment. The sample is then brought back to the vessel where it is logged and stored for further analysis.

3.3 Drilling activities

3.3.1 Pre-drill conductor installation

A Neodrill Conductor Anchor Node Conductor (CANDuctor) may be used to replace the conventional conductor for either or both of the WA-285-P and WA-343-P wells. If used, the installation will be undertaken using an AHSV and may occur up to 6 months prior to the arrival of the MODU at the drilling location. The CANDuctor is an alternative well foundation based on suction pile methodology. It is transported to the drilling location in a horizonal position on the rear deck of an AHSV and lowered to the seabed using the AHSV's work wire. It will self-penetrate the sea floor (mudline) and then an ROV operated from the AHSV will attach to the CANDuctor and pump out the seawater held inside. This will pull a vacuum and draw the CANDuctor into the seabed. The CANDuctor has the low-pressure wellhead housing pre-installed into it and as such can be drilled through once the MODU arrives on location.

Installation of the CANDuctor from the AHSV is expected to take approximately 2 days; however, may require several attempts in the instance where progress into the seabed is prevented due to an unforeseen geological feature or if the final verticality of the CANDuctor is not within tolerance.

The CANDuctor(s) to be used on the WA-285-P and/or WA-343-P well(s) will be sized based on the outcomes of engineering studies, most notably those relating to the geotechnical conditions at the well location. While the exact size is not known at this time, CANDuctor(s) with a nominal 6 m diameter and 12 m to 18 m in length are planned.

The use of a CANDuctor eliminates the requirement to drill the conductor hole section both and avoids the need for cementation of the conductor string therefore reducing drill cuttings and cement discharges from the wells. In the event that the pre-installation of the CANDuctor is not successful, the MODU will drill and cement a conventional conductor hole section and the discharges from these operations have been accounted for in this EP (Table 3-1).

3.3.2 Indicative drilling method

The WA-285-P well, targeting the upper Brewster Member and Plover Formation, is expected to reach a total depth (TD) of approximately 5,000 m MDRT (measured depth below the rotary table). In the WA-343-P exploration well, the main target is the Plover Formation. The well is designed as a High Pressure – High Temperature exploration well and a TD of 5,310 m MDRT is expected.

After reaching TD at each well, it is planned to conduct a wireline evaluation program followed by well testing (drill stem test). Once all evaluation activities are complete, both wells will be permanently abandoned.

Well design details are presented in Table 3-1.

Table 3-1: Well details

Well section description	Drilling fluid type	Volume of fluid disposed with cuttings (m^3)	Volume of cuttings discharged (m^3)
Conductor Hole Section Indicatively, 36-44" well-bore diameter. 30-36" conductor complete with a low-pressure wellhead housing	WBM, sea water and high viscosity gel sweeps. At TD the hole will be displaced with high viscosity gel mud. While drilling riserless, all returns will be to the seabed. Fluid remaining at the end of this hole section will be used on the next hole section.	~240	~60
Surface Hole Section Indicatively,20" well-bore diameter. 16" surface casing complete with high pressure wellhead housing	WBM, gel polymer. This hole section may be drilled riserless with a semi-closed circulating system, (i.e. returns from the well will be circulated back to the MODU via a riserless fluid return system and then pumped back down the well). In the event that a riserless fluid return system is not used, returns will be to the seabed. At the end of this section all remaining WBM will discharged overboard.	~1350	~420
Intermediate Hole Section (1)	Low toxicity SBM.	~65	~45

Well section description	**Drilling fluid type**	**Volume of fluid disposed with cuttings (m^3)**	**Volume of cuttings discharged (m^3)**
Indicatively, 14 ½" x 17 ½" well-bore diameter. 13 $^3/_8$" drilling liner	Technical justification for SBM use: This hole section will penetrate massive claystone sections including the Jamieson formation. The Jamieson formation is known to contain highly reactive claystones. The use of WBM in these formations is known to result in borehole breakout and well-bore collapse which will possibly result in the loss of the hole section and compromising the well objectives. SBM has much lower levels of reactivity with shales and as such is much less likely to cause destabilisation during drilling, tripping and running casing. SBM containment management systems, shale shakers and cuttings dryers will be used to minimise the amount of SBM discharged to the environment as residual oil-on-cuttings. At the end of the section, the mud will be retained and used on the next hole section and/or future wells. At the end of drilling, all the recaptured SBM will be returned to the vendor for reuse.		
Intermediate Hole Section (2) Indicatively, 12 $^1/_4$- 13 ½" well-bore diameter. 9 $^5/_8$ – 9 $^7/_8$" production casing	Low toxicity SBM. This hole section will penetrate massive claystone sections including the Echuca Shoals and Lower Echuca Shoals formations. These formations are known to contain highly reactive claystones. Refer to the technical justification for SBM use presented in the previous section (Intermediate Hole Section (1)).	~160	~130
Production Hole Section Indicatively, 8 ½" well-bore diameter. 7" production liner	Low toxicity SBM. Brewster and Plover reservoirs will be drilled in one section. Anticipated bottom hole temperatures in this section are expected to be high, approximately 155 -175°C.	~50	~30

Well section description	Drilling fluid type	Volume of fluid disposed with cuttings (m^3)	Volume of cuttings discharged (m^3)
	Previous laboratory testing has confirmed both the Brewster and Plover reservoirs are sensitive to water and that SBM provides the least damaging option when drilling these sections. Therefore, the use of SBM will be used to prevent formation damage and assist optimal productivity evaluation.		

The conductor hole section of each well (indicatively 36 - 44") will be drilled using sea water and high viscosity “sweeps” (comprising prehydrated bentonite, i.e. WBMs) to circulate drilled cuttings from the hole for discharge at the seabed. Prehydrated bentonite consists of up to 98% water, the remainder being drilling fluid additives that are either completely inert in the marine environment, or naturally occurring benign materials. Bentonite is a naturally occurring clay of low toxicity (World Health Organization 2005). Alternatively, a suction pile type conductor system e.g. Neodrill CANDuctor may be installed in place of a conventional drilled and cemented conductor system as described in Section 3.3.1.

After the setting of the conductor (indicatively 30 - 36"), the surface hole section of each well (indicatively 20") will be drilled using WBM and may utilising a riserless mud return (RMR) system. The RMR is installed on the wellhead and includes a pump and hose on the seabed. It enables drilling fluids and drilled cuttings to be either discharged from the well at the seabed (conventional riser-less drilling) or circulated back to the MODU, via the RMR. In the event that a RMR system is not used, returns will be to the seabed.

The surface casing (indicatively 16") will then be cemented in place and the blowout preventer (BOP) and marine riser installed. This closed-system facilitates the transfer of drilling fluids and drilled cuttings back to the MODU for all subsequent drilling operations.

For the well in WA-343-P, and possibly for the well in WA-285-P, a weak fracture gradient is expected at the surface casing shoe. To maintain a sufficient drilling mud weight window, the short intermediate hole section (indicatively 14 ½" x 17 ½") will be drilled using SBM and the drilling liner / intermediate casing (indicatively 13$^3/_8$") will be cemented in place.

Thereafter, the intermediate hole section (indicatively 12 $^1/_4$ -13 ½") will then be drilled using SBM and the production casing (indicatively 9 $^5/_8$ – 9 $^7/_8$") will be cemented in place. Up until this point, the well design is the same regardless of whether the target is the Brewster or Plover reservoir.

The next section is the production hole section (indicatively 8 ½") through Brewster and Plover formations and drilled using SBM. If the existence of movable hydrocarbon is confirmed by logging while drilling (LWD) and wireline measurements, the production liner (indicatively 7") will be set for conducting drill stem tests (DSTs) to check productivities from the target reservoirs.

Drill stem test

Following drilling activities, a DST will be performed to assess various reservoir parameters. One DST will be undertaken per primary target in each well (up to two DSTs per well). The DST will be performed using well test equipment on the MODU which will be supplied by a third-party service contractor. Each well will be flowed at gas rates of up to 90 MMscf/day and up to 960 m^3/day of condensate. During DST operations, reservoir fluids (hydrocarbons) will be flared via the well test package. PW (approximately 160 m^3/day) will either be recombined and sent to the flare for disposal through a high efficiency burner head via a separator or processed via a water filtration package and discharged overboard.

A multi-rate DST will be conducted at various flow rates to establish baseline well deliverability; to obtain reservoir fluid samples and estimate key formation parameters. All operations will be conducted in accordance with the MODU's safety case accepted by NOPSEMA.

The estimated time for DST operations is approximately 72 - 96 hours per test, although this will be subject to the precise reservoir characteristics and other factors. Flaring associated with the DST is expected to last approximately 36 hours per test.

Drilling fluids and chemical selection

The wells will be drilled using both water-based mud (WBM) and synthetic-based mud (SBM) systems. A description of the chemical selection procedure for drilling fluids is presented in Section 9.6.1. The proposed formulations and chemicals to be used are listed in Table 3-2 (WBM) and Table 3-3 (SBM).

The listed products are only proposed and may change during the activity as new products are required. Indicative offshore chemical notification system (OCNS) or chemical hazard assessment and risk management (CHARM) hazard quotient (HQ) rankings have been included where possible. Any new products will be selected in accordance with the selection and approval process, and the list will be reviewed periodically and updated.

Table 3-2: Water-based formulation – provisional additives

Generic product name	Function	OCNS or CHARM HQ
Sea water	Continuous phase	n/a
Biocide	Bacteria control	Gold
Bentonite	Viscosifier	E
Caustic soda	Alkalinity control	E
Glycol medium Cloud Point	Clay inhibition	Gold
PAC Low Vis	Fluid loss control	E
PAC Hi Vis	Fluid loss control	E

Generic product name	Function	OCNS or CHARM HQ
Potassium chloride	Clay inhibition	E
Soda ash	Alkalinity control	E
Soltex (Sodium)	Clay inhibition	Gold
Sized cellulose	Lost circulation	E
Desco CF	Dispersion	Gold
Xanthan gum	Viscosifier	E

Table 3-3: Synthetic-based formulation - provisional additives

Generic product name	Function	OCNS or CHARM HQ
Primary emulsifier	Primary emulsifier	D
Secondary emulsifier	Secondary emulsifier	D
Option A: linear alpha olefins synthetic base oil [1]	Continuous emulsion phase	E
Option B: Saraline 185V synthetic base oil [1]	Continuous emulsion phase	E
Organophillic clay HT	Viscosifier	E
Organophillic clay	Viscosifier	E
Lime	Alkalinity control	E
Calcium chloride	Internal water phase salinity	E
Fluid loss additive powder	Fluid loss control	E
Fluid loss additive liquid	Fluid loss control	D

Generic product name	Function	OCNS or CHARM HQ
Calcium carbonate	Reservoir bridging	E
Barite	Density control	E

[1] Note: Both Option A and Option B base oils are generally available in the region and suitable for use.

Drill cuttings

WBM drill cuttings will either be discharged directly to the seabed (while drilling the riserless conductor hole section) or brought up to the MODU (while drilling the subsequent surface hole section). Cuttings brought up to the MODU will be directed over solids control equipment (SCE), which comprises vibrating screens (shale shakers), and to centrifuges, and then discharged overboard. Where SBM is used, SCE will also include cuttings dryers. Except for residual fluid on drill cuttings, no SBM will be discharged to the marine environment. Details of the SCE equipment are provided below.

Shale shakers

Shale shakers primarily remove large amounts of cuttings from drilling mud by directing it from the well to flow over vibrating wire-cloth screens. The screens remove the cuttings after which the mud is directed back to the MODU mud storage pits.

Centrifuges

Following the processing by shale shakers, the mud will be directed to centrifuges which are used to separate barite and remove fine solids (those below 4.5 to 6 microns). Centrifuges use a rotating bowl to create high centrifugal forces to affect the separation of coarse and fine particles from the mud. Solids from the centrifuge are discharged to sea and the mud recirculated into the fluid system.

Cuttings dryer and dryer centrifuge

While using SBM, a circulating system will be active that processes the SBM over shale shakers and through centrifuges. These allow the SBM fluid component to be separated from the cuttings and captured for continuous recirculation into the fluid system during drilling.

Table 3-1 provides a summary of estimated fluid and cuttings volumes to be discharged. The cuttings dryer will aid in ensuring the volume of SBM retained on cuttings is ≤7% weight per weight (wt/wt). The dried cuttings will be discharged overboard. The reclaimed SBM will be retained on board for disposal onshore or recycled into the mud system. At the end of drilling, all recaptured SBM will be returned to the vendor for reuse.

Cementing

Cementing operations are undertaken to ensure well integrity, through the following mechanisms:

- cementing the casing and conductors in place
- sealing the annulus between the casing string and the formation
- sealing lost circulation zones
- setting plugs in an existing well from which to sidetrack

- setting plugs for zonal isolation
- plugging and abandoning the well at the end of the activity.

Cement is transported as dry bulk to the MODU by the support vessels and is mixed with water and additives in the cementing unit immediately before use to form a cement slurry, which is then injected down the well by high pressure pumps.

It is standard practice to allow some excess cement slurry to overflow to the sea floor when cementing the top-hole section as this provides visual evidence that the annular space between the hole and the casing has been filled. This typically covers an area of seabed of up to 10 m from the well. Small volumes of cement slurry may also be discharged to the sea surface when testing the cementing unit or disposing of excess slurry before it sets at the end of a cementing job. Excess cement will be retained for use on the next well, at the end of the drilling campaign, should any bulk cement remain, INPEX will aim to transfer the excess volume to the vessel for onshore disposal/reuse. The bulk transfer (MODU to vessel) will be dependent on the transfer capability of the contracted MODU. Should this option not be available, the remaining cement will be mixed and operationally discharged to the marine environment.

In accordance with the Section 9.6.1, cement products used will have an OCNS rating of D or E or a HQ rating of silver or gold. If not OCNS registered, all chemicals will be assessed as 'green' via the INPEX pseudo ranking system in line with the OCNS CHARM/non-CHARM criteria.

Blowout preventer

A blowout preventor (BOP) plays a critical role in assuring safe operations in the event of a loss of primary well control. As part of ongoing drilling operations, the BOP stack is required to be regularly function tested when subsea (typically weekly/fortnightly), as defined by the INPEX Well Operations Standard (0000-AD-STD-60004) and Well Operations Manual (0000-AD-MAN-60002). During testing, volumes of water-based BOP control fluid will be released to the marine environment.

Well abandonment

At the end of the drilling and evaluation activities within each permit, both wells will be permanently plugged and abandoned in accordance with the approved Well Operations Management Plan (WOMP). A two-barrier philosophy for permanent abandonment will be maintained in compliance with INPEX barrier standards (INPEX Well Integrity Standard (0000-AD-STD-60003) and INPEX Well Operations Manual (0000-AD-MAN-60002)).

Well abandonment activities will also be undertaken in accordance with the requirements of the OPGGS Act, the OPGGS (Resource Management and Administration) Regulations 2011. Additionally, in accordance with Section 572 of the OPGGS Act (removal of property) and NOPSEMA's Section 572 Maintenance and removal of property policy (NOPSEMA 2020a) INPEX will remove all structures, equipment and other property associated with the activity.

On completion of the drilling and evaluation activities the conductor[1] and casing will be cut below the sea floor (mudline) and all equipment will be removed. It is anticipated that the duration of the well abandonment will be approximately 7 days per well.

[1] The conductor may or may not be installed conventionally i.e. drilled and cemented. If a suction pile type of conductor system e.g. Neodrill CANductor is installed (Section 3.3.1), the MODU will leave the location once the high pressure wellhead housing is recovered, then another vessel will recover the conductor complete with the low pressure wellhead housing therefore removing all equipment from the seabed as described in Section 3.3.8.

3.3.3 Gas venting

During drilling operations, minor quantities of drill gas will be separated and safely discharged from mud processing equipment. During DST operations, venting may also occur from vessel surge tanks. Gas will not be vented near any ignition sources.

3.3.4 Wireline formation evaluation

The wireline formation evaluation program consists of a firm "dry hole" program and a contingent "success case" program within the planned 8 ½" hole section. The "success case" program will be run if gas bearing reservoir quality sandstones are confirmed by either mud-logging and/or LWD analysis. A summary of the wireline logging tool types planned to be utilised is included below.

Dipole sonic tool

A dipole sonic tool measures the travel time of an elastic wave, derived from a low energy pulse of sound, through the formation. Quantitatively, the sonic log can be used to evaluate porosity and provide direct geomechanical analysis input. As an aid to seismic interpretation it can be used to give interval velocities and velocity profiles and can be calibrated with the seismic section.

Gamma ray/spectral gamma ray tool

A gamma ray tool measures the natural gamma radiation emanating from a rock. This gamma radiation originates from the naturally occurring radioactive elements potassium, uranium and thorium. The spectral gamma ray tool measures both the total natural gamma radiation and each individual contribution from potassium, uranium and thorium. The gamma ray log is used quantitatively to derive a shale/clay volume and potentially clay type/s. Qualitatively, the gamma ray log can potentially be used to correlate formations, facies and depositional sequences.

Mechanical rotary sidewall core

A mechanical rotary sidewall core tool allows for the extraction of small rock samples from the drilled formation. An electrically driven rotary coring tool extends from the tool and penetrates the borehole wall and formation. The core, once cut, is snapped off and pulled into the body of the wireline tool for recovery to surface. A small electrically driven rotary coring tool extends from the wireline tool and penetrates the surrounding formation. The core, once cut, is snapped off and pulled into the body of the wireline tool for recovery to surface later. Core samples are used to evaluate mineralogy, porosity, permeability, fluid type/volume, rock strength and biostratigraphy.

Resistivity/conductivity/density/neutron tools

A resistivity tool measures the resistance to current passing through the formation which is used to infer the presence of hydrocarbons as opposed to water. Conductivity tools measure a rocks conductivity or its ability to conduct an electric current. Conductivity is the reciprocal of resistivity and is usually plotted as a resistivity log.

A density tool produces a continuous record of a formations bulk density and the density log can be used to calculate porosity and indirectly, hydrocarbon and mineral density.

A neutron tool provides a continuous record of a rocks reaction to fast/high energy neutron interaction. Neutron log data is used for porosity evaluation and fluid type identification (gas, oil and water).

Formation pressures test tool

A wireline formation pressure test tool measurement is acquired by inserting a small probe into the borehole wall/intersected formation and performing a mini pressure drawdown and build-up by withdrawing a small amount of formation fluid and then waiting for the pressure to build up to the formation pore pressure. This analysis provides a measure of in-situ fluid densities and fluid mobility/permeability.

Formation fluid sample tool

A wireline formation fluid sampling tool can take multiple samples of formation fluids. To acquire samples, a tool probe is mechanically pressed into the formation and then a fluid sample chamber is opened within the tool into which formation fluid flows. The retrieved formation fluid samples are sent to a laboratory for detailed pressure/volume/ temperature analysis.

Borehole geological imaging tool/element measurement tool/dielectric tool/nuclear magnetic resonance tool

A borehole geological imaging tool consists of several retractable pads that are pushed onto the borehole wall. Each pad records formation voltage allowing for both sedimentary and structural features of the rock to be evaluated in detail by obtaining a precise borehole image to determine its shape and form.

An element measurement tool (spectroscopy) is used to measure rock elemental concentrations. The measured elements can be used for accurate quantitative mineralogy analysis and input into detailed petrophysical and geological property evaluation.

A dielectric tool provides a measurement of dielectric dispersion in the formation/rock. The principle of the dielectric dispersion measurement is the propagation of high frequency electromagnetic waves into the formation/rock and measuring the response to determine key petrophysical properties.

A nuclear magnetic resonance wireline logging tool measures the induced magnetic moment of hydrogen nuclei (protons) contained within fluid-filled pore space of rocks and the bound water of certain minerals.

3.3.5 Vertical seismic profile (VSP)

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. VSP measurements are used primarily for correlation of existing seismic data.

The sound source used for VSP is similar to, but much smaller than, those used during seismic surveys. Typically, an acoustic source with a total array volume of 0.012 m^3 (~750 cubic inches) is employed. The sound pressure level will be 232 dB re 1 µPa@1m with a frequency range of 5–125 Hz.

The airgun source array is discharged 5–10 m below the sea surface approximately five times at roughly 20 second intervals, with recordings taken down-hole at a specific depth. Additional recordings are made at 5–7-minute intervals as the down-hole tool is repositioned within the well. VSP is planned for both wells with the total duration of VSP activities (excluding soft-starts) estimated to take approximately 18 hours per well (but will be dependent on the results of the well which is being profiled and the schedule of activities).

3.3.6 Contingent drilling activities

A number of contingencies, detailed in Table 3-4, may be required in the event of operational or technical issues during the exploration drilling activity.

Table 3-4: Drilling contingencies

Contingency	Contingency establishment	Description	Environmental considerations
Well re-spud	In the event that operational or technical issues are encountered while drilling.	The process of beginning to drill a well. The location of the re-spud would typically be within the immediate area of the original well at a safe location.	The net environmental effect will be limited to an increase in the volume of cuttings generated. In a worst-case scenario, this could be a doubling of the estimated drill cuttings from the first two sections of the well-bore (Table 3-1). There may also be some additional temporary, localised damage to benthic habitat. Should a well re-spud be required, the original well will be permanently plugged and abandoned as described in Section 3.3.2 *Well abandonment*
Sidetrack	In some instances, the option of a sidetrack instead of a re-spud might be pursued when operational issues are encountered.	The process of drilling a secondary well-bore away from an original well-bore.	The net environmental effect will be limited to an increase in the volume of cuttings generated. The worst case would be equivalent to cuttings generated from a single section of the well.
Lost circulation	Circulation is said to be lost when the drilling fluid flows into one or more geological formations instead of returning up the annulus.	A number of contingencies are available when lost circulation occurs, depending on the severity: • minor losses may be controlled with the use of fluid loss control materials such as bentonite and/or polymers, or other additives	The net environmental effect would be a change in the water quality at the point of discharge. Depending on the volume of discharge, this could potentially form a temporary plume before it is dispersed back to ambient levels.

Contingency	Contingency establishment	Description	Environmental considerations
		• severe losses will require the use of fluid loss control materials such as bentonite and/or polymers and the addition of bridging agents such as ground calcium carbonate and fibrous material • pull back, cement the zone where the losses occurred, and drill through the cement and recommence drilling the well.	
Removal of formation fluid influx (well control)	It is possible that a well kick may occur resulting in an undesirable influx of formation fluid into the well-bore.	The influx will be removed from the wellbore in a controlled manner as per the approved well control procedures.	The resultant effect would be a release of gas via the mud-gas separator to the atmosphere during well control operations. Gas will not be vented near any ignition sources.

3.3.7 Concurrent drilling operations

Although unlikely, it is possible that concurrent drilling operations may occur during this activity. This would involve a MODU operating in WA-285-P and WA-343-P simultaneously. In addition, during the life of this EP drilling activities are expected to continue in the WA-50-L production licence area associated with INPEX's Ichthys development drilling campaign.

3.3.8 Post-drill conductor recovery

In the event that a CANDuctor is used to replace the conventional conductor for either or both of the WA-285-P and WA-343-P wells, operations to recover the CANDuctor(s) will commence within 6 months of the departure of the MODU from the drilling location of the later of the two wells drilled. This recovery will be undertaken using an AHSV.

If not already done so, internal casing strings will be severed using a casing cutting tool suspended on the AHSV's work wire. The work wire will then be connected to the CANDuctor and the ROV controlled from the AHSV used to pump the CANDuctor out the seabed. The CANDuctor and wellhead system will then be recovered to the AHSV and secured on deck prior to it being transported to the demobilisation point.

3.4 Semi-submersible MODU, supporting vessels and aircraft

The MODU contracted to undertake the drilling activities will be a semi-submersible MODU with an expected complement of 100 to 180 personnel onboard. The MODU will maintain position using either DP or an anchored mooring system. While on location, a PSZ with a 500 m radius will be maintained around the MODU at all times; to control activities, and to reduce the risk of marine collisions, as required under the OPGGS Act. Maritime Safety Information (MSI) notifications will be issued via AMSA, while the Australian Hydrographic Office (AHO) will issue a Notice to Mariners. The MODU will be powered by marine diesel with a typical usage of 30,000 L per day for a moored MODU. Fuel usage will increase if the MODU is dynamically positioned (approximately 50,000 L per day).

The MODU will be supported by two to three vessels (i.e. AHSVs and Platform Supply PSVs), as well as regular helicopter flights from the mainland.

The AHSVs and the PSVs will be used to transport equipment, materials and fuel between the MODU and the port of Broome, the marine supply base for the activity. The AHSVs will be used to deploy and accurately position anchors for the MODU if required. The vessels will also conduct safety lookouts for helicopter landings and take-offs; monitor the 500 m PSZ maintained around the MODU; and provide support in the event of emergencies. Vessels will remain outside of the PSZ unless undertaking duties and will maintain position using DP (no anchoring). Support vessels will be powered by marine diesel with a typical usage of 5,000 L per day when on standby (Gustavson Associates 2011) and 15,000 L per day when steaming. Each supply vessel will be crewed by up to 25 personnel. Should concurrent drilling operations occur, vessel support may be shared between MODUs.

Aviation support will be based at Broome International Airport. Helicopters based in Broome will be used to transfer personnel to and from the MODU several times per week. The transfer frequency may vary depending on MODU manning, the operational phase of the well, and the specification (capacity) of the helicopters contracted. Although not expected, vessels and helicopters may be refuelled in nearby WA-50-L if required during the drilling activities.

3.4.1 Anchoring and dynamic positioning

A DP MODU will maintain position at the well locations using thrusters. Whereas a moored MODU will typically have a minimum of eight anchors, deployed by AHSVs and lowered to the seabed. Anchors may be pre-laid in advance of the MODU arriving at each well location. Once in place, the MODU winches in the slack from the mooring lines to the required tension. Anchors are spread in a radial pattern extending from the MODU. The size of the anchor spread will be dependent on the MODU and the MODU specific mooring analysis conducted during the well planning stage. Typically, mooring lines extend approximately 2,000 m from the MODU with approximately 1,000 m of grounded chain. Each anchor typically occupies a total seabed area of approximately 30 m^2. Retrieval of anchors is the reverse of the deployment procedures.

3.4.2 Remotely operated vehicle

The MODU, and possibly other specialised vessels will be equipped with a ROV for:

- pre-spud hazard surveys
- installation and retrieval of suction pile conductor system i.e. Neodrill CANDuctor, if selected
- monitoring of BOPs/marine riser
- monitoring of openwater landing and cementing operations

- monitoring for shallow gas, and unplanned discharges
- functioning and troubleshooting of subsea equipment e.g. BOPs, RMR system or survey/positioning system, as required.

Camera systems (still and video) are also fitted to the ROV to capture permanent records of the environment and operations.

3.5 Summary of emissions, discharges and wastes

A summary of the emissions, discharges, and wastes resulting from the activities are described in Table 3-5, including indicative volumes where relevant. Relevant monitoring and measurement conducted on the emissions and discharges are detailed below and further described within the respective subsections of Section 7.

Table 3-5: Emissions (E), discharges (D) and wastes (W) generated during the planned activity

Activity/system	E, D, W	Description	
Pre-drill site surveys	E	Survey vessel	Combustion emissions from survey vessels and diesel-powered generators onboard emitted to the atmosphere. Noise emissions from survey vessel engines.
	E	Survey equipment	Noise emissions from echo sounders, side-scan sonar and sub-bottom profiling.
ROV operations	D	MODU or vessel based ROV	Routine subsea discharges of water-based hydraulic fluids and subsea control fluids (< 1 m^3).
BOP	D	MODU	Water-based BOP control fluids. BOP function/pressure testing results in approximately 0.25 m^3 of BOP fluid discharged to the marine environment per test.
Drilling	E	MODU	Noise emissions resulting from drilling.
Drilling fluids	D	MODU	Basic WBM system uses low-toxicity drilling fluid that is benign to the environment. Sections of the well will be drilled with SBM for technical reasons (Table 3-1). All drilling fluids selected for use are assessed and approved by the environmental advisor prior to use.
Drill cuttings	D	MODU	While drilling riserless, all returns will be to the seabed. For well sections that require SBM, SCE will be used, and cuttings discharged from the surface. No whole SBM will be discharged, only residual fluid on drill cuttings will be discharged (≤7% oil-on-cuttings wt/wt (averaged over the SBM sections)).

Activity/system	E, D, W	Description	
Cementing	D	MODU	Seabed discharge of cement at each well location may cover an area of seabed up to 10 m^2 from the well, in addition to surface discharge from tank cleaning. Any bulk cement remaining at the end of the campaign is transferred onshore for disposal/reuse. Should this option not be available, the remaining cement will be mixed and operationally discharged to the marine environment.
Gas venting	E	MODU	Atmospheric emissions when venting during drilling (via the mud-gas separator during well control operations).
Drill stem testing	E	MODU	Flaring of gas (approximately 36 hours duration up to twice per well), burning of hydrocarbons, cold venting of gases from tank vents. Utilisation of diesel driven air compressors and steam generators.
	D	MODU	PW generated during the DST will either be recombined with the condensate and sent to flare for disposal, or where poor burn quality is observed it will be processed via a water filtration unit and discharged overboard at an oil in water (OIW) concentration of < 30 ppm.
	D	MODU	Mono ethylene glycol (MEG) is injected to the well during the DST (approximately 4 m^3 per well) and is ultimately discharged to sea.
VSP	E	MODU	Noise emissions (pulses) from seismic source during VSP (approximate 18 hours duration). Typical total array volume of 0.012 m^3 (~750 cubic inches).
Power generation	E	MODU	Combustion emissions from MODU and diesel-powered generators onboard emitted to the atmosphere.
	E	MODU	Noise emissions from power generation (and other topside activities) including DP thrusters.
	E	Vessels	Combustion emissions from support vessels and diesel-powered generators onboard emitted to the atmosphere.
	E	Vessels	Noise emissions from support vessel engines and propulsion systems (such as DP thrusters).

Activity/system	E, D, W	Description	
Cooling water	D	MODU Vessels	Seawater used as heat-exchange medium for machinery engines. Return seawater containing residual heat and residual sodium hypochlorite is returned to sea. During DST, a deluge of cooling water (seawater) is used to cool the exterior of the MODU during flaring and returned to sea containing residual heat.
Open-drains system	D	MODU	The MODU main deck and moon pool areas will have an open drains system. Deck drainage water will be discharged to sea. Note low toxicity rig wash will be used for washing the main deck of the MODU. MODU drill floor drainage may be routed for mud recovery and re-used in the active mud system.
Closed-drains system	W	MODU	The MODU pump rooms and engine rooms are closed drainage areas. Oily waste material from the closed drains is collected in a holding tank and returned to shore for treatment and disposal. During the use of SBM, all drains in areas exposed to SBM will be plugged. A mud vacuum system (mud-vac) will be used to collect spillages of SBM. The SBM collected by the mud-vac will either be treated and reused or shipped to shore for disposal.
Vessel deck drainage	D	Vessels	Vessel deck drainage water will be discharged to sea.
Bilge system	D	MODU Vessels	Treated contaminated bilge water with <15 ppm(v) OIW is discharged to sea.
Sewage, grey water and macerated food waste effluent	D	MODU Vessels	Treated effluent produced by sewage treatment plants is discharged to sea.
Ballast system	D	MODU Vessels	Return ballast is discharged to sea.
Foam fire-extinguishing	D	MODU Vessels	Firefighting foam is routed to the open-drains/deck drainage system and may be released to sea in the event of system deployment. Minor quantities of wind-blown foam may also be released.
Desalination brine	D	MODU Vessels	Brine produced from the Reverse Osmosis (RO) process will be diluted and discharged to sea.

Activity/system	E, D, W	Description	
Miscellaneous	E	MODU Vessels	Light emissions from deck and navigation lights on MODU and vessels.
	W		Solid and liquid wastes from general maintenance operations, equipment replacement, etc., and domestic wastes are transported to shore for disposal.

4 EXISTING ENVIRONMENT

4.1 Regional setting

Exploration permits WA-285-P and WA-343-P are situated in the northern Browse Basin (Figure 1-1). In the event of a worst-case unplanned oil spill, the area potentially exposed to hydrocarbons, hereafter referred to as the potential exposure zone (PEZ), covers a considerably larger area than the permit areas where planned activities will occur.

The spatial extent of the PEZ was determined from stochastic spill modelling using the low hydrocarbon exposure thresholds described in NOPSEMA Bulletin #1 (NOPSEMA 2019). This considered the worst-case credible hydrocarbon scenarios identified for the activity (refer Section 7.7, Table 7-16) for surface hydrocarbons, shoreline accumulations of oil, and entrained oil and dissolved aromatic hydrocarbons in the water column. The PEZ has been used to identify relevant values and sensitivities that may be affected and has been used as the basis for the EPBC Act Protected Matters database search (Appendix A). In addition, an EPBC Act Protected Matters database search was undertaken for each permit area and is also presented in Appendix A.

The low thresholds that have been used to inform the extent of the PEZ are useful for oil spill response planning and scientific monitoring (water quality) purposes but may not be ecologically significant (NOPSEMA 2019). Therefore, in addition to the PEZ, an environment that may be affected (EMBA) has also been established from stochastic spill modelling using hydrocarbon exposure thresholds identified as having the potential to cause impacts to receptors such as fauna and habitats (refer Section 8, Table 8-2). An EPBC Act Protected Matters database search was also undertaken for the EMBA and is presented in Appendix A.

The resulting PEZ and EMBA from the oil spill modelling are the sum of overlaid stochastic modelling runs for the worst-case spill scenarios (Table 8-1), during all seasons (wet, transitional and dry) and under different hydrodynamic conditions (e.g. currents, winds, tides, etc.). As such, the actual area that may be affected from any single spill event would be considerably smaller than represented by the PEZ or EMBA. The PEZ and EMBA are both geographically represented in the figures throughout this section of the EP and in Figure 8-1.

4.1.1 Australian waters

Australia's offshore waters have been divided into six marine regions in order to facilitate their management by the Australian Government under the EPBC Act. The permit areas are located entirely within the North-west Marine Region (NWMR). The PEZ intersects both the NWMR and the North Marine Region (NMR). The relevant key features of the NWMR and NMR in the context of WA-285-P, WA-343-P and the PEZ are further described in subsequent sections of this EP.

North-west Marine Region

The NWMR comprises Commonwealth waters, from the WA–Northern Territory (NT) border in the north, to Kalbarri in the south. The NWMR encompasses a number of regionally important marine communities and habitats which support a high biodiversity of marine life and feeding and breeding aggregations (DSEWPaC 2012a).

North Marine Region

The NMR comprises Commonwealth waters from the WA–NT border to West Cape York Peninsula. This region is highly influenced by tidal flows and less by ocean currents. The marine environment of the NMR is known for its high diversity of tropical species but relatively low endemism, in contrast to other bioregions (DSEWPaC 2012b).

4.1.2 External Australian Territories

In total there are seven Australian external territories; Ashmore and Cartier Islands, Australian Antarctic Territory, Christmas Island, Cocos (Keeling) Islands, Coral Sea Islands, Heard and McDonald Islands and Norfolk Island (Geoscience Australia 2022a). They represent remote offshore territories located in the Pacific, Indian and Southern oceans, and the Coral Sea (Geoscience Australia 2022a). External Australian territories located within the PEZ include Ashmore and Cartier Islands, Christmas Island and the Cocos (Keeling) Islands described in Section 4.3.

4.1.3 International waters

The PEZ extends into the international waters of the Lesser Sunda Ecoregion and locations along the Indonesian shoreline. The Indonesian archipelago lies between the Pacific and Indian oceans and bridges the continents of Asia and Australia and comprises of over 17,000 islands (Huffard et al. 2012). The archipelago is divided into several shallow shelves and deep-sea basins (ABD 2014). Indonesian waters, especially the eastern part of the archipelago, play an important role in the global water mass transport system, in which warm water at the surface conveys heat to deeper cold waters. The water mass transport from the Pacific to the Indian Ocean through various channels in Indonesia is known as the Indonesian Throughflow (described in Section 4.8.2).

The Lesser Sunda Ecoregion, located at the southern end of the Coral Triangle, encompasses the chain of islands and surrounding waters from Bali, Indonesia to Timor-Leste including East Nusa Tenggara (Indonesia’s southernmost province).

This region contains suitable habitat for corals and is considered important for coral endemism, particularly the areas of Bali-Lombok, Komodo and East Flores. The Indonesian coastline is rich in tropical marine ecosystems such as sandy beaches, mangroves, coral reefs and seagrasses (Hutomo & Moosa 2005). The majority of the West Timor coastline features a narrow fringing coral reef community with four dense areas of mangrove communities occurring primarily along the south coast (Allen & Erdmann 2013). The Timor-Leste coastline also features mangrove communities surrounding entrances to rivers primarily on the south coast, whilst the north and eastern coasts comprise a higher degree of coral reef communities (Allen & Erdmann 2013).

4.2 Key ecological features

The Australian Government has identified parts of the marine ecosystem that are of importance for a marine region’s biodiversity or ecosystem function and integrity, referred to as key ecological features (KEFs). The permit areas both overlap one KEF, and a further 13 are located within the PEZ (Figure 4-1) as follows:

WA-285-P:

- Continental slope demersal fish communities.

WA-343-P:

- Continental slope demersal fish communities.

PEZ:

- Ancient coastline at 125 m depth contour
- Ashmore Reef and Cartier Island and surrounding Commonwealth waters
- Canyons linking the Argo Abyssal Plain with Scott Plateau
- Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula

- Carbonate bank and terrace system of the Sahul Shelf
- Mermaid Reef and Commonwealth waters surrounding the Rowley Shoals
- Pinnacles of the Bonaparte Basin
- Seringapatam Reef and Commonwealth waters in the Scott Reef complex
- Carbonate bank and terrace system of the Van Diemen Rise
- Shelf break and slope of the Arafura Shelf
- Tributary canyons of the Arafura Depression
- Exmouth Plateau
- Glomar Shoals.

4.2.1 Continental slope demersal fish communities

WA-285-P and WA-343-P both overlap the continental slope demersal fish community KEF. The level of endemism of demersal fish species in this community is the highest among Australian continental slope environments.

The demersal fish species occupy two distinct demersal community types associated with the upper slope (water depth of 225–500 m) and the mid-slope (750–1,000 m) (DAWE 2022b). Although poorly studied, it is suggested that the demersal-slope communities rely on bacteria and detritus-based systems comprised of infauna and epifauna, which in turn become prey for a range of teleost fish, molluscs and crustaceans (Brewer et al. 2007). Higher-order consumers may include carnivorous fish, deep-water 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).

Bacteria and fauna present on the continental slope are the basis of the food web for demersal fish and higher-order consumers in this system. Therefore, loss of benthic habitat along the continental slope at depths known to support demersal fish communities could lead to a decline in species richness, diversity and endemism associated with this feature (DSEWPaC 2012a). Other potential concerns with regard to pressure on the continental slope demersal fish community KEF include climate change (increasing sea temperature/ocean acidification), habitat modification due to fishing gear and commercial fishing by-catch resulting in the potential to diminish the species richness and diversity of these communities (DAWE 2022b).

4.2.2 Ancient coastline at 125 m depth contour

The ancient coastline at 125 m depth contour KEF runs diagonally in a north-easterly direction, approximately 10 km south of WA-285-P and 30 km east of WA-343-P at the closest points. Parts of the ancient coastline, particularly where it exists as a rocky escarpment, are thought to provide biologically important habitats in areas otherwise dominated by soft sediments. The topographic complexity of the escarpments may facilitate vertical mixing of the water column, providing relatively nutrient-rich local environments. The ancient coastline is an area of enhanced productivity, attracting baitfish which, in turn, supplies food for migrating species (DSEWPaC 2012a).

While there is little information available on the fauna associated with the hard substrate of the escarpment, it is likely to include sponges, corals, crinoids, molluscs, echinoderms and other benthic invertebrates representative of hard substrate fauna in the NWMR (DSEWPaC 2012a).

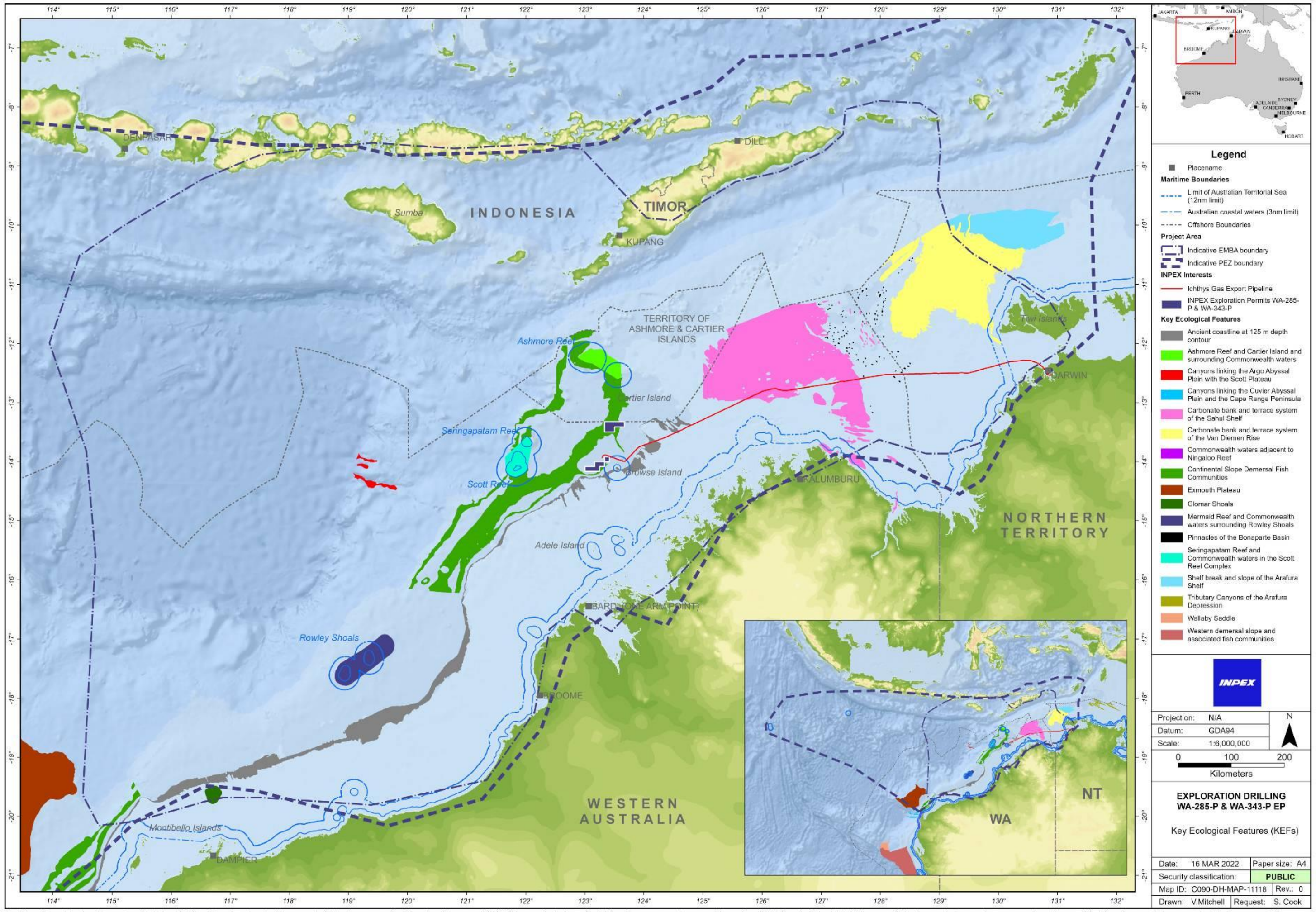

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Figure 4-1: Key ecological features in north-west Australia (showing PEZ and EMBA)

4.2.3 Ashmore Reef and Cartier Island and surrounding Commonwealth waters

The Ashmore Reef and Cartier Island and surrounding Commonwealth waters KEF is located approximately 150 km north of WA-285-P and 80 km from WA-343-P at the closest points. The KEF is recognised for its ecological functioning and integrity (high productivity), and biodiversity (aggregations of marine life) values, which apply to both the benthic and pelagic habitats within the feature.

Ashmore Reef is the largest of only three emergent oceanic reefs in the north-eastern Indian Ocean and is the only oceanic reef in the region with vegetated islands. The waters surrounding Ashmore Reef and Cartier Island are important because they are areas of enhanced productivity in relatively unproductive waters (DSEWPaC 2012a).

Further details regarding the Ashmore Reef and Cartier Island and surrounding Commonwealth waters KEF are provided in Section 4.3 which describes Australian Marine Parks.

4.2.4 Canyons linking the Argo Abyssal Plain with the Scott Plateau

The canyons linking the Argo Abyssal Plain with the Scott Plateau KEF is located approximately 350 km west of WA-285-P and 400 km west of WA-343-P at the closest points. The Bowers and Oats canyons are major canyons on the slope between the Argo Abyssal Plain and Scott Plateau. The canyons cut deeply into the south-west margin of the Scott Plateau at a depth of approximately 2,000–3,000 m, and act as conduits for transport of sediments to depths of more than 5,500 m on the Argo Abyssal Plain. Benthic communities at these depths are likely to be dependent on particulate matter falling from the pelagic zone to the seafloor. The ocean above the canyons may be an area of moderately enhanced productivity, attracting aggregations of fish and higher order consumers, such as large predatory fish, sharks, toothed whales and dolphins. The canyons linking the Argo Abyssal Plain and Scott Plateau are likely to be important features due to their historical association with sperm whale aggregations (DSEWPaC 2012a).

4.2.5 Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula

The canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula KEF is located approximately 1,200 km south of WA-285-P and 1,290 km south of WA-343-P at the closest points. Cape Range Peninsula and the Cuvier Abyssal Plain are linked by canyons, the largest of which are the Cape Range Canyon and Cloates Canyon. These two canyons are located along the southerly edge of Exmouth Plateau adjacent to Ningaloo Reef and are unique due to their close proximity to the North West Cape (DSEWPaC 2012a). The Leeuwin Current interacts with the heads of the canyons to produce eddies resulting in delivery of higher nutrient, cool waters from the Antarctic intermediate water mass to the shelf (Brewer et al. 2007). Strong internal tides also create upwelling at the canyon heads (Brewer et al. 2007). Therefore, the canyons, the Exmouth Plateau and the Commonwealth waters adjacent to Ningaloo Reef interact to create the conditions for enhanced productivity seen in this region (DSEWPaC 2012a). The canyons are also repositories for particulate matter deposited from the shelf and sides of the canyons and serve as conduits for organic matter between the surface, shelf and abyssal plains (DSEWPaC 2012a).

The soft bottom habitats within the canyons themselves are likely to support important assemblages of epibenthic species. Biological productivity at the head of Cape Range Canyon in particular, is known to support species aggregations, including whale sharks, manta rays, humpback whales, sea snakes, sharks, large predatory fish and seabirds. The canyons are thought to be significant contributors to the biodiversity of the adjacent Ningaloo Reef, as they channel deep water nutrients up to the reef, stimulating primary productivity (DSEWPaC 2012a).

4.2.6 Carbonate Bank and Terrace System of the Sahul Shelf

The carbonate bank and terrace system of the Sahul Shelf KEF is located in the western Joseph Bonaparte Gulf, approximately 205 km north-east of WA-285-P and 150 km from WA-343-P at the closest points. The KEF is recognised for its biodiversity values (a unique seafloor feature with ecological properties of regional significance), which apply to both its benthic and pelagic habitats. The banks consist of a hard substrate with flat tops. Each bank occupies an area generally less than 10 km^2 and is separated from the next bank by narrow sinuous channels up to 150 m deep (DSEWPaC 2012a).

Although little is known about the bank and terrace system of the Sahul Shelf, it is considered to be regionally important due to its continuous and large expanse, as well as the ecological role it is likely to play in the biodiversity and productivity of the Sahul Shelf (DSEWPaC 2012a). The banks support a high diversity of organisms, including reef fish, sponges, soft and hard corals, gorgonians, bryozoans, ascidians and other sessile filter-feeders (Brewer et al. 2007). They are foraging areas for loggerhead, olive ridley and flatback turtles. Humpback whales and green and freshwater sawfish are also likely to occur in the KEF (Donovan et al. 2008). However, due to their ecology, sawfish (generally estuarine rather than open-ocean species), are not expected to be present within open-ocean environments.

4.2.7 Mermaid Reef and Commonwealth waters surrounding Rowley Shoals

The Mermaid Reef and the Commonwealth waters surrounding Rowley Shoals KEF is located approximately 475 km south-west of WA-285-P and 545 km from WA-343-P at the closest points. The Rowley Shoals are a collection of three atoll reefs, Clerke, Imperieuse and Mermaid, which are located approximately 300 km north-west of Broome. The KEF is regionally important in supporting high species richness, higher productivity and aggregations of marine life associated with the adjoining reefs themselves (Done et al. 1994; DSEWPaC 2012a).

The reefs provide a distinctive biophysical environment in the region as there are few offshore reefs in the north-west. They have steep and distinct reef slopes and associated fish communities. Enhanced productivity contributes to species richness due to the mixing and resuspension of nutrients from water depths of 500-700 m into the photic zone (DSEWPaC 2012a). 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).

4.2.8 Pinnacles of the Bonaparte Basin

The Pinnacles of the Bonaparte Basin KEF is located approximately 460 km east of WA-285-P and 415 km from WA-343-P at the closest points. This KEF consists of an area containing limestone pinnacles, up to 50 m high (above the surrounding seabed) and is located in the western Joseph Bonaparte Gulf on the mid-to-outer edge of the shelf (DSEWPaC 2012b). They represent 61% of the limestone pinnacles in the NWMR and 8% of limestone pinnacles in the Australian EEZ (Baker et al. 2008).

The pinnacles of the Bonaparte Basin are thought to be the eroded remnants of underlying strata. It is likely that the vertical walls generate local upwelling of nutrient-rich water, leading to phytoplankton productivity that attracts aggregations of planktivorous and predatory fish, seabirds and foraging turtles (DSEWPaC 2012b).

As the pinnacles provide areas of hard substrate in an otherwise relatively featureless, soft sediment environment they are presumed to support a high number of species. Associated communities are thought to include sessile benthic invertebrates including hard and soft corals and sponges, and aggregations of demersal fish species such as snapper, emperor and grouper (Brewer et al. 2007). The pinnacles are thought to be a feeding area for flatback, loggerhead and olive ridley turtles, while green turtles may traverse the area. Humpback whales and green sawfish are also likely to occur in the KEF (Donovan et al. 2008). However, due to their ecology, sawfish (generally estuarine rather than open-ocean species) are not expected to be present within open-ocean environments.

4.2.9 Seringapatam Reef and Commonwealth waters in the Scott Reef Complex

The Seringapatam Reef and Commonwealth waters in the Scott Reef Complex KEF is located approximately 105 km west of WA-285-P and 135 km from WA-343-P at the closest points and comprises Seringapatam Reef, Scott Reef North and Scott Reef South. Scott and Seringapatam reefs are part of a series of submerged reef platforms that rise steeply from the seafloor. The total area of this KEF is approximately 2,400 km^2 (DSEWPaC 2012a).

Seringapatam Reef is a small circular-shaped reef, the narrow rim of which encloses a relatively deep lagoon. Much of the reef becomes exposed at low tide. There are large boulders around its edges, with a few sandbanks, which rise about 1.8 m above the water, on the west side. The reef covers an area of 55 km^2 (including the central lagoon). Scott Reef North is a large circular-shaped reef composed of a narrow crest, backed by broad reef flats, and a deep central lagoon that is connected to the open sea by two channels. The reef and its lagoon cover an area of 106 km^2. Scott Reef South is a large crescent-shaped formation with a double reef crest. The reef and its lagoon cover an area of 144 km^2.

Scott and Seringapatam reefs are regionally significant because of their high representation of species not found in coastal waters off WA, and for the unusual nature of their fauna which has affinities with the oceanic reef habitats of the Indo-West Pacific, as well as the reefs of the Indonesian region.

The coral communities at Scott and Seringapatam reefs play a key role in maintaining the species richness and subsequent aggregations of marine life identified as conservation values for this KEF. Scott Reef is a particularly biologically diverse system and includes more than 300 species of reef-building corals, approximately 400 mollusc species, 118 crustacean species, 117 echinoderm species, and around 720 fish species (Woodside 2009).

Scott and Seringapatam reefs, and the waters surrounding them, attract aggregations of marine life, including humpback whales, blue whales and other cetacean species, whale sharks and sea snakes (Donovan et al. 2008; Jenner et al. 2008; Woodside 2009). Two species of marine turtle, the green and hawksbill, nest during the summer months on Sandy Islet (a small sand cay), located on Scott Reef South. These species also internest and forage in the surrounding waters (Guinea 2006). The reef also provides foraging areas for seabird species, such as the lesser frigatebird, wedge-tailed shearwater, brown booby and roseate tern (Donovan et al. 2008).

4.2.10 Carbonate bank and terrace system of the Van Diemen Rise

The carbonate bank and terrace system of the Van Diemen Rise KEF is located approximately 570 km north-east from WA-285-P and 525 km from WA-343-P at the closest points. It is situated to the north-west of the Tiwi Islands (the two principal islands of which are Melville Island and Bathurst Island).

The carbonate bank and terrace system of the Van Diemen Rise KEF supports a complex system of shallow carbonate banks and shoals over a limestone terrace, strongly dissected by tidal channels and paleo-river channels (including the >150 m deep Malita Shelf Valley). Shallow, clear waters provide for a deep euphotic zone, the depth to which sufficient light for photosynthesis penetrates into the ocean. Therefore, enhanced benthic primary production and localised upwellings generated by interactions between the complex topography and tidal currents encourage phytoplankton productivity and aggregations of fish. The banks, shoals and channels offer a heterogeneous environment of shallow to deep reef, canyon, soft sediment and pelagic habitats to a diverse range of tropical species of predominantly Western Australian affinities (DSEWPaC 2012b).

4.2.11 Shelf break and slope of the Arafura Shelf

The shelf break and slope of the Arafura Shelf KEF is located approximately 775 km north-east of WA-285-P and 720 km from WA-343-P at the closest points. The Arafura Shelf is an area of continental shelf up to 350 km wide and mostly 50–80 m deep, comprising of sea-floor features such as canyons, terraces, the Arafura Sill and the Arafura Depression.

The shelf break and slope of the Arafura Shelf is characterised by continental slope and patch reefs, and hard substrate pinnacles (DSEWPaC 2012b). The ecosystem processes of the feature are largely unknown in the region; however, the Indonesian Throughflow and surface wind-driven circulation are likely to influence nutrients, pelagic dispersal and species and biological productivity in the region. Biota associated with the feature is typical of that found elsewhere in tropical waters around Northern Australia, Indonesia, Timor-Leste and Malaysia (DSEWPaC 2012b).

4.2.12 Tributary canyons of the Arafura Depression

The tributary canyons of the Arafura depression KEF is located approximately 1,150 km north-east of WA-285-P and 1,100 km from WA-343-P at the closest points. The KEF comprises of a series of shallow canyons approximately 80–100 m deep and 20 km wide that lead into the Arafura Depression, which consists mainly of calcium carbonate–based sediments e.g. carbonate sand and subfossil shell fragments (DSEWPaC 2012b).

The largest of the canyons extend some 400 km from Cape Wessel into the Arafura Depression, and are the remnants of a drowned river system that existed during the Pleistocene era. Sediments in this feature are mainly calcium-carbonate rich, although sediment type varies from sandy substrate to soft, muddy sediments and hard, rocky substrate. Marine turtles, deep sea sponges, barnacles and stalked crinoids have all been identified in the area (DSEWPaC 2012b).

4.2.13 Exmouth Plateau

The Exmouth Plateau KEF is located approximately 1,075 km south of WA-285-P and 1,150 km from WA-343-P at the closest points. The Exmouth Plateau KEF is a regionally and nationally unique tropical deep-sea plateau with ecological properties of regional significance and covers an area of 49,310 km^2. The plateau ranges in water depths from 800 to 4,000 m (DSEWPaC 2012a). The plateau's surface is rough and undulating at 800–1,000 m depth. The northern margin is steep and intersected by large canyons (e.g. Montebello and Swan canyons) with relief greater than 50 m. The western margin is moderately steep and smooth, and the southern margin is gently sloping and virtually free of canyons (DSEWPaC 2012a).

The Exmouth Plateau is thought to play an important ecological role by acting as a topographic obstacle that modifies the flow of deep waters that generate internal tides, causing upwelling of deeper water nutrients closer to the surface (Brewer et al. 2007). Sediments on the plateau suggest that biological communities include scavengers, benthic filter feeders and epifauna. Fauna in the pelagic waters above the plateau are likely to include small pelagic species (Brewer et al. 2007).

4.2.14 Glomar Shoals

The Glomar Shoals KEF lies approximately 895 km south of WA-285-P and 970 km from WA-343-P at the closest points. Glomar Shoals are a submerged littoral feature 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 & 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). Cyclones are also frequent in this area of the north-west and stimulate periodic bursts of productivity as a result of increased vertical mixing.

While much of the biodiversity associated with the Glomar Shoals has not been studied the fish of Glomar Shoals are probably a subset of reef-dependent species, and anecdotal and fishing industry evidence suggests they are particularly abundant (DSEWPaC 2012a).

4.3 Australian marine parks

Australian Marine Parks (AMPs) have been established around Australia as part of the National Representative System of Marine Protected Areas (NRSMPA). The primary goal of the NRSMPA is to establish and effectively manage a comprehensive, adequate and representative system of marine reserves to contribute to the long-term conservation of marine ecosystems and protect marine biodiversity.

AMPs under the EPBC Act, and any zones within them, must be assigned to an International Union for the Conservation of Nature (IUCN) Protected Area Category (Environment Australia 2002). The IUCN categories that are present within the AMPs intersected by the PEZ, as shown in Table 4-1, include:

- IUCN Category Ia – Strict nature reserve – Protected area managed mainly for science.
- IUCN Category II – National Park – Protected area managed mainly for ecosystem conservation and recreation.
- IUCN Category IV – Habitat/species management area – Protected area managed mainly for conservation through management intervention.
- IUCN Category VI – Managed resources protected areas – Protected area managed mainly for the sustainable use of natural ecosystems. Area containing predominantly unmodified natural systems, managed to ensure long term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services to meet community needs.

The Director of National Parks (DNP) may make, amend and revoke prohibitions, restrictions and determinations under regulations 12.23, 12.23A, 12.26, 12.56 and 12.58 of the EPBC Regulations where it is considered necessary to:

- protect and conserve biodiversity and other natural, cultural and heritage values; or
- to ensure human safety or visitor amenity; or
- where it is otherwise necessary to give effect to the management plan.

At commencement of the North-west Marine Parks Network Management Plan (Director of National Parks 2018a) prohibitions made under regulation 12.23 of the EPBC Regulations are in place prohibiting entry to Ashmore Reef Marine Park, other than parts of West Lagoon and West Island, to protect the fragile habitats and biodiversity, and to Cartier Island Marine Park due to the presence of unexploded ordnance. These have been in place for many years. Determinations made under Regulation 12.56 of the EPBC Regulations prohibit anchoring in Mermaid Reef Marine Park and prescribe where vessels must be moored to minimise damage to the reef.

All visitors to Ashmore Reef and Cartier Island (except recreational boat users accessing the Marine National Park Zone of Ashmore Reef) require approval from the Commonwealth Department of Agriculture, Water and the Environment (DAWE). Undertaking other activities in these AMPs may also require approval from the DNP under Part 13 of the EPBC Act.

The Commonwealth DNP has issued a general approval under Section 359B of the EPBC Act allowing a range of activities to occur within these AMPs. The activities approved including 'mining operations' which, as defined under the EPBC Act, also includes all petroleum activities, including associated emergency response activities. No other approvals relating to this activity are required from the DNP.

Actions to respond to oil pollution incidents (including environmental monitoring and remediation) in AMPs, can be undertaken without an authorisation issued by the DNP, provided that the actions are undertaken in accordance with an EP that has been accepted by NOPSEMA. However, the DNP is to be notified of the pollution event or proposed spill response actions within AMPs prior to the activity being undertaken where practicable. WA-285-P and WA-343-P do not overlap any AMPs (Figure 4-2). The AMPs that overlap the PEZ and their IUCN categories are outlined in Table 4-1 with a further description provided in subsequent sections.

Table 4-1: AMP and IUCN categories

AMP	Sanctuary Zone (IUCN Ia)	(Marine) National Park Zone (IUCN II)	Habitat Protection Zone (IUCN IV)	Recreational Zone (IUCN IV)	Multiple Use Zone (IUCN VI)	Special Purpose Zone (IUCN VI)	Special Purpose Zone (Trawl) (IUCN VI)
Arafura					X	X	
Argo-Rowley Terrace		X			X		X
Ashmore Reef	X			X			
Cartier Island	X						
Christmas Island		X	X				
Cocos (Keeling) Islands		X	X				
Eighty Mile Beach					X		

AMP	Sanctuary Zone (IUCN Ia)	(Marine) National Park Zone (IUCN II)	Habitat Protection Zone (IUCN IV)	Recreational Zone (IUCN IV)	Multiple Use Zone (IUCN VI)	Special Purpose Zone (IUCN VI)	Special Purpose Zone (Trawl) (IUCN VI)
Gascoyne					X		
Joseph Bonaparte Gulf					X	X	
Kimberley		X	X		X		
Mermaid Reef		X					
Montebello					X		
Oceanic Shoals		X	X		X		X
Roebuck					X		

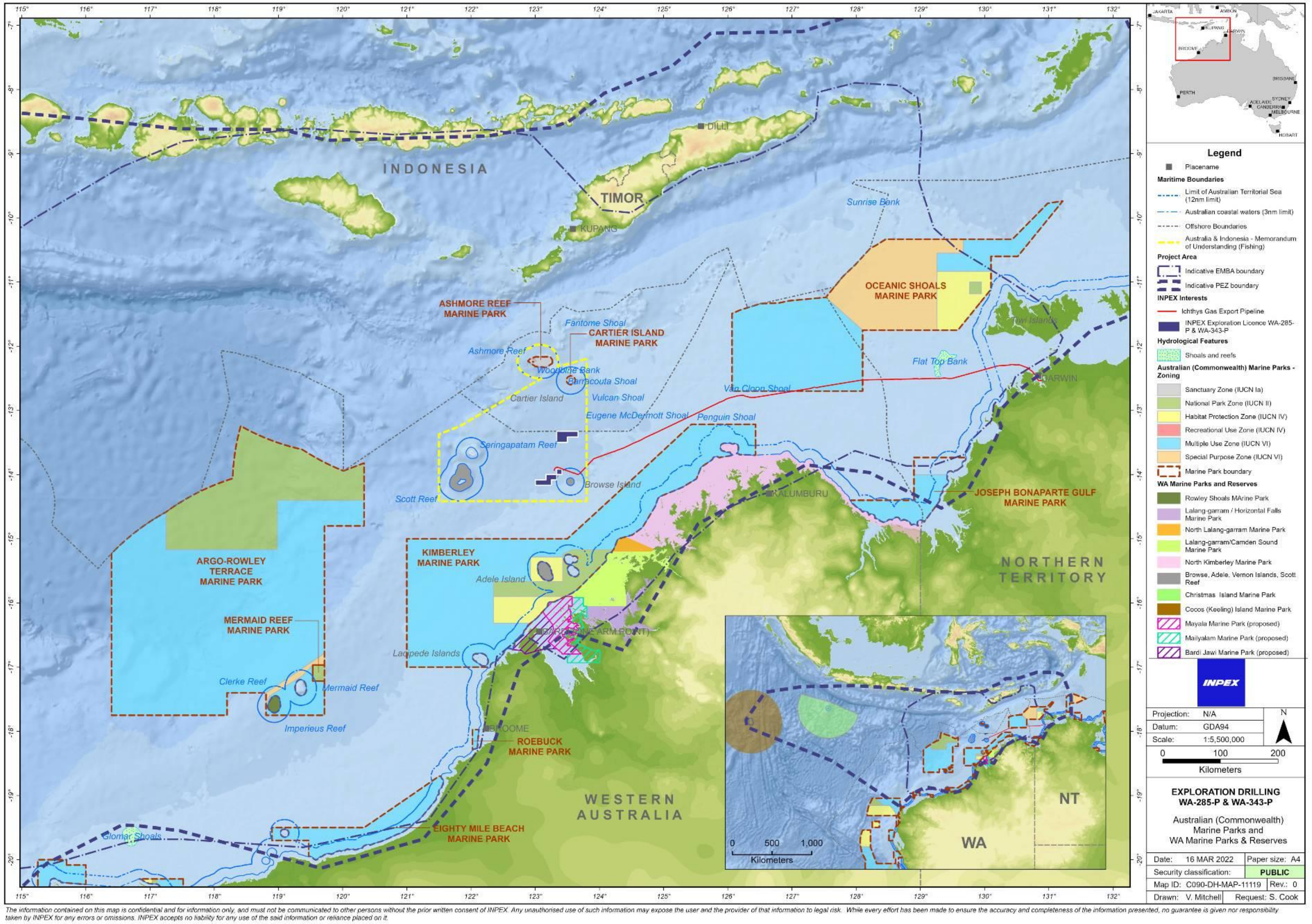

Figure 4-2: Australian and state marine parks, reserves, banks and shoals

4.3.1 Arafura MP

The Arafura MP in the NMR is Australia's most northerly marine park (MP) and covers an area of approximately 23,000 km^2 (Parks Australia 2022a). The boundary of the Arafura MP borders Australia's EEZ and is located approximately 1,050 km from WA-285-P and 1,000 km from WA-343-P. The Arafura MP includes canyons that are remnants of an ancient, drowned river system (the tributary canyons of the Arafura Depression). The canyons funnel deep, nutrient-rich ocean waters upward, boosting marine life in the Arafura MP (Director of National Parks 2018b).

Marine life found in the Arafura MP includes commercially important finfish, whale sharks, sawfishes as well as marine turtles and deep-sea sponges (Parks Australia 2022a).

4.3.2 Argo-Rowley Terrace MP

The Argo-Rowley Terrace MP covers an area of approximately 146,000 km^2 and is the largest AMP in the north-west (Parks Australia 2022b). Its eastern boundary is approximately 285 km from WA-285-P and 325 km from WA-343-P.

The Argo-Rowley Terrace MP is an important area for sharks, which are found in abundance around the Rowley Shoals, and provides important foraging areas for migratory seabirds and the endangered loggerhead turtle (Director of National Parks 2018a).

4.3.3 Ashmore Reef MP

Ashmore Reef MP is in the NWMR and is located approximately 175 km north of WA-285-P and 115 km from WA-343-P. It covers an area of 583 km^2 and the site is also a designated a "wetland of international importance" under the Convention on Wetlands of International Importance (Ramsar Convention) especially as Waterfowl Habitat (Parks Australia 2022c) (refer Section 4.6.1).

Ashmore Reef is an atoll-like structure with low, vegetated islands, sand banks, lagoon areas, and surrounding reef. It is the largest of only three emergent oceanic reefs present in the north-eastern Indian Ocean and is the only oceanic reef in the region with vegetated islands. The reef exhibits a higher diversity of marine habitats compared with other North West Shelf (NWS) reefs, and supports an exceptionally diverse fauna, particularly for corals and molluscs (Director of National Parks 2018a).

The reef and its surrounding Commonwealth waters are regionally important for feeding and breeding aggregations of birds. It has major significance as a staging point for wading birds migrating between Australia and the northern hemisphere, including 43 species listed on one or both of the China–Australia Migratory Bird Agreement (CAMBA) and the Japan–Australia Migratory Bird Agreement (JAMBA).

Ashmore Reef supports some of the most important seabird rookeries on the NWS, including colonies of bridled terns, common noddies, brown boobies, eastern reef egrets, frigatebirds, tropicbirds, red-footed boobies, roseate terns, crested terns and lesser crested terns. It provides important staging points/feeding areas for many migratory seabirds (Parks Australia 2022c; Director of National Parks 2018a).

4.3.4 Cartier Island MP

Cartier Island MP is located in the NWMR approximately 145 km north of WA-285-P and 80 km from WA-343-P. The Cartier Island MP covers an area of approximately 172 km^2 (Parks Australia 2022d). The reserve includes Cartier Island and the area within a 4-nm-radius of the centre of the island, to a depth of 1 km below the seafloor. It is an IUCN Category Ia Sanctuary Zone with water depths from less than 15 m to 500 m (Director of National Parks 2018a).

Cartier Island is an unvegetated sandy cay surrounded by a reef platform. The island and its surrounding waters support prolific seabird rookeries, many species of which are migratory and have their main breeding sites on the small, isolated islands. Seabirds at Cartier Island include colonies of bridled terns, common noddies, brown boobies, eastern reef egrets, frigatebirds, tropicbirds, red-footed boobies, roseate terns, crested terns and lesser crested terns (Parks Australia 2022d). Much like Ashmore Reef, Cartier Island is an important staging point/feeding area for many migratory seabirds. The island also supports significant populations of feeding and nesting marine turtles and a high abundance and diversity of sea snakes (DSEWPaC 2012a).

Cartier Island is part of the Ashmore Reef and Cartier Island and surrounding Commonwealth waters KEF (Section 4.2.3).

4.3.5 Christmas Island MP

Established in March 2022, Christmas Island MP is one of two Indian Ocean Territories MPs. It covers an area of 277,016 km^2 and extends from the island's shoreline to the limit of Australia's EEZ, approximately 200 nm from shore (except to the north of Christmas Island) (Parks Australia 2022m).

The Christmas Island MP, located approximately 1,950 km from WA-285-P and WA-343-P, provides habitats for a range of migratory and threatened species and adjoins the Christmas Island National Park. Christmas Island covers an area of approximately 135 km^2 and is the summit of a submarine mountain, which rises steeply from sea level to a central plateau. The plateau reaches heights of up to approximately 360 m and consists mainly of limestone and layers of volcanic rock. Surrounding Christmas Island is a narrow tropical reef which plunges steeply to the ocean floor. The seafloor drops steeply to reach depths of 500 m within approximately 200 m of the shoreline (Geoscience Australia 2022b).

The Christmas Island MP contains a mix of coral reef species from both the Indian and Pacific Oceans and over 680 species of fish have been recorded in the region (Parks Australia 2022m). Christmas Island is known for its populations of more than 20 species of terrestrial and intertidal crabs, most notably the red crab (*Gecarcoidea natalis*) (Geoscience Australia 2022b; DAWE 2022a). Hosnies Spring and the Dales Ramsar sites are located on Christmas Island (described in Section 4.6).

4.3.6 Cocos (Keeling) Islands MP

Established in March 2022, Cocos (Keeling) Islands MP is one of two Indian Ocean Territories MPs. It covers an area of 467,054 km^2 and extends from most of the islands' shoreline to the limit of Australia's EEZ, approximately 200 nm from shore (Parks Australia 2022n).

The Cocos (Keeling) Islands are a series of 27 coral islands formed into two large coral atolls situated in the Indian Ocean, with a total land area of 14 km^2 (Geoscience Australia 2022c). The Cocos Islands are approximately 2,900 km from WA-285-P and WA-343-P. The Cocos (Keeling) Islands MP adjoins the Pulu Keeling National Park and contains abundant wildlife, particularly seabirds (Parks Australia 2022n).

The Cocos (Keeling) Islands MP also has land crabs, turtles, and a wide variety of corals, fish, molluscs, crustaceans and dolphins, deep sea fish and sharks, as well as other species (Geoscience Australia 2022c). The Cocos (Keeling) Islands MP also contains the foraging habitat of thousands of seabirds which nest on North Keeling Island (Pulu Keeling National Park), (Parks Australia 2022n).

North Keeling Island and the marine area extending 1.5 km from the coastline forms Australia's most remote Commonwealth National Park, the Pulu Keeling National Park, which is also a Ramsar site (described in Section 4.6.5). The Cocos (Keeling) Islands provide important habitat for green turtles with a 20 km internesting buffer surrounding the Pulu Keeling National Park (October to April) (DEE 2017a).

4.3.7 Eighty Mile Beach MP

The Eighty Mile Beach MP is located in the NWMR and is approximately 535 km south of WA-285-P and 620 km from WA-343-P. The Eighty Mile Beach MP covers an area of approximately 11,000 km^2 (Parks Australia 2022e).

Eighty Mile Beach MP provides habitat for endangered sawfish, and food supplies for the migratory shorebirds that use the adjacent Eighty Mile Beach, one of the most important migratory shorebird sites in Australia (Rogers & Hassell 2017). The Eighty Mile Beach MP also provides important foraging areas adjacent to the nesting areas for marine turtles and includes part of the migratory pathway of the protected humpback whale (Director of National Parks 2018b). The reserve provides protection for the shelf, including terrace and banks and shoal habitats, with depths ranging from 15 m to 70 m (Parks Australia 2022e).

4.3.8 Gascoyne MP

The Gascoyne MP is located in the NWMR and is approximately 1,225 km south-west of WA-285-P and 1,300 km from WA-343-P. The Gascoyne MP covers an area of approximately 82,000 km^2 (Parks Australia 2022f).

The canyons in the Gascoyne MP are believed to be associated with the movement of nutrients from deep water over the Cuvier Abyssal Plain onto the slope where mixing with overlying water layers occurs at the canyon heads. These canyon heads, including that of Cloates Canyon, are sites of species aggregation and are thought to play a significant role in maintaining the ecosystems and biodiversity associated with the adjacent Ningaloo Reef (Director of National Parks 2018a). The Gascoyne MP therefore provides connectivity between the inshore waters of the Ningaloo MP (which is outside of the PEZ) and the deeper waters of the area (Parks Australia 2022f).

4.3.9 Joseph Bonaparte Gulf MP

The Joseph Bonaparte Gulf MP is located in the NMR, approximately 500 km east of WA-285-P and 475 km from WA-343-P, on the WA-NT waters border. It occupies an area of approximately 8,600 km^2 with water depths ranging from less than 15 m to 100 m (Parks Australia 2022g; Galaiduk et al, 2018).

The Joseph Bonaparte Gulf MP experiences a large tidal range (up to 7 m) which, together with a wide intertidal zone create a physically dynamic and turbid environment characterised by a high level of primary productivity (Galaiduk et al, 2018). Key conservation values of the Joseph Bonaparte MP include (Parks Australia 2022g; Director of National Parks 2018b):

- important foraging area for threatened and migratory marine turtles (green and olive ridley), and the Australian snubfin dolphin
- examples of the shallow water ecosystems and communities of the NWS Transition Province, the second largest of all the provincial bioregions on the shelf, which includes the extensive banks that make up the Sahul Shelf, broad shelf terraces and the shallow basin in the Joseph Bonaparte Gulf (including the Cambridge-Bonaparte, Anson Beagle and Bonaparte Gulf mesoscale bioregions).

The carbonate bank and terrace system of the Sahul Shelf KEF described in Section 4.2.6 (enhanced productivity, high biodiversity, and unique seafloor feature) is partly located within this AMP.

4.3.10 Kimberley MP

The Kimberley MP is located approximately 85 km to the south east of WA-285-P and 115 km from WA-343-P. The Kimberley MP occupies an area of approximately 74,500 km^2 (Parks Australia 2022h).

This Kimberley MP provides an important migration pathway and nursery areas for humpback whales, and foraging areas for migratory seabirds, migratory dugongs, dolphins and threatened and migratory marine turtles (Director of National Parks 2018a). It is adjacent to important foraging and pupping areas for sawfish and important nesting sites for green turtles (Parks Australia 2022h).

4.3.11 Mermaid Reef MP

The Mermaid Reef MP is located approximately 470 km south-west of WA-285-P and 550 km from WA-343-P. The Mermaid Reef MP is near the edge of Australia's continental slope, surrounded by waters that extend to a depth of over 500 m. Mermaid Reef covers an area of approximately 540 km^2 and is the most north-easterly of three reef systems forming the Rowley Shoals (Parks Australia 2022i). Mermaid Reef is totally submerged at high tide and therefore falls under Australian Government jurisdiction. The other two reefs of the Rowley Shoals, Clerke Reef and Imperieuse Reef are managed by the WA Government.

Mermaid Reef (and the other Shoals) supports over 200 species of hard corals and 12 classes of soft corals with coral formations in pristine condition. The shoals are an important area for sharks, including the grey reef shark, the whitetip reef shark and the silvertip whaler; important foraging area for marine turtles; toothed whales; dolphins; tuna and billfish; and an important resting and feeding site for migratory seabirds (Parks Australia 2022i; Director of National Parks 2018a).

4.3.12 Montebello MP

The Montebello MP covers an area of approximately 3,400 km^2. It is located approximately 995 km south-west of WA-285-P and 1,050 km from WA-343-P. The Montebello MP includes part of the migratory pathway for humpback whales; foraging areas for vulnerable and migratory whale sharks; foraging areas adjacent to important nesting sites for marine turtles; and breeding sites of migratory seabirds (Parks Australia 2022j). The Montebello MP includes shallow shelf environments with depths ranging from 15 to 150 m and provides protection for shelf and slope habitats, as well as pinnacle and terrace seafloor features.

The Montebello Islands comprise over 100 islands, the majority of which are rocky. Other marine habitats within the marine park include coral reefs, mangroves, intertidal flats, extensive sheltered lagoonal waters, and shallow algal and seagrass reef platform extending to the south of the Montebello Islands to the Rowley Shelf (Director of National Parks 2018a). The complex seabed and island topography create a unique environment where these diverse habitats occur in close proximity to each other.

The Montebello MP's natural values include breeding habitat for seabirds, internesting, foraging, mating, and nesting habitat for marine turtles, a migratory pathway for humpback whales and foraging habitat for whale sharks (Director of National Parks 2018a).

4.3.13 Oceanic Shoals MP

The Oceanic Shoals MP is located approximately 315 km north-east of WA-285-P and 265 km from WA-343-P. The Oceanic Shoals MP occupies an area of approximately 72,000 km^2 with water depths from less than 15 m to 500 m (Parks Australia 2022k). The Oceanic Shoals MP is the largest marine park in the NMR with a portion also overlapping the NWMR.

The Oceanic Shoals MP is an important resting area for turtles (internesting) for the threatened flatback turtle and olive ridley turtle. It is also an important foraging area for the threatened loggerhead turtle and olive ridley turtle (Director of National Parks 2018b).

4.3.14 Roebuck MP

The Roebuck MP is located in the NWMR approximately 435 km south from WA-285-P and 515 km from WA-343-P. The Roebuck MP covers an area of approximately 300 km^2 (Parks Australia 2022l).

It includes part of the migratory pathway for the humpback whales as well as foraging areas adjacent to important nesting sites for flatback turtles, foraging areas for migratory seabirds, and foraging habitat for dugong (Director of National Parks 2018b). The Roebuck MP provides protection for shallow shelf habitats ranging in depth from 15 to 70 m and is adjacent to important foraging, nursing and pupping areas for freshwater, green and dwarf sawfish, as well as foraging and calving areas for Australian snubfin, Indo-Pacific humpback and Indo-Pacific bottlenose dolphins (Parks Australia 2022l).

4.4 State and Territory reserves and MPs

No State or Territory MPs/reserves overlap WA-285-P or WA-343-P (Appendix A).

However, the EPBC Act Protected Matters search (Appendix A) identified a total of 39 State and Territory reserves within the PEZ as listed below. Unnamed locations were identified using the Collaborative Australian Protected Areas Database (CAPAD 2020):

- Adele Island (WA)
- Balanggarra (WA)
- Bardi Jawi (WA)
- Bedout Island (WA)
- Browse Island (WA)
- Channel Point (NT)
- Coulomb Point (WA)
- Dambimangari (WA)
- Garig Gunak Barlu (NT)
- Jinmamkur (WA)
- Jinmamkur Kulja (WA)
- Karajarri (WA)
- Lacepede Islands (WA)
- Lawley River (WA)
- Lesueur Island (WA)
- Low Rocks (WA)
- Marri-Jabin (Thamurrurr – Stage 1) (NT)

- Mitchell River (WA)
- Montebello Islands (WA)
- Niiwalarra Islands (WA)
- Prince Regent (WA)
- Swan Island (WA)
- Tanner Island (WA)
- Unnamed WA28968 identified as Caffarelli Island
- Unnamed WA37168 identified as Lacepede Islands
- Unnamed WA40828 identified as Trimouille Island
- Unnamed WA41080 identified as NW Island (Montebello)
- Unnamed WA41775 identified as Browse Island
- Unnamed WA44669 identified as Tanner Island
- Unnamed WA44672 identified as Bedout Island
- Unnamed WA44673 identified as Adele Island
- Unnamed WA44677 identified as Lesueur Island
- Unnamed WA51162 identified as site on mainland WA north of Broome
- Unnamed WA51932 identified as site on mainland WA near Roebuck Bay
- Unnamed WA52354 identified as site on mainland WA north of Broome
- Unnamed WA53015 identified as site on mainland WA at Eighty-mile Beach
- Uunguu
- Yampi
- Yawuru.

Of these reserves, six are Indigenous Protected Areas (IPAs); Balanggarra IPA, Bardi Jawi IPA, Dambimangari IPA, Karajarri IPA, Uunguu IPA and the Yawuru IPA. The most relevant value and sensitivity within the IPAs is traditional fishing, which is practised within these reserves, and is further discussed in Section 4.11.3.

Further research and investigation of the Collaborative Australian Protected Areas Database (CAPAD 2020) for the State/Territory reserves and MPs listed in Appendix A was undertaken. Where sites were considered not relevant to the PEZ they are not discussed further in this EP. This is primarily as there are no ‘marine’ values or sensitivities which could be impacted by an oil spill, unlike locations where significant turtle and seabird nesting rookeries may be present, and/or associated biologically important areas (BIAs) have been declared.

The EPBC Act Protected Matters search report for the PEZ (Appendix A) did not identify the following additional MPs/reserves listed below. However, these are considered to be relevant, and therefore they have been described in this EP:

- Scott Reef Nature Reserve
- Lalang-garram / Camden Sound MP
- North Kimberley MP
- North Lalang-garram MP.

For completeness, three new proposed marine parks in the Buccaneer Archipelago have also been included. The relevant State/Territory reserves within the PEZ are described below and displayed on Figure 4-2. Should any new State or Territory MP/reserve management plans come into effect, the impacts of these changes will be assessed in accordance with Section 9.8.1 and Section 9.7 of this EP.

4.4.1 Adele Island Nature Reserve

Adele Island is a declared nature reserve to protect seabird breeding colonies, and is located approximately 155 km south of WA-285-P and 225 km from WA-343-P.

Adele Island is located approximately 97 km north-northwest of Cape Leveque off the central Kimberley coast. The island covers an area of 2.17 km^2. Its surrounding sand banks sit atop a shallow-water limestone platform, surrounded by an extensive reef system (CCWA 2010).

Adele Island is an important site for breeding seabirds with several species listed under the JAMBA, CAMBA and Republic of Korea–Australia Migratory Birds Agreement (ROKAMBA). There are known breeding colonies for masked booby (*Sula dactylatra*), red-footed booby (*Sula sula*), brown booby (*Sula leucogaster*), pied cormorant (Phalacrocorax varius), Australian pelican (*Pelecanus conspicillatus*), greater frigatebird (*Fregata minor*), lesser frigatebird (*Fregata ariel*), Caspian tern and lesser crested tern (CCWA 2010).

The seabird colonies at Adele Island tend to have peak breeding periods from May to July; however, birds may also be present during the non-breeding season (DEWHA 2008). A study undertaken as part of an Applied Research Program (ARP) between INPEX and Shell Australia in the Browse Basin, reported 12 species of seabird were found to breed at Adele Island in the 2014/2015 season (Cannell et al 2015). An additional eight species of seabird were considered non-breeding visitors. Twenty-six migratory shorebird species and three Australian resident shorebird species were also reported as using the Adele Island Nature Reserve (Clarke 2015).

4.4.2 Bedout Island Nature Reserve

Bedout Island is a Class 'A' nature reserve off the Pilbara coast of WA approximately 95 km north-east of Port Headland. The island is located approximately 730 km south-west of WA-285-P and 810 km from WA-343-P. It covers an area of approximately 0.4 km^2 and was designated in 1975 (UNEP-WCMC 2022a). Bedout Island is an undulating sand cay recognised as an Important Bird Area (IBA) and provides important habitat for breeding birds including the masked booby (*Sula dactylatra*), white-bellied sea eagle (*Haliaeetus leucogaster*), brown noddy (*Anous stolidus*) and several species of terns (crested, lesser crested, roseate and sooty) (Birdlife International 2022a).

4.4.3 Browse Island Nature Reserve

Browse Island, a Class 'C' nature reserve, is the nearest landform to both WA-285-P and WA-343-P (located approximately 19 km south east of WA-285-P and 68 km south of WA-343-P at the closest points). It is an isolated sand cay surrounded by an intertidal reef platform and shallow fringing reef. The purpose of this reserve (#41775) is conservation, navigation (a lighthouse is present on the island), communication, meteorology and survey.

The Browse Island reef complex is an outer shelf, biohermic structure rising from a depth of approximately 200 m. It is a flat-topped, oval-shaped, platform reef with the largest diameter being about 2.2 km. Browse Island is a triangular, vegetated sandy cay, standing just a few metres above high-tide level. It measures approximately 700 m by 400 m.

Browse Island features diverse coral reef fauna with numerous patch reefs and hard coral cover in shallow depths (Heyward et al. 2019). Benthic cover transitions to hard and soft coral communities at deeper (40-60 m) depths around Browse Island before transitioning into filter feeding communities. Browse Island also supports a highly diverse assemblage of tropical reef fish with 385 species identified (Heyward et al. 2019). In contrast to the subtidal habitat surround the island, the intertidal areas (e.g. reef platform/flat) has low species richness of flora and fauna (Olsen et al. 2018). Interestingly, seagrass is completely absent at Browse Island. Rocky shore habitat is represented only by exposed beach rock, and there are no intertidal sand flats.

Green and flatback turtle (*Chelonia mydas* and *Natator depressus*) nesting occurs during the summer months and Browse Island also provides habitat for seabirds and shorebirds. Additionally, Browse Island (inclusive of a 20 km buffer) has been classified as important nesting areas for green turtles from November to March under the Recovery Plan for Marine Turtles in Australia (DEE 2017a). The Scott-Browse green turtles are a distinct genetic unit, nesting only at Scott Reef (Sandy Islet) and Browse Island.

It is not a regionally significant habitat for seabirds, with previous surveys finding a lack of diversity of seabirds breeding there (Clarke 2010). The DAWE has not listed Browse Island as a marine avifauna BIA. However, colonies of nesting crested terns (*Thalasseus bergii*) were observed nesting on the north-western side of Browse Island in a colony of approximately 1,000 birds (Olsen et al. 2018). Browse Island has also been recognised, through stakeholder consultation between INPEX and the DBCA, as an important location for seabirds.

4.4.4 Lacepede Islands Nature Reserve

The Lacepede Islands are a Class ‘C’ nature reserve located approximately 120 km north-west of Broome. The islands are located approximately 320 km south-west of WA-285-P and 395 km from WA-343-P. The purpose of the Lacepede Islands Nature Reserve is the conservation of flora and fauna, navigation, communication, meteorology and survey. The Lacepede Islands are a 12 km long chain of four islands known as West Island, Middle Island, Sandy Island and East Island. They are all small, low spits of coarse sand and coral rubble, lying atop a platform coral reef. They are treeless but support low vegetation.

INPEX (2010) identified the Lacepede Islands as the largest green turtle (*Chelonia mydas*) breeding rookery along the Kimberley coastline. The Recovery Plan for Marine Turtles in Australia recognises the Lacepede Islands as a major important nesting area (DEE 2017a) and confirmed as an important rookery based on track counts (Waples et al. 2019). The Recovery Plan provides for a 60 km interesting buffer around the Lacepede Islands for flatback turtle nesting occurring from October to March, with a peak in December and January. A 20 km interesting buffer has also been provided for green turtle nesting, occurring from November to March each year.

The Lacepede Islands support over 1% of the world populations of brown boobies (*Sula leucogaster*) and roseate terns (*Sterna dougallii*). The breeding colony of brown boobies, of up to 18,000 breeding pairs, is possibly the largest in the world (Birdlife International 2022b). Core foraging habitat of the brown boobies was reported to range from 50 km – 90 km from the colony with the furthest recorded as approximately 120 km north-west of the Lacepede Islands (Cannell et al. 2018). Up to 20,000 roseate terns have been recorded there (Birdlife International 2022b). Other birds breeding on the Lacepede Islands include masked boobies, Australian pelicans, lesser frigatebirds, eastern reef egrets, silver gulls, crested, bridled and lesser crested terns, common noddies, and pied and sooty oystercatchers. Visiting waders include grey-tailed tattlers, ruddy turnstones, great knots and greater sand plovers (Birdlife International 2022b).

4.4.5 Yawuru Nagulagun/Roebuck Bay MP

The Roebuck Bay MP includes an internationally significant wetland for migratory shorebirds in Australia (described in Section 4.6.6) and provides habitats to a range of marine fauna as described in Section 4.3.14. Roebuck Bay is located approximately 445 km south-west of WA-285-P and 520 km from WA-343-P. Within the Roebuck Bay MP, a high diversity of infauna is present with the mudflats often covered with a surface film of microscopic microphytobenthos. Studies indicate that microphytobenthos form the basis of food webs for a large variety of organisms, ranging from benthic invertebrates to shorebirds and fish (Bennelongia 2010).

4.4.6 Scott Reef Nature Reserve

Sandy Island is a C class nature reserve (under WA legislation) for the purpose of conservation (No. 42749), declared to Low Water Mark. It has an approximate area of 117 km^2. This encompasses much of the South Scott lagoon, and the south-western reef flat of North Scott Reef. The remainder of the South Scott Reef lagoon and North Scott Reef are Commonwealth waters and Commonwealth jurisdiction applies. The Scott Reef Nature Reserve values and sensitivities are described in Section 4.2.9.

Scott Reef (including a 20 km buffer) has been classified as habitat critical to the survival of marine turtles in the Recovery Plan for Marine Turtles (2017a).

4.4.7 Lalang-garram/Camden Sound MP

The Lalang-garram/Camden Sound MP is located in the Buccaneer Archipelago of the Kimberly coast, approximately 180 km from WA-285-P and 230 km from WA-343-P. The marine park covers an area of approximately 7,050 km^2 (DPaW 2013a). The marine park is located approximately 150 km north of Derby and 300 km north of Broome and lies within the traditional country of three Aboriginal native title groups. It is under joint management between DBCA and the Traditional Owners.

The Lalang-garram/Camden Sound MP includes a principal calving habitat and resting area for the humpback whale (*Megaptera novaeangliae*) and a wide range of other protected species, including marine turtles, snubfin and Indo-Pacific humpback dolphins, dugong, saltwater crocodiles and several species of sawfish. The park also includes a wide range of marine habitats and associated marine life, such as coral reef communities, rocky shoal and extensive mangrove forests (DPaW 2013a).

Within the Lalang-garram/Camden Sound MP, mangroves and their associated invertebrate-rich mudflats are an important habitat for migratory shorebirds from the northern hemisphere. Up to 35 species of migratory shorebirds potentially occur in the Lalang-garram/Camden Sound MP, which are subject to the JAMBA, CAMBA and ROKAMBA migratory bird agreements and are listed as migratory species under the EPBC Act (Appendix A). Many other bird species may also be found in mangrove habitat with nesting occurring in the dense mangrove foliage and birds seeking prey around the roots of mangrove trees. (DPaW 2013a).

4.4.8 North Kimberley MP

The North Kimberley MP is located approximately 145 km south east of WA-285-P and 180 km from WA-343-P. The North Kimberley MP extends all the way from the northern boundary of the Camden Sound MP to the NT border (DPaW 2016a). The North Kimberley MP was declared in December 2016 and is the second largest MP in Australia spanning approximately 18,540 km^2. This vast area has a complex coastline with many gulfs, headlands, cliff-lined shores and archipelagos. Extensive tidal flats have formed in places, some associated with the mouths of the numerous rivers that drain to the coast. Marine ecosystems include extensive fringing mangrove forests and remote and virtually untouched coral reefs and sponge gardens which in turn support a wide range of marine life (DPaW 2016a).

High densities of dugongs have been recorded in areas of the North Kimberley MP correlating with extensive seagrass habitat (Waples et al. 2019). The North Kimberley MP also supports populations of Manta rays (*Manta* spp.) and six species of threatened marine turtle found in Australia. Cetaceans that are known to utilise the area include humpback whales (*Megaptera novaeangliae*), Indo-Pacific humpback dolphins (*Sousa chinensis*) and snubfin dolphins (*Orcaella heinsohni*) (DPaW 2016a). Saltwater crocodiles (*Crocodylus porosus*), and a variety of fish, sharks, rays and sea snakes also inhabit the waters of the North Kimberley MP. A wide variety of seabirds also utilise the offshore islands and intertidal flats for breeding and foraging. Nature based tourism, commercial and recreational fishing and remote seascapes are also identified as values within the North Kimberley MP management plan (DPaW 2016a).

4.4.9 North Lalang-garram MP

The North Lalang-garram MP, located approximately 170 km from WA-285-P and 210 km from WA-343-P, includes the waters from the edge of Cape Wellington (WA mainland) to the WA State waters boundary (three nautical miles (nm) from the territorial baseline), and several islands, including Booby Island, Duguesclin Island and Jackson Island. Its northern boundary adjoins the North Kimberley MP, and its southern boundary adjoins the Lalang-garram/Camden Sound MP. The North Lalang-garram MP parks geology, wide variety of habitats, ecological values and sensitivities (DPaW 2016b) are virtually identical to that described above for the North Kimberley MP (DPaW 2016a).

4.4.10 Proposed Mayala MP

The proposed Mayala MP is located approximately 195 km from WA-285-P and 265 km from WA-343-P and will cover an area of approximately 3,150 km^2. The proposed Mayala MP is located in the Buccaneer Archipelago within the Kimberley region of WA, approximately 200 km north-east of Broome. The proposed Mayala MP will be reserved as a 'Class A' MP providing the highest level of protection (DBCA 2020a).

The proposed Mayala MP will be bordered to the west by the proposed Bardi Jawi MP and bordered to the east by the proposed Maiyalam MP described in Section 4.4.11 and Section 4.4.12. The proposed Mayala MP comprises an extensive network of hundreds of islands. No terrestrial areas are included within the proposed Mayala MP but intertidal areas to the high-water mark are included (DBCA 2020a).

The area covered by the proposed Mayala MP is home to a diverse range of marine life. Fringing reefs have formed around the many islands of the Buccaneer Archipelago, withstanding a tidal range in excess of 11 m (Richards et al. 2017). Mangrove-lined creeks, seagrass meadows and macroalgae communities create important nursery areas for fish, and turtles are regularly seen foraging and nesting in the area. From June to November each year humpback whales (*Megaptera novaeangliae*) migrate to Mayala Sea Country and beyond to give birth to their young, and dugongs visit the proposed marine park from May to July.

The proposed Mayala MP supports commercial activities such as pearling, aquaculture and commercial fishing. Customary hunting of turtles, dugongs and saltwater crocodiles is permitted by Mayala people in the proposed MP.

The proposed Mayala MP contains many places of cultural and spiritual importance such as the Port of Yampi Sound; and the establishment of the proposed Mayala MP will contribute to the conservation and enhancement of the outstanding cultural, ecological, recreational and commercial values in the area (DBCA 2020a).

4.4.11 Proposed Bardi Jawi MP

The proposed Bardi Jawi MP is situated in the west Kimberley region of WA surrounding the northern part of the Dampier Peninsula and the western islands of the Buccaneer Archipelago. Located approximately 230 km from WA-285-P and 290 km from WA-343-P, the proposed Bardi Jawi MP covers an area of 2,040 km^2. The proposed Bardi Jawi MP will be reserved as a 'Class A' MP providing the highest level of protection (DBCA 2020b).

The proposed Bardi Jawi MP extends around the tip of the Dampier Peninsula from Pender Bay on the western side of the Dampier Peninsula to Cunningham Point on the eastern side of the Peninsula. The eastern boundary of the proposed MP borders the proposed Mayala MP and the western boundary extends out to the seaward limit of WA State waters (three nm from the territorial baseline) and includes intertidal areas to the high-water mark. The southern boundary of the proposed Bardi Jawi MP is situated approximately 160 km north of Broome (DBCA 2020b).

Similar to the adjacent proposed Mayala MP (Section 4.4.10) the proposed Bardi Jawi MP supports a diverse array of plants and animals. Fringing reefs have formed around the many islands of the Buccaneer Archipelago with large tides and complex currents created between the islands. Important nursery habitat is provided through many areas of mangroves, seagrasses and macroalgae communities. Sunday Island located within the proposed Bardi Jawi MP is recognised as having particularly extensive and diverse seagrass meadows with eight species being recorded in the raised lagoons of the islands (Kendrick et al. 2017). The high rates of growth and consumption of the seagrass and macroalgae in the lagoons, indicate they are important habitats for marine herbivores such as green turtles and rabbitfish (*Siganus lineatus*).

The warm tropical waters of the proposed Bardi Jawi MP also provide optimal conditions for commercial activities such as pearling, aquaculture and commercial fishing.

The proposed Bardi Jawi MP also contains many places of cultural and spiritual importance to Bardi and Jawi people. The majority of significant cultural sites and places occur on land, but many have sea-related aspects (DBCA 2020b).

4.4.12 Proposed Maiyalam MP

The proposed Maiyalam MP is situated in the west Kimberley region of WA in the Buccaneer Archipelago. The eastern boundary of the proposed Maiyalam MP borders the proposed Mayala MP (Section 4.4.10) and it is proposed that the creek systems of Yampi Sound which are currently in the Port of Yampi Sound will be included into the proposed Maiyalam MP (DBCA 2020c)

Located approximately 210 km from WA-285-P and 275 km from WA-343-P, the proposed Maiyalam MP covers an area of 470 km^2 and following gazettal of the proposed Maiyalam MP, it is intended that the Lalang-garram/Camden Sound MP, North Kimberley MP, North Lalang-garram MP and the Maiyalam MP will be amalgamated to form the Lalang-gaddam MP (DBCA 2020c). The existing MPs are currently gazetted as Class A MPs and it is intended that the proposed Maiyalam MP will also be gazetted as a Class A reserve.

As described previously, the Kimberley region where the proposed Maiyalam MP is located experiences one of the largest tidal ranges in Australia. The large tides result in extensive intertidal areas with diverse ecosystems such as coral reefs, mangroves and mudflat communities. The subtidal habitats and communities of the proposed Maiyalam MP include diverse filter-feeding communities of sponges and hard and soft corals. The intertidal and subtidal habitats of the proposed Maiyalam MP provide critical foraging and nursery areas for a wide range of threatened, protected and culturally important species such as dugong, turtles, estuarine crocodiles, cetaceans and migratory sea birds (Mustoe & Edmunds 2008).

4.5 International marine parks

4.5.1 Savu Sea Marine National Park

The Savu Sea (Laut Sawu) Marine National Park (MNP) is located within the Lesser Sunda Ecoregion located to the south of the Coral Triangle and covers approximately 35,000 km^2 (MCI 2022; UNEP-WCMC 2022b). It was established in 2009 and has an IUCN Category II status (UNEP-WCMC 2022b). The Savu Sea MNP is split into three management areas; the Pantar Strait Marine Protected Area, the Sumba Strait Marine Area and the Tirosa-Batek Marine Area.

The Savu Sea MNP acts as a marine corridor and migratory pathway for marine fauna and is also an important upwelling zone in the Indo-Pacific region due to the presence of deep ocean trenches (Perdanahardja & Lionata 2017). The Savu Sea MNP area is a known migration route for several cetacean species, including the blue whale and sperm whale (Huffard et al. 2012). Other cetacean species such as pygmy killer whales, melon-head whales, short-finned pilot whales and numerous dolphin species (including Risso's dolphin, Fraser's dolphin, common dolphin, bottlenose dolphin and spinner dolphin) are known to frequent the Savu Sea MNP area (Coral Triangle Atlas 2014). Several species of marine turtle, including the green turtle, hawksbill turtle and leatherback turtle have also been recorded in the Savu Sea MNP area (Huffard et al. 2012).

The Sauv Sea MNP provides productive marine habitats that support large populations of fish and artisanal and commercial fisheries. It is estimated that 65% of the East Nusa Tenggara regional fisheries production comes from the Savu Sea (Perdanahardja & Lionata 2017).

4.6 Wetlands of conservational significance

Wetlands of conservational significance are presented in Figure 4-8 (Section 4.9.4) and described below.

4.6.1 Ashmore Reef National Nature Reserve

In addition to being listed as a National Nature Reserve, Ashmore Reef has been designated a Ramsar site due to the importance of the islands in providing a resting place for migratory shorebirds and supporting large breeding colonies of seabirds (Hale & Butcher 2013). Ashmore Reef is located within the EMBA and is approximately 175 km and 115 km north from WA-285-P and WA-343-P respectively.

The Ashmore Reef National Nature Reserve provides a staging point for many migratory wading birds from October to November and March to April as part of the migration between Australia and the northern hemisphere (Commonwealth of Australia 2002). Migratory shorebirds use the reserve's islands and sand cays as feeding and resting areas during their migration. The values of this wetland (habitat which supports migratory birds) are described in Section 4.3.3.

4.6.2 Coburg Peninsula Ramsar site

The Cobourg Peninsula Ramsar site overlaps the PEZ and is situated in the NT, 200 km north-east of Darwin, and covers an area of approximately 2,200 km^2. It is approximately 1,000 km from WA-285-P and WA-343-P. The site includes freshwater and extensive intertidal areas but excludes subtidal areas. The wetlands are mostly tidal and numerous creeks flow into the tidal areas. The northern coastline of the Peninsula has isolated bays, rocky headlands and beaches. The intertidal and coastal areas consist of extensive dunes, fringing coral and rocky reefs, sand and mudflats, with few areas of mangroves and seagrass communities. In contrast, the southern coastline and islands are dominated by mangrove communities associated with large mudflats (DAWE 2022c).

An abundance of fauna use the wetlands including a large variety of birds, frogs, marine turtles, mammals and reptiles including the saltwater crocodile. Dugong are found in the surrounding marine area. The Cobourg Peninsula Ramsar site is in a remote location and there has been minimal human impact on the site (DAWE 2022c).

4.6.3 Eighty Mile Beach Ramsar site

The Eighty Mile Beach Ramsar site overlaps the EMBA. It comprises a 220 km beach between Port Hedland and Broome with extensive intertidal mudflats and Mandora Salt Marsh, located 40 km east (Hale & Butcher 2009) totalling approximately 1,750 km^2. Eighty Mile Beach is characterised by extensive mudflats supporting an abundance of macroinvertebrates which provide food for large numbers of shorebirds (DAWE 2022d).

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

Eighty Mile Beach also supports a high diversity and abundance of wetland birds (Hale & Butcher 2009). This includes 42 species that are listed under international migratory agreements CAMBA (38), JAMBA (38) and ROKAMBA (32) as well as an additional 22 Australian species that are listed under the EPBC Act.

The Mandora Salt Marsh area contains an important and rare group of wetlands (Lake Walyarta and East Lake), including raised peat bogs, a series of small permanent mound springs and the most inland occurrence of mangroves in WA (Hale & Butcher 2009). The Mandora Salt Marsh lakes fill predominantly from rainfall and runoff in the wet season then dry back to clay beds. Flatback turtles, listed as vulnerable under the EPBC Act, regularly nest at scattered locations along Eighty Mile Beach.

4.6.4 Hosnies Spring Ramsar site

The Hosnies Spring Ramsar site is located in the Australian External Territory of Christmas Island in the Indian Ocean and covers an area of approximately 2 km^2. Christmas Island is approximately 1,950 km from WA-285-P and WA-343-P and the Hosnies Spring Ramsar site overlaps the PEZ.

Hosnies Spring is a small area of shallow freshwater streams and seepages, 20-45 m above sea-level on the shore terrace of the east coast of Christmas Island. The Hosnies Spring Ramsar site consists of a stand of two species of mangroves and also includes surrounding terrestrial areas with rainforest grading to coastal scrub, and an area of shoreline and coral reef (DAWE 2022e).

The site is an example of a specific type of wetland unique to Christmas Island and perhaps unique worldwide. Hosnies Spring is isolated and relatively inaccessible so there is minimal human impact on the area (DAWE 2022e).

4.6.5 Pulu Keeling National Park Ramsar site

The Pulu Keeling National Park Ramsar site is located in the Australian External Territory of Cocos (Keeling) Island in the Indian Ocean and covers an area of approximately 26 km^2. The Cocos Islands are approximately 2,900 km from WA-285-P and WA-343-P and the Ramsar site overlaps the PEZ.

As described in Section 4.3.6, the Cocos (Keeling) Islands are a group of 27 coral islands forming two atolls 24 km apart. North Keeling Island, with an area of 1.2 km^2, is part of the Cocos Islands. The Ramsar site includes the marine area surrounding the North Keeling Island along with the terrestrial area of North Keeling Island, matching the boundary of Pulu Keeling National Park.

As an island atoll in its most natural state, North Keeling Island is a significant biological resource and is internationally important for the conservation of biodiversity. The Pulu Keeling National Park Ramsar site is one of the few remaining islands where rats have not yet been introduced and is generally unaffected by feral animals (DAWE 2022f).

The Pulu Keeling National Park Ramsar site is also an internationally significant seabird rookery. Fifteen species of birds recorded on North Keeling Island are listed under international migratory bird agreements and 15 seabird species use the atoll for nesting. The breeding colony of the dominant bird species, the red-footed booby, is one of the largest in the world. It is also the main locality of the endangered, endemic Cocos buff-banded rail. The North Keeling Island is home to a number of crabs and is used by the threatened green turtle and hawksbill turtle. Green turtles also occasionally nest on North Keeling Island. Some 525 fish species are recorded from the Cocos (Keeling) Islands, including the angelfish, which has only been recorded from these islands and Christmas Island. There are no mammals on North Keeling Island, although marine mammals visit the surrounding waters (DAWE 2022f).

Current use of the Pulu Keeling National Park Ramsar site includes scientific research, and tourism activities such as scuba diving, snorkelling and surfing.

4.6.6 Roebuck Bay Ramsar site

The Roebuck Bay Ramsar site is located at Roebuck Bay near Broome in northern WA totalling 341 km^2. The Ramsar site overlaps the EMBA. Roebuck Bay has a large tidal range which exposes around 160 km^2 of mudflat, covering most of the Ramsar site and is one of only a dozen intertidal flats worldwide where benthic food sources are sufficient to support internationally significant numbers of waders (DAWE 2022g).

The intertidal mud and sand flats support a high abundance of bottom dwelling invertebrates (between 300—500 benthic invertebrate species), which are a key food source for waterbirds (DAWE 2022g). The site is one of the most important migration stopover areas for shorebirds in Australia and globally. For many shorebirds, Roebuck Bay is the first Australian landfall they reach on the East Asian Australasian (EAA) Flyway.

Mangrove swamps line the eastern and southern edges of the site and extend up into the linear tidal creeks (DAWE 2022g). They are important nursery areas for marine fishes and crustaceans, particularly prawns.

Extensive seagrass beds occur in Roebuck Bay, providing an important feeding ground for dugongs and loggerhead and green turtles (Bennelongia 2010). Flatback turtles nest in small numbers, while marine fish (including sawfish) regularly breed in the tidal creeks and mangroves. Dolphins also regularly use the site (DAWE 2022g).

4.6.7 The Dales Ramsar site

Overlapping the PEZ, the Dales Ramsar site is located in the Australian External Territory of Christmas Island and covers an area of approximately 5.8 km^2 and is located on the western side of Christmas Island. The western boundary of the Dales Ramsar site extends 50 m seaward from the low water mark and incorporates part of the coastline (DAWE 2022h).

The Dales Ramsar site has a near-pristine system of seven watercourses collectively known as The Dales. The Dales contain numerous wetland types including surface and karst features, and inland and coastal wetlands (DAWE 2022h). The Dales also supports a number of unique ecological and geomorphic features and a significant number of seabirds including Abbott's booby (*Papasula abbotti*), red-footed booby (*Sula sula*) and the brown booby (*Sula leucogaster*), all of which breed at the site (DAWE 2022h).

Vegetation in The Dales ranges from tall plateau rainforest to lower coastal vegetation. Migratory or vagrant bird species use The Dales as a staging site during migration, and a landfall for vagrant bird species outside their range (DAWE 2022h).

4.6.8 Mermaid Reef Nationally Important Wetland

Although not a Ramsar site, Mermaid Reef is identified as a Nationally Important Wetland in the EPBC Act Protected Matters search (Appendix A) and overlaps the EMBA. The intertidal and subtidal reef system and associated ecological values and sensitivities are described above in Section 4.3.11. It is considered that marine avifauna which roost on the islands within Clerke and Imperieuse Reef may forage at Mermaid Reef.

4.6.9 Finniss Floodplain and Fog Bay Systems Nationally Important Wetland

The Finniss Floodplain and Fog Bay System is an example of a beach-fringed curved bay with continuous intertidal mudflats (DAWE 2022i). The site is a major breeding area for magpie goose (*Anseranas semipalmata*) and during the dry season acts as a refuge area for water birds. It is also a migration stop-over area for shorebirds and a major breeding area for saltwater crocodile (DAWE 2022i). There are extensive paperbark swamps and small areas of samphire near the estuaries and the south-west part of Fog Bay. This site overlaps the EMBA and is recognised as an IBA with the intertidal mudflats of Fog Bay reported to support many species of shorebird and waterbird colonies (Birdlife International 2022c).

4.6.10 Yampi Sound Training Area Nationally Important Wetland

Identified as a Nationally Important Wetland (Appendix A), Yampi Sound Training Area is located 140 km north of Derby in the Kimberley Region of WA. The area overlaps the EMBA and covers approximately 5,660 km^2 containing coastal habitats such as mangroves and low-lying coastal flood plains (DAWE 2022j). Several bird species have been recorded in the area including the little tern (*Sternula albifrons*) (DAWE 2022j).

4.6.11 Big Springs Nationally Important Wetland

Located on the mud flats on the eastern shore of King Sound in the West Kimberley, Big Springs is a Nationally Important Wetland (DAWE 2022k). The site overlaps the PEZ and comprises a single large mound spring along with further scattered clusters of outlying, densely vegetated spring islands. The total area of the Big Springs Nationally Important Wetland is approximately 0.8 km^2. The wetland is a complex system of freshwater seepages and mound sprigs that support rainforest, surrounded by saline tidal flats devoid of vegetation (DAWE 2022k). Freshwater crocodiles and many bird species have been recorded however, no threatened flora or fauna have been documented.

4.6.12 Bunda Bunda Mound Springs Nationally Important Wetland

Identified as a Nationally Important Wetland that overlaps the EMBA (Appendix A), the Bunda-Bunda Mound Springs comprises of one large (approximately 0.2 km^2) and one small mound area (approximately 0.02 km^2) located approximately 300 m from the shoreline on tidal mudflats in Carnot Bay on the Kimberley coastline (DAWE 2022k). Bunda-Bunda supports a range of flora and fauna on raised peaty swamps, approximately 2 – 3 m above the surrounding tidal flats, that resemble islands (DAWE 2022k). They provide freshwater for birds during summer and the surrounding area is used for pastoral cattle grazing (DAWE 2022k).

4.6.13 Mitchell River System Nationally Important Wetland

Situated in the Shire of Wyndham in the North Kimberley, the Mitchell River System Nationally Important Wetland comprises the entire Mitchell River drainage system including waterfalls, tidal creeks and flats (DAWE 2022m). It overlaps the EMBA (Appendix A). Mangroves present within the site support bats, possums and mangrove forest birds and at least 10 species of freshwater fish occur including the Mitchell Gudgeon (*Kimberleyeleotris hutchinsi*), a species endemic to the Kimberley and only found in the Mitchell River system (DAWE 2022m).

4.6.14 Prince Regent River System Nationally Important Wetland

The Prince Regent River System comprising of estuary and river catchment in the Prince Regent Nature Reserve is identified as a Nationally Important Wetland (Appendix A) located in the North Kimberley region of WA. The site overlaps the EMBA and comprises of large areas of mangrove that provide important habitat for waterbird species, forest bird species typically confined to mangroves and one of the largest populations of saltwater crocodiles in WA (DAWE 2022n).

4.6.15 Willie Creek Nationally Important Wetlands

Identified as a Nationally Important Wetland, the Willie Creek Wetlands are situated on the tidal flats of Willie Creek estuary in the Shire of Broome and cover an area approximately 0.2 km^2 (DAWE 2022o). The site overlaps the EMBA and consists of two spring-fed and tidally inundated wetlands, Nimalaica swamp and a crescent-shaped lake fringed by bare mudflats. Bird and fish breeding habitats support a range of species including migratory seabirds such as the Broad-billed Sandpiper (*Limicola falcinellus)* and barramundi that are reported to grow to maturity in the freshwater streams then move downstream to breed in the estuaries (DAWE 2022o).

4.7 Threatened Ecological Communities

An ecological community is a naturally occurring group of plants, animals and other organisms that interact within a unique habitat. Ecological communities are listed as threatened if the community is presumed to be totally destroyed or at risk or becoming totally destroyed. There is one threatened ecological community found adjacent to the waters of the PEZ, the monsoon vine thickets on the coastal sand dunes of Dampier Peninsula (Appendix A).

Monsoon vine thicket occurs as semi-deciduous and evergreen vine thicket communities on and behind landward slopes of coastal sand dunes on the Dampier Peninsula in the Kimberley Region. This community is closely associated with coastal dunes elsewhere on the Dampier Peninsula and is listed as Endangered under the EPBC Act (DAWE, 2022p).

Although present within the EPBC Act Protected Matters search of the PEZ (including a 1 km buffer) as presented in Appendix A, upon further consideration the threatened ecological community is not considered relevant to the PEZ and is therefore not discussed further in this EP. This is primarily because there are no ‘marine’ values or sensitivities which could be impacted by an oil spill. This is supported by the description of the community in the Approved Conservation Advice (DSEWPaC 2013) which states that most patches of the ecological community occupy the leeward slopes and swales and sometimes the exposed crests. Some patches may extend landward into the red-soil pindan plains.

4.8 Physical environment

4.8.1 Climate

Air temperature

Air temperatures recorded at Browse Island, the closest Bureau of Meteorology (BOM) climatological station to WA-285-P and WA-343-P, shows a maximum temperature of 33.3 degrees Celsius (°C) and a minimum of 21.6 °C (BOM 2022). Air temperatures in the Browse Basin remain warm throughout the year with means and maxima ranging from 26–30 °C and 32–35 °C, respectively (INPEX 2010).

Winds

The climate of northern Australia shows two distinct seasons: winter, from April to September; and summer, from October to March. There are rapid transitional periods between the two main seasons, generally in April and September/October (RPS MetOcean Pty Ltd 2011).

The winter season is characterised by steady north-east to south-east winds of 5 metres per second (m/s) to 12 m/s, driven by south-east trade winds. The prevailing south-east winds bring predominantly fine conditions throughout the north of Australia. The summer season is the period of the predominant north-west monsoon. It is characterised by north-west to south-west winds of 5 m/s for periods of five to 10 days with surges in airflow of 8 m/s to 12 m/s for periods of one to three days.

During the summer season, the weather in northern Australia is largely determined by the position of the monsoon trough, which can be in either an active or an inactive phase. The active phase is usually associated with broad areas of cloud and rain, with sustained moderate to fresh north-westerly winds on the north side of the trough. Widespread heavy rainfall can result if the trough is close to, or over, land. An inactive phase occurs when the monsoon trough is temporarily weakened or retreats north of Australia. It is characterised by light winds, isolated showers, and thunderstorm activity, sometimes with gusty squall lines.

Tropical cyclones can also develop off the coast in the summer season, usually forming within an active monsoon trough. Heavy rain and strong winds, sometimes of destructive strength, can be experienced along the coast within several hundred km of the centre of the cyclone. The Browse Basin is prone to tropical cyclones, mostly during the tropical wet season from December to March (INPEX 2010). Under extreme cyclone conditions, winds can reach 83 m/s.

Rainfall

The region has a pronounced monsoon season between December and March, which brings heavy rainfall. Heaviest rainfall is typically associated with tropical cyclones.

Troughton Island located on the Kimberley coastline is the closest location to the permit areas with a historical rainfall record. Historical rainfall data shows the highest maximum (269.8 mm) and mean (>100 mm) monthly rainfalls occur from December to March (BOM 2022). Rainfall intensity at the Ichthys Field is expected to range from approximately 215 mm per hour (mm/h) to 460 mm/h over a five minute interval (based on 1-year and 200-year average recurrence intervals) (AMEC Ltd. 2011).

Air quality

There is currently no air quality data recorded within the vicinity of the permit areas, WA-285-P or WA-343-P. However, given the distance from land, air quality is expected to be relatively high. Potential sources of air pollution associated with anthropogenic influences are expected to be emissions generated by shipping, and oil and gas activities, and therefore considered to be localised in relation to the regional setting.

4.8.2 Oceanography

Currents

Broad-scale oceanography in the north-west Australian offshore area is complex, with major surface currents influencing the region, including the Indonesian Throughflow, the Leeuwin Current, the South Equatorial Current, and the Eastern Gyral Current (Figure 4-3). The Indonesian Throughflow current is generally strongest during the south-east monsoon from May to September (Qiu et al. 1999). The Indonesian Throughflow is a key link in the global exchange of water and heat between ocean basins. It brings warm, low-nutrient, low-salinity water from the western Pacific Ocean, through the Indonesian archipelago, to the Indian Ocean. It is the primary driver of the oceanographic and ecological processes in the region (DSEWPaC 2012a).

Offshore regions with water depths exceeding 100-200 m tend to experience significant large-scale drift currents. These drift currents tend to be stronger than tidal currents. Drift currents within nearby WA-50-L are expected to be directed towards the south-west during summer and winter. During the transitional period, drift currents will be variable, predominantly switching between the south-west and north-east directions. Typical drift current speeds range from zero to 0.3 m/s throughout the year (APASA 2015). Tidal current data, also from within WA-50-L, indicate that tidal currents are likely to be directed along a north-west to south-east axis throughout the year. Typical tidal current speeds are in the range of 0.2–0.6 m/s (APASA 2015). Wind shear at the surface also generates local-scale currents.

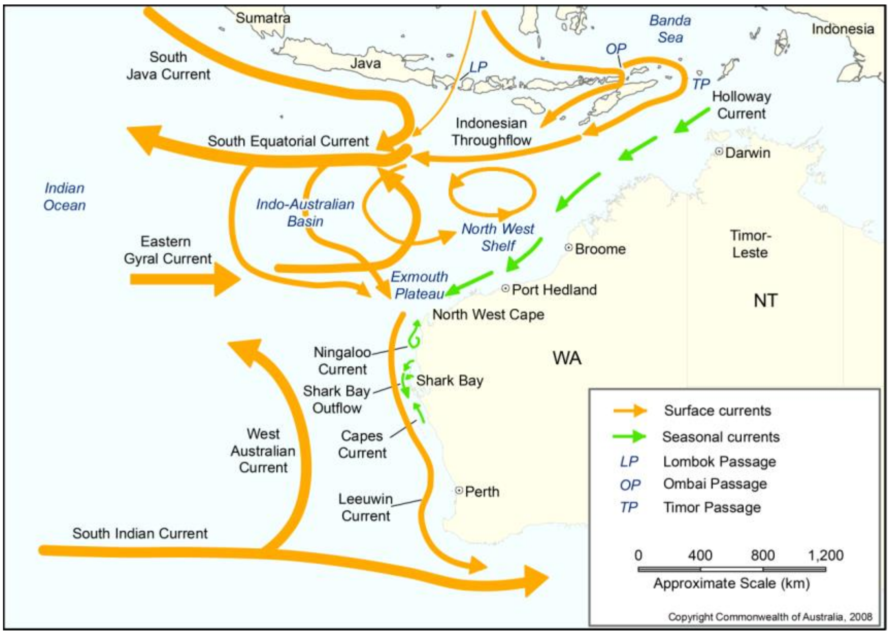

Figure 4-3: Surface currents for Western Australian waters

Tides

Tides within the permit areas are semidiurnal, with two daily high tides and two daily low tides (McLoughlin et al. 1988). Both the semidiurnal and diurnal tides appear to travel north-eastwards in the deep water leading to the Timor Trough before propagation eastwards and southwards across the wide continental shelf. The NWMR experiences some of the largest tides along a coastline adjoining any open ocean in the world.

Waves

Summertime tropical cyclones generate waves propagating radially out from the storm centre. Depending upon the storm size, intensity, relative location and forward speed, tropical cyclones may generate swell with periods of 6–10 seconds (s) from any direction and with wave heights of 0.5–9.0 m. During severe tropical cyclones, which can generate major short-term fluctuations in current patterns and coastal sea levels (Fandry & Steedman 1994; Hearn & Holloway 1990), current speeds may reach 1.0 m/s and occasionally exceed 2.0 m/s in the near-surface water layer. Such events are likely to have significant impacts on sediment distributions and other aspects of the benthic habitat.

4.8.3 Bathymetry and seabed habitats

Water depths within WA-285-P and WA-343-P are approximately 290 m and 350 m respectively. Studies using sub-bottom profiling, multibeam echo-sounder and sidescan sonar have been undertaken by INPEX at the Ichthys Field which lies adjacent to the northern boundary of WA-285-P and is approximately 50 km south of WA-343-P. Studies by INPEX were also undertaken in areas close to Heywood and Echuca shoals and south-east towards the Kimberley coast (INPEX 2010). These studies indicated that seabed topography is relatively flat and featureless, and the geology is generally homogeneous through the region.

Soft substrates in the Browse Basin and continental shelf are typical of deep-sea, outer continental shelf and slope benthic habitats found along the length of the NWS (RPS 2007). This habitat generally supports a diverse infauna dominated by polychaetes and crustaceans typical of the broader region and this is reflected in survey results which indicate the epibenthic fauna is diverse but sparsely distributed (RPS 2008). Deep-sea infaunal assemblages of this kind are very poorly studied on the NWS but are likely to be widely distributed in the region (INPEX 2010).

Areas of mud and fine sand are widespread on the outer shelf and slope in the Browse Basin indicating that it is a depositional area where fine sediments and detritus accumulate. The distribution of seabed type shows some correlation with water depth, with sediments becoming coarser as water depth increases (INPEX 2010). However, there are also large sand waves in parts of the basin, showing that, locally, there are strong seabed currents. The sand waves are likely to move in response to seasonal changes in the currents and the substrate instability is expected to limit the development of infaunal communities in this habitat.

During surveys of the Ichthys Field, no obstructions were noted on the seafloor and no features such as boulders, reef pinnacles or outcropping hard layers were identified (INPEX 2010; Fugro Survey Pty Ltd 2005). In general, the seabed sediments grade from soft featureless sandy silts to gravelly sand suggestive of strong near-seabed currents and mobile sediments that do not favour the development of diverse epibenthic communities.

Based on the data from the Ichthys Field and surrounding areas in proximity to WA-285-P and WA-343-P, the seabed is suggestive of strong near-seabed currents and mobile sediments that do not favour the development of diverse epibenthic communities.

4.8.4 Water quality

Offshore surface waters are typically oligotrophic. This has been confirmed by studies recording low nitrate concentrations and low phytoplankton abundance (Hallegraeff 1995). In general, the region experiences an influx of comparatively nutrient-rich waters at depth in summer and a variety of processes, such as tidal currents, internal waves and cyclone mixing, are known to carry these nutrients into the bottom waters of the shelf (Hallegraeff 1995).

Inshore coastal waters tend to be more turbid than offshore open ocean waters due to suspension of sediments by wave action and sediment laden runoff from the land. Higher total suspended solids (TSS) concentrations tend to occur during spring tide conditions due to stronger tidal currents and meteorological perturbations, such as periods of strong winds.

Water quality has been measured by INPEX during numerous surveys in order to describe the natural water quality conditions in the Ichthys Field and in surrounding areas. Given the proximity of WA-285-P and WA-343-P to the Ichthys Field, the results of these studies are considered to be representative of the conditions expected within the permit areas. An overview of the water quality studies undertaken are as follows:

- Water quality sampling was conducted at 27 offshore locations near the Ichthys Field, Echuca Shoal and their surrounds between March 2005 to June 2007 as a part of the INPEX Ichthys EIS studies (INPEX 2010).
- Near-seabed temperature and salinity profiles were obtained along the proposed pipeline route from the Ichthys Field to Darwin Harbour during geophysical and geotechnical surveys conducted between August and October 2008 (Neptune Geomatics 2009).
- ARP studies between INPEX and Shell in the Browse Basin included 66 water quality profiles and more than 1,300 water samples collected from 56 locations around the Ichthys Field in May 2015. Sampling locations were based on a gradient design away from a central point in the Ichthys Field and also included increased sampling around Browse Island, Echuca and Heywood shoals. Samples were analysed for metals and hydrocarbons (Ross et al. 2017). In addition, ad hoc water quality samples have also been collected from sampling locations during other ARP field surveys to increase the dataset and knowledge.
- Water quality monitoring in the receiving environment was undertaken in 2019, as part of the INPEX offshore facility liquid effluent management plan, to detect changes in water quality attributable to liquid discharges from the Ichthys Central Processing Facility (CPF) and floating production storage and offloading (FPSO) facility located in nearby WA-50-L. Samples were collected from 31 locations based on the modelled mixing zones for the CPF and FPSO and included fixed sampling locations and sampling sites along the prevailing currents (Jacobs 2019).

The results of these studies, as relevant to this EP, are summarised in Table 4-2.

Table 4-2: Summary of water quality parameters in the vicinity of WA-285-P & WA-343-P

Parameter	Description
Surface-water temperature	The surface waters of the region are tropical year-round, with surface temperatures of ~26 °C in summer and ~22 °C in winter (DSEWPaC 2012a). The baseline monitoring in the Ichthys Field area recorded surface water temperatures of ~30 °C in summer (March) and ~26–27 °C in winter (July) (INPEX 2010). Offshore waters in the region are typified by thermal stratification, with the start of the thermocline generally around 60 m below sea surface (but ranging from 30-80 m) (Ross et al 2017). Temperature decays rapidly through the water column to 14 °C at approximately 200 m and then decays more slowly to a minimum of circa 8 °C recorded at the deepest sites (Ross et al. 2017).
Salinity	Salinity was spatially and temporally consistent at 34 to 35 parts per thousand (ppt) across all sampling sites and can reasonably be expected to be similar within the wider area, given the distance from major freshwater discharges (INPEX 2010).

Parameter	Description
	Sampling undertaken in 2019, found the vertical salinity profiles of various sites sampled within and around the CPF and FPSO in WA-50-L were similar and did not change markedly from surface to bottom. Generally, salinity was approximately 34.4 ppt at the surface and then increased slightly at the seabed 34.5 ppt (Jacobs 2019).
Dissolved oxygen	Dissolved oxygen concentrations in the Ichthys Field mirrored water temperatures, with concentrations varying considerably between the surface and subsurface layers. The surface mixed layer was generally well oxygenated throughout; however, below the thermocline (starting at approximately 60 m through to 200 m water depth), the concentration of dissolved oxygen decreased consistently with depth (RPS 2007; Ross et al. 2017; Jacobs 2019). Dissolved oxygen concentrations were recorded at constant levels of 6.0 to 6.5 ppm at or above the thermocline in both summer and winter. In the cooler waters below the thermocline, dissolved oxygen decreased with increasing depth, with levels as low as 4.5 to 5.0 ppm recorded at a depth of 93 m and 3 ppm at a depth of 250 m (INPEX 2010). This indicates that the strong thermal stratification at the offshore locations results in limited oxygen replenishment of subsurface waters due to the lack of regular mixing between water layers (RPS 2007).
pH	The average pH of waters was measured at approximately 8.4 (RPS 2007), which is slightly higher (more alkaline) than normally encountered in the marine environment and is above the default criteria given in the Australian and New Zealand guidelines for fresh and marine water quality (ANZG 2018). Sampling undertaken in 2019 reported, the pH of the surface water for sites within and around the CPF and FPSO in WA-50-L ranged from 8.12 to 8.20 (Jacobs 2019). Further, the shape of the profiles for pH and dissolved oxygen were similar, with a decrease in pH occurring near the top of the thermocline, due to oxidation of organic matter.
Turbidity and light attenuation	Turbidity is generally higher in the shallow waters of the continental shelf and towards the base of many of the deeper water column profiles. Sampling undertaken in 2019, found turbidity was very low throughout the majority of the water column at each site sampled. At approximately 20–50 m above the seabed the turbidity was slightly elevated and increased with depth (Jacobs 2019). This has been attributed to the action of currents passing over the seabed causing some turbulence and resuspension of sediments. The re-suspension of materials from the seafloor includes organic material, which could comprise a pathway for hydrocarbon materials to become incorporated into sediments. Light attenuation coefficients calculated from photosynthetically active radiation measurements ranged from 0.026 to 0.043 μMol/m^2/s in October and December 2006, and 0.048 to 1.09 μMol/m^2/s in June 2007. These were observed to be consistent with reported “typical” levels for the region (RPS 2007).
Petroleum hydrocarbons	Baseline sampling has indicated low levels of naturally occurring hydrocarbons released by organic matter decay or higher trophic level organisms. Shallow water sites showed a constant hydrocarbon concentration through the profile. Deep water sites showed a low and constant concentration above the thermocline, with a peak of 0.2-0.25 µg/L at the thermocline before slowly diminishing (Ross et al. 2017).

Parameter	Description
Radionuclides	Water-column sampling for radionuclides in the Ichthys Field area indicated concentrations of radium-226 ranging from below lower limits of reporting (LLR) to 0.034 (±0.012) becquerels per litre (Bq/L) and concentrations of radium-228 ranging from below LLR to 0.167 (±0.128) Bq/L. With the exception of one mid-depth sample, all samples returned gross alpha-particle and gross beta-particle radiation levels below the Australian Drinking Water Guidelines screening criterion of 0.5 Bq/L provided by the National Health and Medical Research Council (NHMRC) and the Natural Resource Management Ministerial Council (NRMMC).
Metals	Total metal concentrations in the offshore waters sampled were below the 99% species protection level for marine waters with the exception of zinc and cobalt at one site each. The reason for these two slightly elevated readings is unknown (INPEX 2010). Ultra-trace-level analysis methods were used to assess metal concentrations in surface waters because ANZG (2018) guideline trigger values at the 99% species protection level are lower than the limits of standard laboratory methods. Mercury was the only metal not detected above the LLR, while cobalt was marginally above the LLR at only one site. Concentrations of arsenic, nickel, chromium and zinc were consistent across all sites, but the concentrations of cadmium, copper and lead showed greater variability (INPEX 2010). Sampling undertaken in 2019, found copper concentrations above 99% species protection levels were recorded at various sites including sites up to 10 km from the FPSO in WA-50-L (Jacobs 2019). There were no exceedances of the copper guideline value for sites closest to the discharge for either fixed or mobile sites and all sites with exceedances were different distances and directions from the discharge. Chromium was detected in water samples collected from both fixed and mobile sites the edge of the CPF and FPSO mixing zones or beyond. All chromium concentrations were below the laboratory limits of reporting (LOR) (Jacobs 2019).

Water quality in the Indonesian waters of the PEZ is unknown. However, the Asian Development Bank (2014) reported that approximately 40% of domestic sewage in Indonesia is discharged directly or indirectly via rivers and into the sea without proper treatment. The high organic and nutrient content of untreated sewage can lead to eutrophication or excessive nutrient enrichment, which triggers the growth of phytoplankton in the form of harmful algal blooms, or red tides, in many places in Indonesia.

4.8.5 Sediment quality

Similar to water quality, marine sediments have been sampled during numerous surveys in order to characterise the marine sediments in the Ichthys Field and surrounding areas (URS 2009). Overviews of the studies are listed below, with the results as relevant to this EP summarised in Table 4-3:

- Sampling and characterisation of marine sediments in the Ichthys development area was conducted at 10 sites in September 2005 and May 2007. This included five sites within 20 km of the Ichthys FPSO location and another five sites between 36 km and 134 km away. A further 10 sites were also sampled for particle size distribution (PSD) between 24 km and 66 km of the FPSO location in WA-50-L.
- Seabed sediment sampling along the proposed pipeline route from the Ichthys Field to Darwin Harbour was conducted at approximately 10 km intervals during geophysical and geotechnical surveys between August and October 2008.

- ARP studies included 133 sediment samples at 56 locations collected around the Ichthys Field in May 2015. Sampling locations were based on a gradient design away from a central point in the Ichthys Field and also included increased sampling around Browse Island, Echuca and Heywood shoals. Samples were analysed for metals and hydrocarbons (Ross et al. 2017). In addition, ad hoc sediment samples have also been collected from sampling locations during other ARP field surveys to increase the dataset and knowledge.
- Sediment quality monitoring in the receiving environment was undertaken in 2019 to detect changes in surficial sediment quality attributable to liquid discharges from the CPF and FPSO located in nearby WA-50-L. Sediment samples were collected from 18 fixed sampling locations based on a gradient design radiating out from the FPSO to approximately 10 km as the FPSO represents a point source discharge.

Table 4-3: Summary of sediment quality parameters in the vicinity of WA-285-P & WA-343-P

Parameter	Description
Particle size distribution	The seabed in offshore locations on the continental shelf is known to consist of generally flat, relatively featureless plains characterised by soft sandy-silt marine sediments that are easily resuspended. Similarly, the substrate of the Scott Reef – Rowley Shoals Platform, in water depths of 200–600 m, is considered to be a depositional area with predominantly fine and muddy sediments (INPEX 2010). The PSD of sediment at sites located within the Ichthys Field was primarily sand, with some silts.
Petroleum hydrocarbons	Concentrations of benzene, toluene, ethylbenzene and xylene (BTEX) and polycyclic aromatic hydrocarbons (PAH) compounds in sediments in the vicinity of the sampling sites were very low (Ross et al. 2017, RPS 2007). The components of the more prevalent alkane compounds found indicated that the concentrations observed were likely to have originated from biogenic sources (Ross et al. 2017). Sampling undertaken in 2019 at fixed and mobile sites around the FPSO (out to 10 km) found all hydrocarbons, BTEX and speciated phenols were below the laboratory limits of reporting and guideline values (Jacobs 2019).
Radionuclides	Naturally occurring radioactive materials (NORMs) for the majority of results were below or close to LLR. Radium-226 was detected at one site but all other samples were below LLR for each radium isotope. The concentration of uranium and thorium was consistent across all sites (RPS 2007). Sampling undertaken in 2019 found NORMs were below background concentrations at all sampling sites (fixed and mobile) (Jacobs 2019).
Metals	Concentrations of all metals were consistent across the sampling sites and well below the interim sediment quality guidelines low screening level (ANZG 2018), with the majority also below their respective LLR (RPS 2007). Organometallics (i.e. tributyltin) were below ANZG (2018) guidelines and lower than the LLR at all sampling locations. Sampling undertaken in 2019 at fixed sampling sites at the FPSO, found all metals/metalloids were below the guideline values indicating no significant change to sediment quality has occurred as a result of the FPSO discharges in WA-50-L (Jacobs 2019).

4.8.6 Underwater noise

The Centre for Marine Science and Technology at Curtin University undertook a study on behalf of INPEX from September 2006 to August 2008 to assess ambient biological and anthropogenic sea noise sources in the Browse Basin. Ambient noise in the Ichthys Field was measured using a sea noise logger deployed at a depth of 240 m on the seabed 45 km north-west of Browse Island. The monitoring revealed an average ambient noise level of 90 dB re 1 µPa under low sea states, with inputs of low frequency energy from the Indian Ocean (INPEX 2010).

Biological noise sources recorded in the Ichthys Field included regular fish choruses (one at >1 kHz and another at around 200 Hz) and several whale calls from humpback whales, pygmy blue whales, minke whales and other unidentified species. Results from this survey are considered to be indicative of typical underwater noise levels and frequencies within the NMR and NWMR bioregions as a whole.

4.9 Biological environment

4.9.1 Planktonic communities

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). Eggs and larvae may be dispersed throughout the water column and throughout the region, playing an important role in species recruitment.

Plankton abundance and distribution is patchy, dynamic and strongly linked to localised and seasonal productivity (Evans et al. 2016). The mixing of warm surface waters with deeper, more nutrient-rich waters (i.e. areas of upwelling) generates phytoplankton production and zooplankton blooms. In the offshore waters of north-western Australia, productivity typically follows a ‘boom and bust’ cycle. Productivity booms are thought to be triggered by seasonal changes to physical drivers or episodic events, which result in rapid increases in primary production over short periods, followed by extended periods of lower productivity.

The Indonesian Throughflow has an important effect on biological productivity in the northern areas of Australia and Indonesia. Generally, its deep, warm and low nutrient waters suppress upwelling of deeper, comparatively nutrient-rich waters, thereby forcing the highest rates of primary productivity to occur at depths associated with the thermocline (generally 70–100 m depth). When the Indonesian Throughflow is weaker, the thermocline lifts, and brings deeper, more nutrient-rich waters into the photic zone, which results in conditions favourable to increased productivity. Consequently, plankton populations have a high degree of temporal and spatial variability. In tropical regions, higher plankton concentrations generally occur during the winter months (June to August).

In waters surrounding Indonesia, seasonal peaks in phytoplankton biomass are linked to monsoon related changes in wind. When the winds reverse direction (offshore vs. onshore), nutrient concentrations decrease/increase because of the suppression/enhancement of upwelling (NASA 2010). Annual variability of phytoplankton productivity in waters surrounding Indonesia is heavily influenced by the El Niño-Southern Oscillation climate pattern (NASA 2010). For example, phytoplankton productivity around Indonesia increases during El Niño events.

The waters of north-western Australia, encompassing WA-285-P and WA-343-P, are generally considered to be of low productivity in comparison with other global oceanic systems. This is largely due to the relatively low-nutrient, shallow water environment. Planktonic community densities recorded in the Ichthys Field are considered to be very sparse and are indicative of offshore waters where no significant nutrient sources exist. The most common plankton classes recorded from the sampling of the Ichthys Field development area were the Prasinophyceae (68%), followed by the Bacillariophyceae (30%), the Dinophyceae (1%) and the Cryptophyceae (<1%), all of which are common throughout the region (INPEX 2010).

4.9.2 Benthic communities

Banks and shoals

A number of banks, shoals and reefs exist within the Browse Basin (Figure 4-2). The closest to WA-285-P and WA-343-P are Echuca and Heywood shoals. They are located approximately 79 km and 96 km away from WA-285-P respectively: and approximately 62 km and 75 km away from WA-343-P respectively. Browse Island is the nearest intertidal habitat which is located approximately 19 km and 68 km away from WA-285-P and WA-343-P respectively.

Other representative banks and shoals within the PEZ, with approximate distances to each permit area include:

- Vulcan Shoals (185 km WA-285-P; 105 km WA-343-P)
- Eugene McDermott Shoals (195 km WA-258-P; 125 km WA-343-P)
- Barracouta Shoals (190 km WA-285-P; 110 km WA-343-P)
- Woodbine Bank (190 km WA-285-P; 110 km WA-343-P)
- Fantome Shoals (250 km WA-285-P; 200 km WA-343-P)
- Penguin Shoal (280 km WA-285-P; 280 km WA-343-P)
- Gale Bank (350 km WA-285-P; 300 km WA-343-P)
- Van Cloon Shoals (390 km WA-285-P; 335 km WA-343-P)
- Rowley Shoals (490 km WA-285-P; 610 km WA-343-P)
- Sunrise Bank (620 km WA-285-P; 660 km WA-343-P)
- Flat Top Bank (680 km WA-285-P; 650 km WA-343-P
- Glomar Shoals (900 km WA-285-P; 985 km WA-343-P).

The shoals and banks within the PEZ are characterised by abrupt bathymetry, rising steeply from the surrounding shelf to horizontal plateau areas typically 20–30 m deep (AIMS 2012). Substrate types tend to differ from patches of coarse sand, to extensive fields of rubble and rocks, limited areas of consolidated reef and occasional isolated rock or live coral outcrops.

A detailed study on Echuca and Heywood Shoals, the two closest submerged shoals to the permit areas, was undertaken as part of the Shell/INPEX ARP comprising of annual field surveys conducted from 2014 to 2016 (Heyward et al. 2018). The focus of the study was the shoal benthic habitats and associated fish communities predominantly on the plateau areas, present as horizontal or gently sloping seabed in depths of 15 m to 30 m. The outcome of the study by Heyward et al. (2018) reported that Echuca Shoal's oval shaped and slightly shallower 11 km^2 plateau had less unconsolidated substrate, such as sand or rubble, than Heywood Shoal's plateau of approximately 31 km^2. The benthic habitats and fish communities were similar, with many species in common. All epibenthic organisms on both shoals appeared normal and healthy throughout the study. Fish abundance and diversity was high but varied over time and between the shoals in a consistent manner. Species richness, abundance and fish community structure were influenced mainly by depth and the abundance of epibenthos, especially hard coral (Heyward et al. 2018). These results are comparable with other shoals throughout the region.

The submerged shoals within the PEZ can support diverse tropical ecosystems, including phototrophic benthos typical of tropical coral reefs. The shoals support a diverse biota, including algae, reef-building corals, hard corals and filter-feeders. In general, the flora and faunal assemblages are typical of the oceanic reefs of the Indo–West Pacific region (INPEX 2010), with many of the species in common with those found at the Ashmore, Cartier and Scott reef complexes. The shoals and banks of the area may therefore act as 'stepping stones' for enhanced biological connectivity between the reef systems of the region. Shoal and bank habitats are thought to provide additional regional habitat for marine fauna, including sharks and sea snakes (AIMS 2012).

The community structure of the banks and shoals is likely to be influenced by a number of processes, including disturbance resulting from storms and cyclones, and localised recruitment due to the limited larval dispersal of some invertebrate species (AIMS 2012). It is unknown how interconnected the individual banks and shoals are in regard to larval recruitment. The majority lie in the path of a south-westerly flowing current originating in the Indonesian Throughflow. However, seasonal reversals of current flow suggest larval recruitment can be supplied from outside this process. Seasonal current patterns, local effects within ocean currents (e.g. reversal of current direction against prevailing winds) and species lifecycle characteristics are all likely to exert an influence over the larval recruitment (and hence biodiversity) of the banks and shoals (INPEX 2010).

Coral reefs

Coral reefs within the NWMR 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 and have an iconic status in the environments where they occur.

Coral reefs considered to have significant value within the PEZ include:

- Ashmore Reef (175 km WA-285-P; 115 km WA-343-P)
- Cartier Island (145 km WA-285-P; 80 km WA-343-P)
- Seringapatam Reef (110 km WA-285-P; 125 km WA-343-P)
- Scott Reef (105 km WA-285-P; 135 km WA-343-P)
- Hibernia Reef (210 km WA-285-P; 150 km WA-343-P)
- Rowley Shoals (490 km WA-285-P; 610 km WA-343-P)
- Mermaid Reef (470 km WA-285-P; 550 km WA-343-P).

These reefs, in particular Ashmore Reef, are recognised as having the highest richness and diversity of coral species in Western Australia (Mustoe & Edmunds 2008, cited in Department of State Development 2010). The Rowley Shoals and Scott Reef also support very high coral species diversity, as discussed in Section 4.2 and Section 4.3. The intertidal reefs surrounding the outer islands of the Bonaparte Archipelago also exhibit very high coral species diversity (INPEX 2010). Coral reefs associated with Browse Island (the nearest coral reef to the permit areas) are discussed in Section 4.4.3.

Fringing coral reefs around Christmas Island are relatively simple with 88 coral species previously identified which are identified to support and over 600 fish species (Director of National Parks 2012; Hobbs et al. 2014). The Cocos (Keeling) Islands also have a wide variety of corals species (Geoscience Australia 2022c).

Indonesia has the largest coral reef area in Southeast Asia and estimates of the extent of these coral reefs vary, but they likely total about 51,000 km² (ABD 2014). More than 590 species of corals have been identified in Indonesian waters. The Lesser Sunda Ecoregion which intersects the PEZ is considered important for coral endemism, particularly the areas of Bali-Lombok, Komodo and East Flores. Fringing coral reefs tend to be less developed on the southern, more exposed shorelines (Wilson et al. 2011). Coral species composition is influenced by regional and local scale seasonal upwellings that typically occur from April to May each year on the southern side of the Indonesian islands (DeVantier et al. 2008).

Observations throughout the world indicate that coral spawning on most reefs extends over a few months during the spawning period, typically between late spring and autumn (Stoddart & Gilmour 2005, cited in INPEX 2010). Spawning of corals in the NT Aquarium has been observed around the full moon period in October and November (TWP 2006, cited in INPEX 2010). In northern Queensland, captive corals have been observed to spawn at the same time as those in the adjacent waters. Coral spawning has been observed at Scott Reef during summer/autumn (March/April; main spawning event) and spring (October/November) (Gilmour et al. 2009). This has been confirmed by the Australian Institute of Marine Science (AIMS) research at Scott Reef, which estimates that 60–75% of community reproductive output occurs in autumn, 15–25% in spring, and 5–15% in summer, with comparatively little reproductive output during winter (Gilmour et al. 2013). Research into coral larval dispersal (Gilmour et al. 2009, 2010, 2011; Underwood et al. 2009, 2017; Cook et al. 2017; Waples et al. 2019) has indicated that dispersal and recruitment is predominately local and limited to within a few kilometres to a few tens of kilometres from natal reef patches.

Seagrass

There is no seagrass within WA-285-P or WA-343-P due to water depth (approximately 290 and 350 m) and lack of suitable habitat.

Seagrasses occur in the PEZ with the closest seagrasses to the permit areas located at Ashmore Reef, approximately 175 km north of WA-285-P and 115 km north of WA-343-P, where a high coverage of seagrass supports a small dugong population (Whiting & Guinea 2005). Other locations include the mainland coastline of the NT and WA and within the protected coastal areas of islands, including the Tiwi Islands, outer Darwin Harbour and in the waters surrounding of the Van Diemen Gulf adjacent to Arnhem Land (Roelofs et al. 2005).

The largest known seagrass locations for the NWMR have been reported from around the Buccaneer Archipelago located north of the Dampier Peninsula (Wells et al. 1995) located approximately 215 km south of WA-285-P and 295 km south of WA-343-P. Other important areas include the Lacepede Islands, Browse Island, Scott Reef, Ashmore Island and Cartier Island. Coastal shallow-water seagrass habitats are generally rare in the region, accounting for only 11.5 km or 0.2% of the total coastline surveyed by Duke et al. (2010). The regionally dominant genera in Australia are *Halophila* and *Halodule*.

The Cocos (Keeling) Islands have an extensive lagoon with more than 26 km^2 of shallow seagrass meadows that include *Thalassia* spp. and *Thalassodendron* spp. (Hobbs et al. 2007). Due to a lack of lagoonal habitats, no seagrass habitats have been recorded at Christmas Island (Hobbs et al. 2014).

Seagrass habitats are widely distributed across the Lesser Sunda Ecoregion and within Indonesian waters the lower intertidal and upper subtidal zones are considered important areas for the growth of seagrass (Hutumo & Moosa, 2005). Pioneering vegetation in the intertidal zone is dominated by *Halophila ovalis* and *Halodule pinifolia* while *Thalassodendron ciliatum* dominate the lower subtidal zones (Hutumo & Moosa, 2005). Data from the United Nations Environment Program's (UNEP) World Conservation Monitoring Centre has identified the south-west and west Lombok, Savu and the south coast of Timor-Leste as potential areas of importance for seagrass (DeVantier et al. 2008).

4.9.3 Shoreline habitats

There are no islands within WA-285-P or WA-343-P, with the closest intertidal habitat located at Browse Island (19 km and 68 km away respectively). However, within the PEZ there are many islands that occur including numerous small islands and literally thousands of islands along the Australian and Indonesian coastlines.

In the offshore waters of the PEZ there are multiple islands which have an associated Commonwealth or State marine park/reserve status. The values and sensitivities associated with the shorelines of these islands are described in sections 4.3, 4.4, 4.5 and 4.6.

Sandy beaches

Sandy beaches are the dominant shoreline habitat on all the offshore islands within the PEZ and provide significant habitat for turtles and seabird nesting above the high tide line. Sandy beaches are present within the PEZ at the sandy cays of Ashmore Reef, Cartier Island, Browse Island, Scott Reef and the Tiwi Islands as described in Sections 4.3 and 4.4. The southern coastlines of the islands of the Lesser Sunda Ecoregion of Indonesia and Timor-Leste are known to contain sandy beaches consisting of soft black sand, formed by volcanic activity. Within this region, a number of important sites for turtle nesting beaches have been identified (Huffard et al. 2012).

Generally, sands are highly mobile and therefore do no support a high level of biodiversity. Fauna within sandy beach habitats usually consists of polychaete worms, crustaceans and bivalves. These fauna provide a valuable food source for resident and migratory sea and shorebirds (DECMPRA 2005). Natural processes tend to supply fresh sediments and larval stock (food source) with each tidal influx.

Mangroves

Mangrove communities make up a common shoreline habitat along the northern WA coastlines with extensive mangrove communities along the Australian and Indonesian coastline within the PEZ. They commonly occur in sheltered coastal areas in tropical and sub-tropical latitudes. 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).

More than a quarter of the world's species of mangroves can be found along the Kimberley coast, covering an area of approximately 1,400 km^2. 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.

No mangroves are present on Christmas Island with the exception of a stand of estuarine mangrove species, identified approximately 37 m above sea level at the Hosnies Spring wetland (Ramsar site, Section 4.6.4) (Director of National Parks 2012).

Within Indonesia, 41 species of mangroves, occupying some 32,000 km^2 have been recorded (ABD 2014). The Timor-Leste coastline also features mangrove communities surrounding entrances to rivers, primarily situated on the southern coast.

4.9.4 Marine fauna

Species of conservation significance

Species of conservation significance within the PEZ were identified through a search of the EPBC Act Protected Matters database (including a 1 km buffer).

The search identified a total of 39 "listed threatened" species and 89 "listed migratory" species that potentially use or pass through the PEZ.

In addition, 168 "listed marine" species were identified, of which 32 are "whales and other cetaceans" that may occur at, or immediately adjacent to, the area. The full search results are contained in Appendix A.

Table 4-4 presents the marine species that are "listed threatened" species or "listed migratory species". Note that true terrestrial species have not been listed in Table 4-4.

Table 4-4: Listed threatened and/or migratory species under the EPBC Act potentially occurring within the PEZ

Species	Common name	Conservation status	Migratory
Marine mammals			
Balaenoptera borealis	Sei whale	Vulnerable	Migratory
Balaenoptera edeni	Bryde's whale	N/A	Migratory
Balaenoptera musculus	Blue whale	Endangered	Migratory
Balaenoptera physalus	Fin whale	Vulnerable	Migratory
Eubalaena australis	Southern Right Whale	Endangered	Migratory
Megaptera novaeangliae	Humpback whale	N/A	Migratory
Balaenoptera bonaerensis	Antarctic Minke Whale	N/A	Migratory
Orcinus orca	Killer whale	N/A	Migratory
Physeter macrocephalus	Sperm whale	N/A	Migratory

Species	Common name	Conservation status	Migratory
Dugong dugon	Dugong	N/A	Migratory
Orcaella heinsohni	Australian snubfin dolphin	N/A	Migratory
Sousa chinensis/ Sousa sahulensis	Indo-Pacific humpback dolphin	N/A	Migratory
Tursiops aduncus	Spotted bottlenose dolphin	N/A	Migratory
Marine reptiles			
Caretta caretta	Loggerhead turtle	Endangered	Migratory
Chelonia mydas	Green turtle	Vulnerable	Migratory
Dermochelys coriacea	Leatherback turtle	Endangered	Migratory
Eretmochelys imbricata	Hawksbill turtle	Vulnerable	Migratory
Lepidochelys olivacea	Olive Ridley turtle	Endangered	Migratory
Natator depressus	Flatback turtle	Vulnerable	Migratory
Crocodylus porosus	Saltwater crocodile	N/A	Migratory
Aipysurus apraefrontalis	Short-nosed seasnake	Critically Endangered	N/A
Aipysurus foliosquama	Leaf-scaled seasnake	Critically Endangered	N/A
Sharks, fish and rays			
Rhincodon typus	Whale shark	Vulnerable	Migratory
Carcharodon carcharias	Great white shark	Vulnerable	Migratory
Carcharias taurus	Grey nurse shark	Vulnerable	N/A
Glyphis garricki	Northern river shark	Endangered	N/A
Glyphis glyphis	Speartooth Shark	Critically Endangered	N/A
Pristis clavata	Dwarf sawfish	Vulnerable	Migratory
Pristis pristis	Northern sawfish, Freshwater sawfish, Largetooth sawfish	Vulnerable	Migratory
Pristis zijsron	Green sawfish	Vulnerable	Migratory
Anoxypristis cuspidata	Narrow sawfish	N/A	Migratory
Isurus oxyrinchus	Shortfin mako	N/A	Migratory
Isurus paucus	Longfin mako	N/A	Migratory

Species	Common name	Conservation status	Migratory
Carcharhinus longimanus	Oceanic whitetip shark	N/A	Migratory
Manta alfredi	Reef manta ray	N/A	Migratory
Manta birostris	Giant manta ray	N/A	Migratory
Marine avifauna			
Anous tenuirostris melanops	Australian lesser noddy	Vulnerable	N/A
Calidris canutus	Red Knot	Endangered	Migratory
Calidris ferruginea	Curlew Sandpiper	Critically Endangered	Migratory
Calidris tenuirostris	Great Knot	Critically Endangered	Migratory
Charadrius leschenaultii	Greater Sand Plover	Vulnerable	Migratory
Charadrius mongolus	Lesser Sand Plover	Endangered	Migratory
Fregata andrewsi	Christmas Island Frigatebird, Andrew's Frigatebird	Endangered	Migratory
Hypotaenidia philippensis andrewsi	Buff-banded Rail (Cocos (Keeling) Islands), Ayam Hutan	Endangered	N/A
Limosa Lapponica baueri	Bar-tailed Godwit	Vulnerable	Migratory
Limonsa lapponica menzbieri	Northern Siberian Bar-tailed Godwit	Critically Endangered	Migratory
Macronectes giganteus	Southern giant petrel	Endangered	Migratory
Numenius madagascariensis	Eastern curlew	Critically Endangered	N/A
Papasula abbotti	Abbott's Booby	Endangered	Migratory
Phaethon lepturus fulvus	Christmas Island White-tailed Tropicbird, Golden Bosunbird	Endangered	N/A
Pterodroma arminjoniana	Round Island Petrel, Trinidade Petrel	Critically Endangered	N/A
Pterodroma mollis	Soft-plummaged Petrel	Vulnerable	N/A
Rostratula australis	Australian Painted Snipe	Endangered	N/A
Sternula nereis nereis	Australian Fairy Tern	Vulnerable	Migratory

Species	Common name	Conservation status	Migratory
Thalassarche carteri	Indian Yellow-nosed Albatross	Vulnerable	Migratory
Anous stolidus	Common noddy	N/A	Migratory
Apus pacificus	Forktailed swift	N/A	Migratory
Ardenna carneipes	Flesh-footed Shearwater	N/A	Migratory
Ardenna pacifica	Wedge-tailed Shearwater	N/A	Migratory
Calonectris leucomelas	Streaked shearwater	N/A	Migratory
Fregata ariel	Lesser frigatebird	N/A	Migratory
Fregata minor	Great frigatebird	N/A	Migratory
Hydroprogne caspia	Caspian tern	N/A	Migratory
Sterna anaethetus	Bridled tern	N/A	Migratory
Phaethon lepturus	White-tailed tropicbird	N/A	Migratory
Phaethon rubricauda	Red-tailed tropicbird	N/A	Migratory
Sterna dougallii	Roseate tern	N/A	Migratory
Onychoprion anaethetus	Little tern	N/A	Migratory
Sula dactylatra	Masked booby	N/A	Migratory
Sula leucogaster	Brown booby	N/A	Migratory
Sula sula	Red-footed booby	N/A	Migratory
Acrocephalus orientalis	Oriental Reed-Warbler	N/A	Migratory
Actitis hypoleucos	Common Sandpiper	N/A	Migratory
Arenaria interpres	Ruddy Turnstone	N/A	Migratory
Calidris acuminata	Sharp-tailed Sandpiper	N/A	Migratory
Calidris alba	Sanderling	N/A	Migratory
Calidris melanotos	Pectoral Sandpiper	N/A	Migratory
Calidris ruficollis	Red-necked Stint	N/A	Migratory
Charadrius bicinctus	Double-banded Plover	N/A	Migratory
Charadrius dubius	Little Ringed Plover	N/A	Migratory
Charadrius veredus	Oriental Plover	N/A	Migratory

Species	Common name	Conservation status	Migratory
Gallinago megala	Swinhoe's Snipe	N/A	Migratory
Gallinago stenura	Pin-tailed Snipe	N/A	Migratory
Glareola maldivarum	Oriental Pratincole	N/A	Migratory
Limicola falcinellus	Broad-billed Sandpiper	N/A	Migratory
Limnodromus semipalmatus	Asian Dowitcher	N/A	Migratory
Limosa limosa	Black-tailed Godwit	N/A	Migratory
Numenius minutus	Little Curlew, Little Whimbrel	N/A	Migratory
Numenius phaeopus	Whimbrel	N/A	Migratory
Pandion haliaetus	Osprey	N/A	Migratory
Philomachus pugnax	Ruff (Reeve)	N/A	Migratory
Pluvialis fulva	Pacific Golden Plover	N/A	Migratory
Pluvialis squatarola	Grey Plover	N/A	Migratory
Thalasseus bergii	Greater Crested Tern	N/A	Migratory
Tringa brevipes	Grey-tailed Tattler	N/A	Migratory
Tringa incana	Wandering Tattler	N/A	Migratory
Tringa glareola	Wood Sandpiper	N/A	Migratory
Tringa nebularia	Common Greenshank	N/A	Migratory
Tringa stagnatilis	Marsh Sandpiper, Little Greenshank	N/A	Migratory
Tringa totanus	Common Redshank	N/A	Migratory
Xenus cinereus	Terek Sandpiper	N/A	Migratory

Conservation management plans

In addition to species being identified as threatened or migratory and MNES, depending on the threat classification, the DAWE has established management policies, guidelines, plans and other materials for threatened fauna, threatened flora (other than conservation-dependent species) and threatened ecological communities listed under the EPBC Act.

In particular, the objectives of the published recovery plans and conservation advices, seek to support the long-term recovery of various species outlining research and management measures that must be undertaken to stop the decline of, and support the recovery of a species, including the management of threatening processes.

Species identified during the EPBC Act Protected Matters database search that have a conservation advice or a recovery plan in place, as well as any particular relevant actions to assist their recovery and conservation, including threat abatement plans, are summarised in Appendix A.

Biological important areas

The DAWE has, through the marine bioregional planning program, identified, described and mapped BIAs for protected species under the EPBC Act. BIAs spatially and temporally define areas where protected species display biologically important behaviours (including breeding, foraging, resting or migration), based on the best available scientific information. These areas are those parts of a marine region that are particularly important for the conservation of protected species.

Table 4-5 provides an overview of the EPBC-listed species, identified by the EPBC Act Protected Matters database search, that are associated with a BIA in the PEZ. The locations of relevant BIAs for EPBC-listed species are shown in Figure 4-4 to Figure 4-8.

Table 4-5: BIAs intersecting the PEZ

Species	Migration route	Foraging	Internesting	Resting/breeding	Aggregation/calving	Pupping/ nursing
Humpback whale	x				x	
Pygmy blue whale	x					
Dugong		x				
Coastal dolphins: Indo-Pacific humpback dolphin, bottlenose dolphin and Australian snubfin dolphin		x		x	x	
Whale shark		x				
Largetooth/freshwater, dwarf and green sawfish		x				x
Avifauna		x		x		
Flatback turtle		x	x			
Green turtle		x	x			
Hawksbill turtle		x	x			
Loggerhead turtle		x				

Marine mammals

Noise logging surveys were undertaken by INPEX to determine the critical areas of use and to establish a baseline of abundance for cetaceans within the Kimberley region. Noise loggers were set on the sea floor at two sites: in the Browse Basin 45 km north-west of Browse Island (in 240 m of water) and at an inshore site near the Maret Islands (in 45 m of water) between September 2006 and August 2008. The loggers detected anthropogenic noise signals from vessel activities and seismic surveys, as well as signals from pygmy blue whales, humpback whales, Antarctic and dwarf minke whales, a signal which is believed to be from Bryde's whales, and several unknown great whale signals, plus a plethora of fish signal types and choruses (McCauley 2009).

There are no identified BIAs for marine mammals within WA-285-P or WA-343-P. However, a number of marine mammal BIAs overlap the PEZ as outlined in Table 4-5 and shown in Figures 4-4 and 4-5. Marine mammals associated with a BIA in the PEZ are described in more detail within this subsection.

Humpback whale

In February 2022, the status of the humpback whale was updated, and the species was removed from the threatened species list (DAWE 2022r). Despite removal from the threatened species list, the humpback whale remains a MNES under the EPBC Act as a listed cetacean and as a listed migratory species.

There are two humpback whale (*Megaptera novaeangliae*) BIAs located within the PEZ; a migratory corridor and a breeding and calving area, as shown in Figure 4-4. During their annual northern and southern migrations, transitory humpback whales will pass through the PEZ generally between June and October, with peak ingress during July. The population increases up to mid-August when whales begin to depart on their southern migration. Peak egress occurs around September and the final groups of whales tend to have departed by late October (Jenner et al. 2001; Thums et al. 2018).

The migratory habitat for the humpback whale around mainland Australia is primarily coastal waters less than 200 m in depth and generally within 20 km of the coast (Jenner et al. 2001). Breeding and calving generally occurs between the Lacepede Islands and Camden Sound. Camden Sound is considered the northern most limit and is considered an important calving and breeding area (Jenner et al. 2001). A recent study as part of the Kimberley Marine Research Project (Thums et al. 2018) analysed three decades of satellite, aerial, boat-based sightings and determined that abundance was greatest in nearshore waters in water depths of approximately 35 m. However, whales (including cows and calves) may also occur in lower abundance elsewhere within and further offshore from the BIAs, with whales having been recorded in offshore locations such as Browse Island and Scott Reef (e.g. McCauley 2009). Isolated observations of humpback whales and their calves have been noted within the Ichthys Field. The closest BIA to the permit areas relates to calving and resting and is located approximately 100 km south-east from WA-285-P and 175 km east from WA-343-P at its closest point.

Blue Whale

There are two recognised subspecies of blue whale in the southern hemisphere, which are both recorded in Australian waters. They are the southern (or 'true') blue whale (*Balaenoptera musculus intermedia*) and the pygmy blue whale (*Balaenoptera musculus brevicauda*) (DoE 2015; DAWE 2021). 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) (DoE 2015). On this basis, any blue whales present within the permit areas/PEZ would be expected to be pygmy blue whales.

The 2015 Conservation Management Plan for the Blue Whale (DoE 2015) outlines the distribution of blue whales in Australian waters, and associated BIAs (i.e. migratory corridor and foraging areas). The closest BIA present within the PEZ, is a migratory corridor, located approximately 75 km west of WA-285-P and 40 km west of WA-343-P at the closest points. There is also a foraging BIA at Scott Reef, approximately 100 km west of WA-285-P and 130 km south-west of WA-343-P (Figure 4-4)

Pygmy blue whale migration is thought to follow deep oceanic routes. More recently, the migration route has been defined as along the shelf edge at depths between 500 m to 1,000 m (DoE 2015). Observations suggest most pygmy blue whales pass along the shelf edge out to water depths of 1,000 m but centred near the 500 m depth contour (McCauley & Jenner 2010). Satellite tagging (2009–2011) confirmed that the general distribution of pygmy blue whales was offshore in water depths >200 m and commonly >1,000 m (Double et al. 2014).

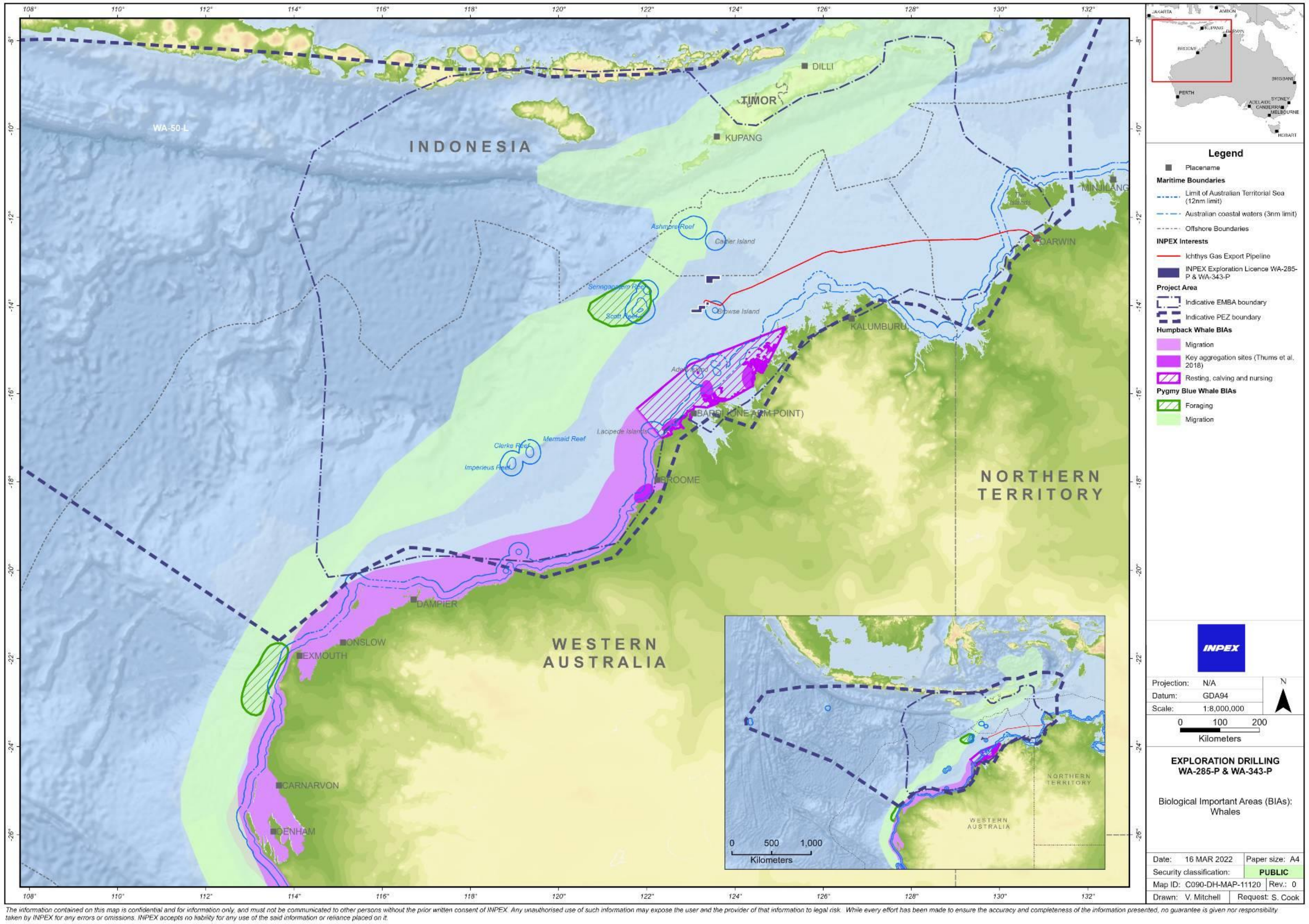

Figure 4-4: Biologically important areas associated with whales that intersect the PEZ and EMBA

Dugongs

Within the PEZ, there is a dugong foraging BIA at Ashmore Reef and another along the Dampier Peninsula, near Broome (Figure 4-5) which correlates with seagrass habitats (refer Section 4.9.2).

Dugongs are considered Specially Protected under Schedule 4 of the *Biodiversity Conservation Act 2018* (WA) and are listed as migratory species under the EPBC Act. A significant proportion of the world's dugong population occurs in the coastal waters of the west-Pilbara nearshore, as well as Ningaloo Reef and Exmouth Gulf (Marsh et al. 2011). Dugongs generally inhabit shallow waters (around 10 m depth) and are commonly found in mangrove channels of inshore islands and shallow areas near the seagrass habitats on which they feed (DAWE 2022s).

The shallow seagrass habitat at the Cocos (Keeling) Islands appears suitable for dugongs and were once part of the dugong's historical range. However, in 1970, it was reported that dugongs no longer occur at the Cocos (Keeling) Islands (Hobbs et al. 2007). Since 1970, there have only been three confirmed sightings (in 1989, 1998 and 2007) of dugongs at the Cocos (Keeling) Islands (Hobbs et al. 2007).

Dolphins

Coastal dolphin BIAs for breeding, resting, calving and foraging are located within the PEZ, as shown in Figure 4-5. There are three species of coastal dolphin to which these BIAs relate as discussed below. A recent study of snubfin and humpback dolphins in the Kimberley region (Waples et al. 2019) confirmed these species of dolphins are present at low densities and occur as relatively small populations across the Kimberley.

Indo-Pacific bottlenose dolphin

The Indo-Pacific spotted bottle nose dolphin (*Tursiops aduncus*) is generally considered to be a warm water subspecies of the common bottlenose dolphin (*Tursiops truncatus*) and may occur within the permit areas and the PEZ. The Indo-Pacific spotted dolphin appears to occupy inshore waters, often in depths of less than 10 m (Bannister et al. 1996). It is known to occur from Shark Bay, north to the western edge of the Gulf of Carpentaria and is regarded as a migratory species under the EPBC Act (DAWE 2022t).

Australian snubfin dolphin

The Australian snubfin dolphin (*Orcaella heinsohni*) may occur within the PEZ. All available data on the distribution and habitat preferences of Australian snubfin dolphin (*Orcaella heinsohni*) indicate that they mainly occur in the shallow coastal and estuarine waters of the NT and north WA (Beasley et al. 2002; Brown et al. 2017). There are no data to estimate any past or potential future declines in the area of occupancy for snubfin dolphins in Australia; however, incidental catches in gillnets (albeit at unknown levels), in addition to habitat degradation, may lead to a reduction of area of occupancy over the next three generations for Australian snubfin dolphins (DAWE 2022u).

Indo-pacific humpback dolphin

The Indo-Pacific humpback dolphin (*Sousa sahulensis/Sousa chinensis*) may occur in the PEZ with its presence reported along the northern coastline of Australia down to Exmouth on the WA coastline. The total population size of the Indo-Pacific humpback dolphin in Australian waters is unknown. Given that the required shallow habitat preferred by this species occurs continuously throughout its recorded range, the distribution of the Indo-Pacific humpback dolphin is considered to represent one continuous location (DAWE 2022v).

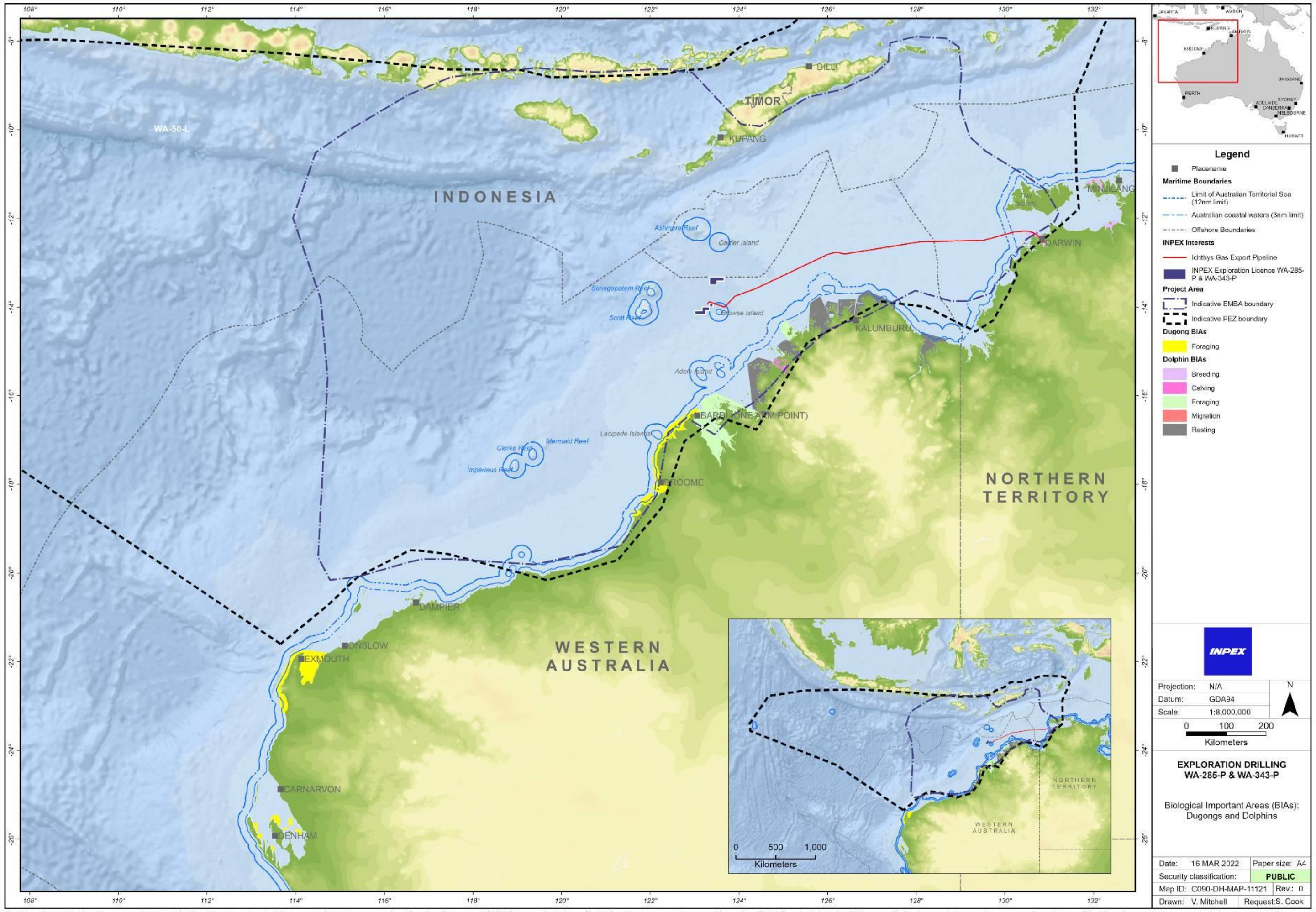

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Figure 4-5: Biologically important areas associated with dugongs and dolphins that intersect the PEZ and EMBA

Marine reptiles

Turtles

The EPBC Act Protected Matters search identified six species of marine turtle which may occur within the PEZ: the green turtle (*Chelonia mydas*), loggerhead turtle (*Caretta caretta*), leatherback turtle (*Dermochelys coriacea*), flatback turtle (*Natator depressus*), hawksbill turtle (*Eretmochelys imbricate*) and olive ridley turtle (*Lepidochelys olivacea*).

Browse Island is the closest turtle-nesting area (located approximately 19 km south-east of WA-285-P and 68 km south of WA-343-P at the closest points) and is surrounded by a 20 km internesting buffer for green turtles between November and March (DEE 2017a).

Within the PEZ there are a range of BIAs and critical habitats for turtle breeding, foraging and internesting (Figure 4-6). Nesting rookeries within the PEZ include Browse Island, Ashmore Reef, Cartier Island, Cassini Island, Scott Reef, Tiwi Islands and the Lacepede Islands as identified in the Recovery Plan for Marine Turtles in Australia (DEE 2017a). Peak nesting periods for all turtle species within these areas are generally between November and April.

A 20 km internesting buffers associated with green turtles have been identified for Browse Island, Scott Reef (Sandy Islet), Adele Island, Melville Island (Tiwi islands) and Cassini Island between November and March. Similarly, a 60 km internesting buffer for flatback turtles has been identified at Cassini Island between May and July (DEE 2017a). At Scott Reef there is an interesting BIA (20 km buffer) for hawksbill turtles where internesting occurs in October–February each year, and peaks in December and January (DEE 2017a). At the Tiwi islands, an internesting buffer for flatback (60 km) and olive ridley (20 km) turtles has been identified year-round (DEE 2017a) with peak nesting occurring between June–September and April-June respectively.

Foraging BIAs for these species occurs at the Joseph Bonaparte Depression and Joseph Bonaparte Gulf, which overlap the PEZ and EMBA (Figure 4-6). Satellite tagging of nesting female loggerhead turtles from the Ningaloo/Pilbara coast of Western Australia have shown dispersal north-west as far as Indonesia and southern Borneo, north-east as far as the Tiwi Islands and south as far as the Great Australian Bight (Waayers et al. 2015; Whiting et al. 2008). Flatback turtles are known to forage across the Australian continental shelf as far north as Indonesia and Papua New Guinea (DEE 2017a). There is limited tag recovery data for olive ridley turtles, but satellite tracking data indicates that they appear to remain on the Australian continental shelf (Waayers et al. 2015).

Satellite tracking data reviewed in recent studies (Ferreira et al. 2020; Thums et al. 2021) concluded that the spatial extent of marine turtle internesting areas was adequately covered by the defined internesting buffers and therefore afforded an appropriate level of protection. However, the spatial extents of foraging BIAs are considered to potentially underestimate the distribution of foraging turtles. The closest turtle foraging BIAs to WA-285-P and WA-343-P relate to Ashmore Reef, Cartier Island and Scott Reef (Figure 4 6).

Turtles are not expected to be present in high numbers in WA-285-P or WA-343-P. However, individual green turtles may occasionally be present associated with the internesting buffer at Browse Island, and other marine turtle species are likely to be present in the waters of the PEZ as it encompasses several locations that support turtle foraging, nesting and internesting behaviours.

Sea snakes

The EPBC Act Protected Matters database search identified 26 sea snakes which may occur within the PEZ (13 of which may also be found in WA-285-P and 12 of which may also be found in WA-343-P. There are no reported BIAs for sea snakes. Scott Reef is considered a region of high sea snake endemism and a decline in sea snake abundance has been reported within the Ashmore Reef MP (Udyawer 2020). Most of the knowledge of sea snakes in Australian waters comes from trawler bycatch (Udyawer et al. 2020; Milton et al. 2009; Ward 1996). These studies indicate that sea snakes in northern regions of Australia tend to breed in shallow embayment's and estuaries which are only represented in the PEZ. Therefore, these species may be seen in the open waters of the permit areas, but their presence is unlikely to be common.

Crocodiles

The salt-water or estuarine crocodile (*Crocodylus porosus*) has a tropical distribution that extends across the northern coastline of Australia, where it can be found in coastal waters, estuaries, freshwater lakes, inland swamps and marshes, as well as far out to sea (Webb et al. 1987). There are no reported BIAs for crocodiles. Due to the species preference for estuaries and swamps and coastal waters they are unlikely to occur in the open waters of the permit areas and are more likely to be observed in the PEZ where these preferred habitats occur.

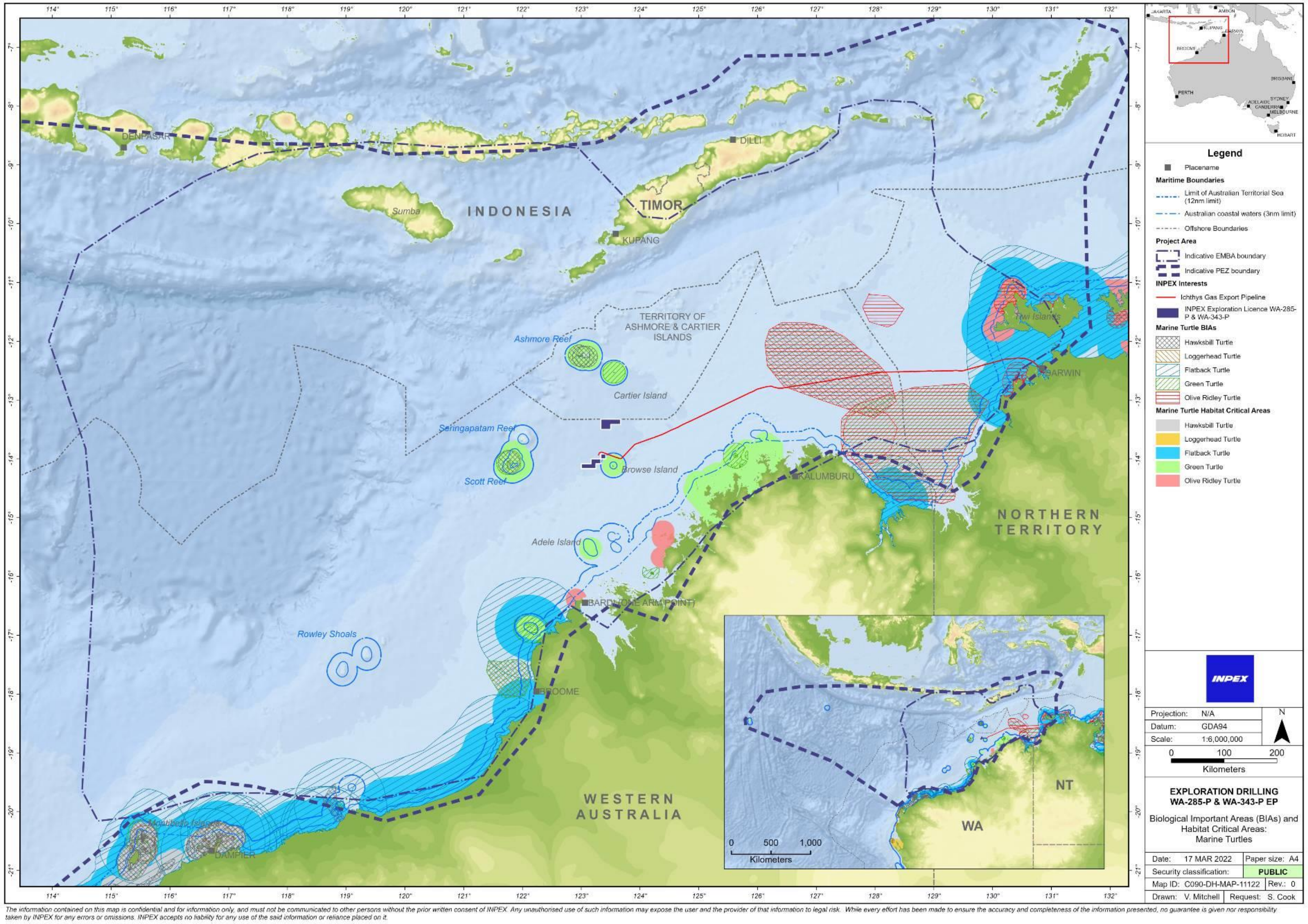

Figure 4-6: Biologically important areas associated with marine turtles that intersect the PEZ and EMBA

Fishes and sharks

While there are no BIAs for fishes and sharks within WA-285-P or WA-343-P, in the PEZ a BIA exists for whale sharks (foraging area) that largely follows the 125 m ancient coastline (Figure 4-7). There are also BIAs for sawfish (green, dwarf and freshwater) located to the south-west and north-east of Broome.

Although not specifically identified as BIAs, several of the KEFs within the PEZ, as described in Section 4.2, are also known to provide important habitat for diverse fish assemblages.

Whale shark

The whale shark is a solitary planktivorous species that spends the greater part of its foraging time at water depths above 100 m, often near the surface (Brunnschweiler & Sims 2011; Wilson et al. 2006). However, whale sharks are also known to engage in mesopelagic and even bathypelagic diving when in bathymetrically unconstrained habitats (Brunnschweiler et al. 2009; Wilson et al. 2006).

Whale sharks appear to prefer different locations at different times of year, and despite a reasonable understanding of the various whale shark aggregation locations and timings, little is known about the large-scale transoceanic movements in response to seasonal abundance of planktonic prey species (Eckert & Stewart 2001). The relatively limited number and dispersed origin of dietary studies of whale sharks mean it is difficult to determine general patterns in the trophic ecology of these animals in coastal ecosystems and the degree to which they act as links between oceanic and reef environments (Marcus et al. 2019). Patterns suggest that their foraging behaviour and role in oceanic and coastal ecosystems, is likely to vary both in space and time (Marcus et al. 2019).

Whale sharks can travel over vast distances between aggregation sites. One whale shark tagged in the Seychelles was relocated after 42 days having travelled 3,000 km to south of Sri Lanka and then located again 4 months later, a further 5,000 km away in the waters of Thailand (Hsu et al. 2007). Therefore, it is possible that whale sharks may transit through the PEZ in both Australian and International waters.

Whale sharks are widely distributed in tropical Australian waters. Within WA, whale sharks aggregate seasonally (March–June) to feed in coastal waters off Ningaloo Reef (Wilson et al. 2006). Taylor (1996) and Rowat & Gore (2007) examined whale shark movements at Ningaloo Reef and observed that the sharks swim parallel to the reef but found no clear evidence of a north-south migration.

While Ningaloo is the nearest aggregation to the permit areas, it is located over 1,300 km to the south. Research on the migration patterns of whale sharks in the Indian Ocean, indicates that a small number of the WA (Ningaloo) population migrate through the wider vicinity of the Browse Basin region (McKinnon et al. 2002; Wilson et al. 2006; Jenner et al. 2008; Meekan & 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 (McKinnon et al. 2002, Wilson et al. 2006, Meekan & Radford 2010; Sleeman et al. 2010). Aerial (Jenner & Jenner 2009a; RPS Environment and Planning Pty Ltd 2010, 2011) and vessel (Jenner et al. 2008; Jenner & Jenner 2009b) surveys conducted in 2008 and 2009, involving over 1,000 hours of observer effort, recorded one whale shark in 2008 and two whale sharks in 2010 in the Browse Basin (Jenner et al. 2008 and RPS Environment and Planning Pty Ltd 2011 respectively).

Within the PEZ, the whale shark BIA largely follows the ancient coastline at 125 m depth contour KEF and at its closest point is located approximately 5 km from WA-285-P and 10 km from WA-343-P at the closest points. However, based on the levels of whale shark abundance observed in the studies listed above, the likelihood of whale shark presence within this BIA is considered very low, with no specific seasonal pattern of migration.

Sawfish

Four species of sawfish (largetooth/freshwater/northern, narrow, dwarf and green sawfish) were identified in the EPBC Act Protected Matters database search of the PEZ (Appendix A). Only the narrow sawfish and green sawfish were identified in the EPBC Act Protected Matters database search of the permit areas. While sawfish are identified as potentially occurring within the permit areas and the PEZ, due to their ecology (generally estuarine rather than open-ocean species) it is expected that they will only be present in high numbers on the periphery of the PEZ where the BIAs are located (Figure 4-7).

As described in Section 4.3, environments found in the PEZ provide protection for shallow shelf habitats that are important foraging, nursing and pupping areas for freshwater, green and dwarf sawfish. The range of sawfish species overlaps with popular recreational fishing locations in some parts of the NMR (DSEWPaC 2012b) and adjacent areas. Observations of dead discarded sawfish species from recreational fishing highlights that mortality occurs as a direct result of capture and discarding (DSEWPaC 2012b).

Pipefish and seahorses

The EPBC Act Protected Matters database search identified 30 species of the family Syngnathidae which may occur within both permit areas and a further 22 species that may also potentially be present within the PEZ. Syngnathidae are a group of bony fishes that includes seahorses, pipefishes, pipehorses and sea dragons. Seahorses and pipefishes are a diverse group and occupy a wide range of habitats. However, the species identified in the EPBC Act Protected Matters database searches (Appendix A) generally display a preference for shallow water habitats such as seagrass and macroalgal beds, coral reefs, mangroves and sponge gardens that can be found in the shallower areas of the PEZ (Foster & Vincent 2004; Lourie et al. 1999; Scales 2010). In the permit areas, water depths are approximately 290 m to 350 m and preclude the presence of seagrass and hard bottom substrates, which can potentially support coral and macroalgae sponge garden communities. Therefore, pipefish and seahorses are only expected to occur in areas where suitable habitats are present, predominantly outside of WA-285-P and WA-343-P, in the broader PEZ.

Sharks and rays

Six shark species (including whale shark described above) and one ray species were identified as having the potential to occur in the permit areas (Appendix A). Two additional shark species and one additional ray species were identified as having the potential to occur within the PEZ (Table 4-4; Appendix A).

It is considered possible that larger pelagic sharks such as the great white, whale and mako sharks may transit through the permit areas. The likelihood of these species occurring in WA-285-P and WA-343-P is expected to be very low as the permit areas are not considered to provide habitat that is of breeding or feeding importance. As such, these species are unlikely to be common or resident within the permit areas.

The majority of recorded great white shark movements in Australian waters are reported to occur between the coast and the 100 m depth contour (DAWE 2022w).

Listed manta rays have been observed within the PEZ, but for the same reasons as the large pelagic sharks, are unlikely to be common or resident within WA-285-P or WA-343-P.

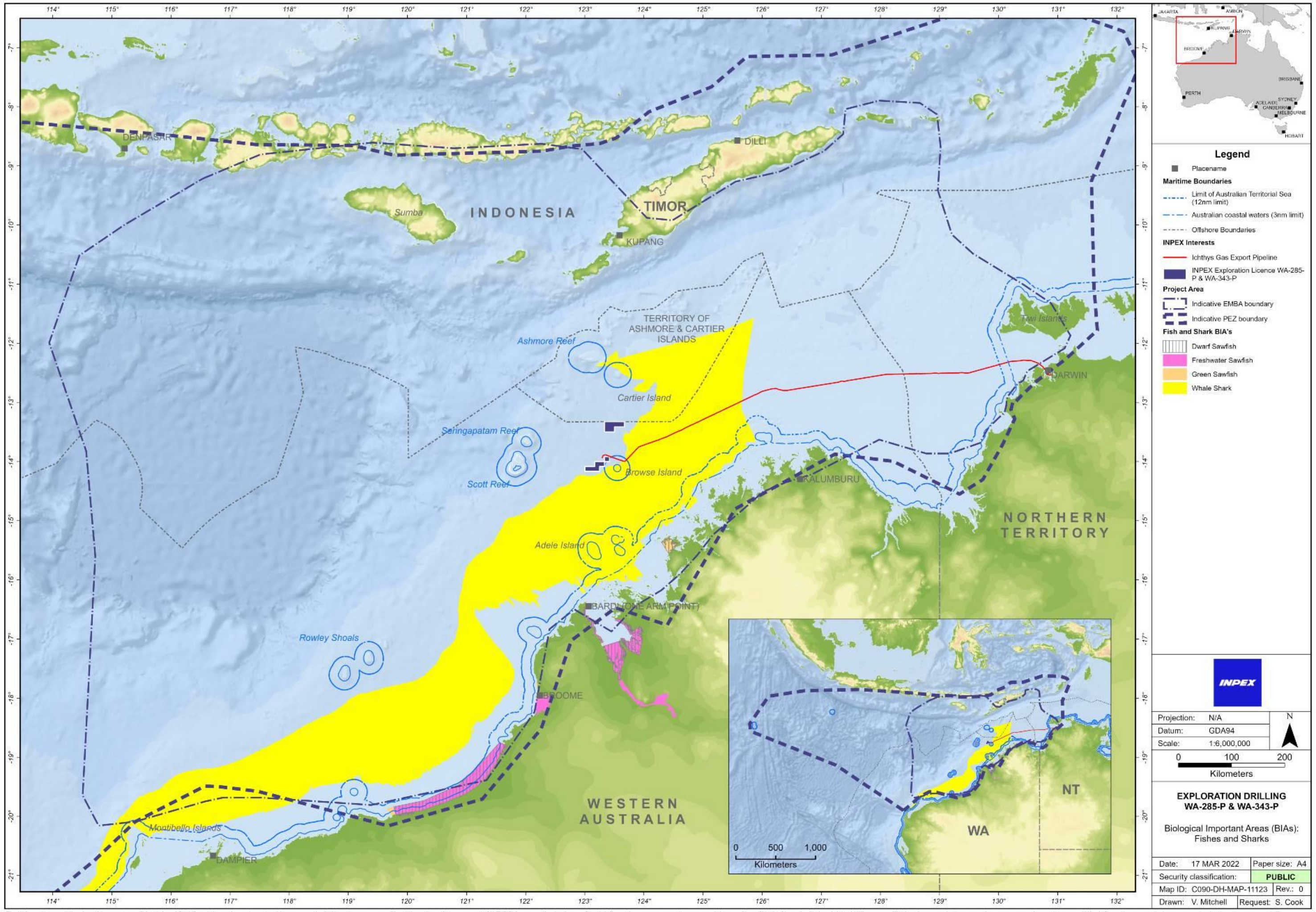

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Figure 4-7: Biologically important areas associated with fishes and sharks that intersect the PEZ and EMBA

Marine avifauna

The permit areas are located within the EAA Flyway an internationally recognised migratory bird pathway that covers the whole of Australia and its surrounding waters. 'Flyway' is the term used to describe a geographic region that supports a group of populations of migratory waterbirds throughout their annual cycle. There are 54 species of migratory shorebirds that are known to specifically follow migration paths within the EAA Flyway (Bamford et al. 2008). Migratory shorebird species are mostly present in Australia during the non-breeding period, from as early as August to as late as April/May each year. After arrival in Australia at the end of long migrations, they disperse throughout the country to a wide variety of habitats including coastal wetlands, mudflats, reefs and sandy beaches (DEE 2017b).

There are no BIAs for marine avifauna within WA-285-P or WA-343-P. However, the PEZ overlaps a large number of BIAs for a number of different marine avifauna species (Figure 4-8). The closest BIAs for marine avifauna relate to foraging around Adele Island, Ashmore Reef and Cartier Island, and Scott Reef. Several nationally important wetlands and Ramsar sites are also present within the PEZ (refer to Section 4.6). These sites provide important habitat for marine avifauna.

Vessel-based surveys conducted around the Ichthys gas field, Browse Island and to the west as far as Scott Reef were conducted by the Centre for Whale Research in 2008. (Jenner et al. 2008). Seabirds observed included frigatebirds, boobies, terns, noddies, tropicbirds, petrels, shearwaters and gulls, with the brown booby the most common species recorded. Of the species recorded during the vessel-based surveys, a number are migratory species listed under the EPBC Act, including the streaked shearwater, brown booby, masked booby, lesser frigatebird, bridled tern, lesser crested tern and little tern. These migratory species can be expected to be encountered in low numbers as they are likely to transit through the permit areas and the PEZ.

In addition to seabirds, the search of the EPBC Act Protected Matters database identified 32 species of migratory wetland bird species potentially present within the PEZ (six of which may also occur within both WA-285-P and WA-343-P). These species may migrate through the permit areas/PEZ to wetland habitats on the mainland and/or larger coastal islands (DEE 2017b). It is considered unlikely that WA-285-P or WA-343-P would provide any significant resources to support these species.

Observations of coastal seabirds in Timor-Leste were recorded from surveys undertaken between 2005-2010 (Trainor 2011). The surveys confirmed the presence of several species included in Table 4-4 such as *Calidris tenuirostris* (Great Knot) and *Limosa Lapponica baueri* (Bar-tailed Godwit).

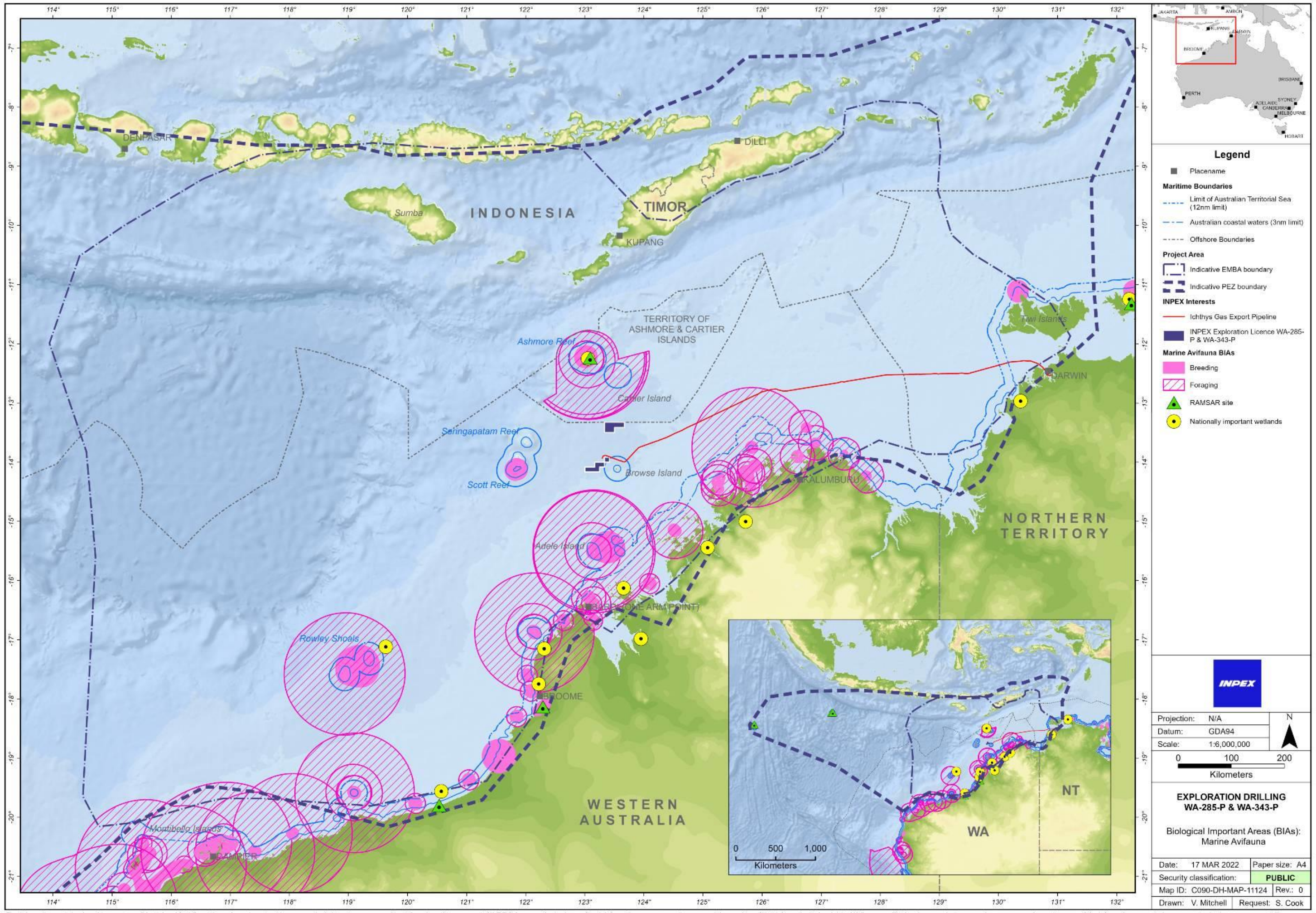

Figure 4-8: Biologically important areas associated with marine avifauna that intersect the PEZ and EMBA

4.10 Marine pests

Marine pests, or invasive marine species (IMS), are defined as non-native marine plants or animals that harm Australia's marine environment, social amenity or industries that use the marine environment; or have the potential to do so if they were to be introduced, established (that is, forming self-sustaining populations) or spread in Australia's marine environment (DAWR 2018). There are 60 known non-native marine species that have become established in WA waters. Most are temperate species, with only six that are exclusively tropical. The greatest number of introduced species is found in the south-west corner of WA (DoF 2016).

Not all marine species introduced into a new area become pests as not all of them will survive or may not manage to reproduce and establish a viable population. Many introduced marine species that establish self-sustaining populations cause no detectable harm. However, others have the potential to cause significant long-term economic, ecological and health consequences for the marine environment (DoF 2016).

Marine pests pose a major threat to the environment, economy and social amenity by disrupting ecological processes both directly (through predation or competition with native plants and animals) or indirectly (through habitat alteration). Once established, marine pests can rarely be eradicated, and their impacts are often long lasting (DAWR 2018).

Shallow water, coastal marine environments are most susceptible to the establishment of invasive populations, with most IMS associated with artificial substrates in disturbed shallow water environments such as ports and harbours (e.g. Glasby et al. 2007; Dafforn et al. 2009a, 2009b). The main supply bases supporting the exploration drilling activity in WA-285-P and WA-343-P are Broome, Darwin and Dampier described in Section 4.11.5 including a summary of their IMS status.

Within WA and NT waters the marine pest, *Didemnum perlucidum* (white colonial sea squirt) is widely established in many ports, marinas and other locations (Smale & Childs 2012; Dias et al. 2016; DPIRD 2021). *D. perlucidum* has been recorded in natural and artificial marine environments in WA from Busselton to Broome and the NT in Darwin and surrounding coastal waters (Muñoz & McDonald 2014.) First identified in WA in 2010, further monitoring confirmed the presence of separate populations along approximately 2,800 km of WA coastline. This ascidian can survive temperatures between 15 and 30 °C and has been recorded at depths of up to 8 m, however, it is commonly found in the upper 1–3 m of the water column (Muñoz & McDonald 2014).

Eradication of this pest has not been possible and the DPIRD manages *Didemnum perlucidum* only at the Montebello Islands where it is known to not have become established.

4.11 Socioeconomic and cultural environment

4.11.1 World heritage areas

No world heritage areas were identified as overlapping WA-285-P, WA-343-P or the PEZ.

4.11.2 National heritage places

The West Kimberley

The West Kimberley was included on the National Heritage List in 2011 and has numerous values which contribute to the significance of the property, including indigenous, historic, aesthetic, cultural and natural heritage values (DAWE 2022q). The West Kimberley is characterised by a diversity of landscapes and biological richness found in its cliffs, headlands, sandy beaches, rivers, waterfalls and islands.

4.11.3 Fishing

Commercially significant fish stocks, considered to be key indicator species, that may be present in WA-285-P and WA-343-P are shown in Table 4-6, including spawning and aggregation times. These species may be present in the permit areas; however, given the water depth and absence of suitable habitats they are considered not likely to spawn or aggregate in the deep waters of WA-285-P or WA-343-P. Preferred spawning and aggregation areas for these species include shallow coastal habitats, reefs and headlands and around estuaries.

Table 4-6: Commercially significant fish species

Key commercial fish species	Spawning/aggregation times
Goldband snapper (*Pristipomoides multidens*)	Goldband snapper typically occur in 50–200 m water depths, and often concentrated in depths from 80–150 m. They spawn throughout their range (rather than aggregating at specific locations) during November to May (extended peak spawning period).
Narrow-barred spanish mackerel (*Scomberomorini commerson)*	Spanish mackerel occur in continental shelf waters and congregate in coastal waters around reefs, shoals and headlands to feed and spawn, occurring typically in water depths from 1-50 m. They form spawning schools around inshore reefs with peak spawning period of September to January.
Rankin cod (*Epinephelus multinotatus*)	Rankin cod typically occur in water depths of 10–150 m. They spawn throughout their range (rather than aggregating at specific locations) during June to December and March (peak spawning period August to October.
Red emperor (*Lutjanus sebae*)	Red emperor typically occur in 10–180 m water depths, and are often concentrated in depths from 60–120 m. They spawn throughout their range (rather than aggregating at specific locations) during September to June (with bimodal peaks from September to November and January to March).
Bluespotted emperor (*Lethrinus erythracanthus*)	Blue spotted emperor typically occur in water depths of 5–110 m. They spawn throughout their range (rather than aggregating at specific locations) during July to March (extended peak spawning period).

Commercial fisheries– Australian waters and external Australian territories

Within the PEZ, five Commonwealth-managed fisheries have the potential to operate, with three of these overlapping both WA-285-P and WA-343-P, as summarised in Table 4-7.

In addition to the Commonwealth-managed fisheries, 38 State/Territory-managed commercial fisheries have the potential to operate within the PEZ. Of these, five fishery boundaries overlap with the permit areas (Table 4-8). Fisheries highlighted in bold in the below tables have potential fishing grounds that overlap with WA-285-P and WA-343-P. This does not mean that they are currently active within the exploration permit area; however, there is a potential that they may be active in the future.

Table 4-7: Commonwealth-managed commercial fisheries (AFMA-managed)

Commercial fishery (BOLD denotes overlap with permit areas)	Fishery summary
North West Slope Trawl Fishery	The North West Slope Trawl Fishery targets scampi (*Metanephrops australiensis*) and deepwater prawn. The fishery is located in deep water from the coast of the Prince Regent National Park to Exmouth between the 200 m depth contour to the outer limit of the Australian Fishing Zone (AFMA 2022a; Patterson et al. 2021). Six vessels operated in the 2019–20 season with a total catch of 111.5 tonnes, up from 67.4 tonnes in 2018–19. Scampi made up approximately 65% of the total catch in 2019–20, with the rest made up of various finfish and other crustaceans (Patterson et al. 2021). It is the only active fishery in the vicinity of WA-285-P and WA-343-P, with reportedly low negligible trawl-fishing in the Ichthys field. The highest levels of fishing intensity (hours per km^2) are undertaken approximately 350 km to the south-west of the permit areas.
Western Tuna and Billfish Fishery	The Western Tuna and Billfish Fishery targets bigeye tuna (*Thunnus obesus*), yellowfin tuna (*Thunnus albacares*), broadbill swordfish (*Xiphias gladius*) and striped marlin (*Tetrapturus audax*). The fishery targets areas of reef which are present within the PEZ and mainly use longline fishing gear to catch the targeted species. The Billfish Fishery covers the sea area west from the tip of Cape York in Queensland, around WA, to the border between Victoria and South Australia. Fishing occurs in both the Australian Fishing Zone and adjacent high seas. In recent years, fishing effort has concentrated off south-west WA (Patterson et al. 2021) with no fishing occurring near the permit areas. The fishery also includes the waters surrounding Christmas Island and the Cocos (Keeling) Islands. Fishing for tuna and tuna-like species in waters outside 12 nm of the Christmas Island and Cocos (Keeling) Islands' fisheries is managed by DPIRD under the Western Tuna and Billfish Fishery Management arrangements (AFMA 2021). In the fishery there are currently 95 vessels with statutory fishing rights (AFMA 2022b). However, since 2005 fewer than 5 vessels have been active in the fishery each year (Patterson et al. 2021).
Western Skipjack Tuna Fishery	The Western Skipjack Tuna Fishery covers the waters surrounding WA out to 200 nm from the coast. The fishery targets the skipjack tuna (*Katsuwonus pelamis*) and employs the purse seine, pole and line, and longline methods as its techniques. Although 14 permits are in place, the fishery is not currently active with no fishing in the Western Skipjack Tuna Fishery since 2008/2009 (AFMA 2022c; Patterson et al. 2021).

Commercial fishery **(BOLD denotes overlap with permit areas)**	**Fishery summary**
Southern Bluefin Tuna Fishery	The Southern Bluefin Tuna Fishery covers Australian waters out to 200 nm from the coast. There are 84 statutory fishing right owners in the fishery. This fishery is managed under a quota system to ensure the species is not subject to overfishing. Commercial fishers mainly use the purse seine fishing method to catch southern bluefin tuna (*Thunnus maccoyii*), with the fish being towed closer inshore and transferred to permanent floating pontoons. Since 2011, most fishing has occurred in the east of the Great Australian Bight, closer to Port Lincoln, resulting in shorter towing distances to bring the fish to aquaculture farms for growing before harvest (Patterson et al. 2021). The major landing port is Port Lincoln in South Australia (AFMA 2022d) and therefore does not overlap the PEZ or either permit area. No catch is taken from the NWS.
Northern Prawn Fishery	The Northern Prawn Fishery targets banana prawns (*Fenneropenaeus merguiensis, F. indicus*) tiger prawns (*Penaeus esculentus, P. semisulcatus*) and endeavour prawns (*Metapenaeus endeavouri, M. ensis*) in northern Australian waters (Patterson et al. 2021). The fishery occasionally operates from Cape York in Queensland to Cape Londonderry in WA and is predominantly active in the shallower waters of the PEZ with the highest catches taken offshore from mangrove forests, which act as juvenile nursery areas (Patterson et al. 2021). The fishery does not overlap WA-285-P or WA-343-P. To manage the fishery, there are 2 fishing seasons (April—June and August—November). There are currently 52 vessels with fishing rights in the fishery (maximum number vessels at one time) and bottom trawl fishing gear is used in this fishery (AFMA 2022e). Total catch in 2020 was 4,767 tonnes, comprising 4,653 tonnes of prawns and 114 tonnes of byproduct species (predominantly squid, bugs and scampi) (Patterson et al. 2021).

Table 4-8: State/Territory-managed commercial fisheries (WA DPIRD/NT DITT)

Commercial fishery **(BOLD denotes overlap with permit areas)**	**Fishery summary**
Northern Demersal Scalefish Managed Fishery (WA) Area 2 (Area 1 & 2 overlaps PEZ but not permit areas)	The Northern Demersal Scalefish Managed Fishery is primarily a trap-based fishery which targets red emperor (*Lutjanus sebae*) and gold band snapper (*Pristipomoides multidens*). The fishery operates off the north-west coast of WA in the waters east of longitude 120°E and overlaps the PEZ. There are currently 11 licences in Area 2 and the value of the fishery is estimated at $5-10 million (Gaughan & Santoro 2021).

Commercial fishery **(BOLD denotes overlap with permit areas)**	**Fishery summary**
Mackerel Managed Fishery (WA) Area 1 (Area 2 overlaps PEZ but not permit areas)	The Mackerel Managed Fishery uses near-surface trolling gear from vessels in coastal areas around reefs, shoals and headlands (WAFIC 2022a). The fishery targets narrow-barred Spanish mackerel (*Scomberomorus commerson*) and lands over 80% of the annual large pelagic catch in WA. There are currently 48 licences in the fishery with 14 active in the Kimberley area (Area 1) (Gaughan & Santoro 2021).
North Coast Shark Fishery (Cwlth/WA) Northern Zone (Southern Zone overlaps PEZ but not permit areas)	The northern shark fisheries comprise the state-managed WA North Coast Shark Fishery in the Pilbara and western Kimberley (closed since 1998), and the Joint Authority Northern Shark Fishery in the eastern Kimberley. The primary fishing methods used are pelagic gillnets and longlines, and most activity and catch occur in waters off the NT (Patterson et al. 2021). Target species of the northern shark fisheries included the sandbar (*Carcharhinus plumbeus*), hammerhead (*Sphymidae* spp.), blacktip (*C. limbatus*) and lemon sharks (*Negaprion brevirostris*) (AFMA 2022f). The Joint Authority Northern Shark Fishery has not been active since 2008/2009 to enable recovery of shark species (AFMA 2022f).
Pearl Oyster Managed Fishery (WA) Zone 3 (Zones 1 and 2 overlap PEZ but not permit areas)	The WA Pearl Oyster Managed Fishery is the only remaining significant wild-stock fishery for pearl oysters in the world. It is a quota-based, dive fishery operating in the shallow coastal waters along the NWS (WAFIC 2022b). The main fishing grounds (Zone 2) are off Eighty Mile Beach (Gaughan & Santoro 2021). In 2019, the catch was taken in Zone 2 only with no fishing in Zones 1 or 3. The number of wild-caught pearl oysters was 611,816 harvested over 14,022 dive hours (Gaughan & Santoro 2021).
West Coast Deep Sea Crustacean Fishery (WA)	The West Coast Deep Sea Crustacean Fishery operates using baited pots in a long-line formation in the shelf edge waters > 150 m depth (Gaughan & Santoro 2021). The catch in 2019 was 153.2 tonnes dominated by crystal (snow) crabs (*Chionoecetes opilio*) with the majority sold live to Asian markets (Gaughan & Santoro 2021).
Trochus Fishery (WA)	The Trochus Fishery is a small fishery based on a single target species (*Trochus niloticus*) harvested by hand from King Sound and the Buccaneer Archipelago. The fishery is operated by the Bardi Jawi and Mayala Aboriginal communities (Gaughan & Santoro 2021). Trochus are found on reef tops and are harvested at low tide. The annual harvest in the past decade has ranged between 2 and 15 tonnes with the product sold locally and overseas (WAFIC 2022c).

Commercial fishery **(BOLD denotes overlap with permit areas)**	**Fishery summary**
Kimberley Prawn Managed Fishery (WA)	The Kimberley Prawn Managed Fishery predominantly target banana prawns (*Penaeus merguiensis*) and catch also includes tiger prawns (*Penaeus esculentus*), endeavour prawns (*Metapenaeus endeavouri*) and western king prawns (*Penaeus latisulcatus*). The fishery operates from the north eastern boundary of the Exmouth Gulf Prawn Fishery to Cape Londonderry, in the PEZ (WAFIC 2022d). In 2019 the total prawn landings were 100 tonnes the lowest catch on record (Gaughan & Santoro 2021).
Specimen Shell Managed Fishery (WA)	The Specimen Shell Managed Fishery is based on the collection of individual shells for the purposes of display, collection, cataloguing, classification and sale. Approximately 200 different species of Specimen Shell are collected generally by hand in shallow coastal waters (Gaughan & Santoro 2021). The fishery currently has 31 licences with a maximum of 4 divers allowed in the water per licence at any one time. Total catch in 2019 was 7,232 shells. While the fishery covers the entire WA coastline, there is some concentration of effort in areas adjacent to population centres in the PEZ such as Broome.
South West Coast Salmon Managed Fishery (WA)	South West Coast Salmon Managed Fishery targets WA salmon (*Arripis truttaceus*) and in 2019 the total catch was 147.8 tonnes using beach seine nets (Gaughan & Santoro 2021). In 2015 and 2016 very large schools of salmon were observed in south-western waters and as far north as Exmouth, which is further north than ever previously reported.
North Coast Crab Fishery (Including Kimberley Crab and Pilbara Crab) (WA)	The North Coast Crab Fishery is a trap-based fishery which targets blue swimmer crabs (*Portunus pelagicus*) in the Pilbara (the Pilbara Crab Managed Fishery) and mud crabs (*Scylla serrata*) in the Kimberley (the Kimberley Crab Managed Fishery). Catch rates in 2019 were 19.3 tonnes for blue swimmer crabs and 7.4 tonnes for mud crabs (Gaughan & Santoro 2021).
Marine Aquarium Fish Fishery (WA)	This Marine Aquarium Fish Fishery is typically more active in coastal waters south of Broome with higher levels of effort around the Capes region, Perth, Geraldton, Exmouth, Dampier and Broome (Gaughan & Santoro 2021). The fishery resource includes more than 1,500 species of marine aquarium fishes under the *Marine Aquarium Fish Managed Fishery Management Plan 2018.* Operators are also permitted to take coral, live rock, algae, seagrass and invertebrates. Ten out of twelve licences were active in 2019 with a total catch of 69,446 fishes, predominantly the Scribbled Angelfish (*Chaetodontoplus duboulayi*) (Gaughan & Santoro 2021).

Commercial fishery **(BOLD denotes overlap with permit areas)**	**Fishery summary**
Hermit Crab Fishery (WA)	The Hermit Crab Fishery specifically targets the Australian land hermit crab (*Coenobita variabilis*) for the domestic and international live pet trade. The fishery operates throughout the year and is one of two land-based commercial fisheries in WA. The fishery is currently permitted to fish in waters north of Exmouth Gulf. There was only one active licence in 2019 with a total catch of < 60,000 crabs (Gaughan & Santoro 2021).
Broome Prawn Managed Fishery (WA)	In 2019, extremely low fishing effort occurred in the Broome Prawn Managed Fishery as only one boat undertook trial fishing to investigate whether catch rates were sufficient for commercial fishing. This resulted in negligible landings of western king prawns (*Penaeus latisulcatus*) (Gaughan & Santoro 2021).
Abalone Managed Fishery (WA) Northern Zone/Area 8 overlaps PEZ	The Abalone Managed Fishery includes the West Coast Roe's Abalone (*Haliotis roei*) resource and the South Coast Greenlip (*H. laevigata)* / Brownlip (*H. conicopora*) Abalone resource. Roe's abalone is found in commercial quantities from the South Australian/ WA border to Shark Bay. The commercial fishery harvest method is a single diver working off a 'hookah' (surface-supplied breathing apparatus) using an abalone 'iron' to prise the shellfish off rocks (WAFIC 2022e). The fishery operates in shallow coastal waters coinciding with abalone distributions (Gaughan & Santoro 2021). Although the area of the fishery overlaps the permit areas, no fishing effort occurs there given the water depth, water temperature and lack of suitable habitat.
Nickol Bay Prawn Managed Fishery (WA)	The Nickol Bay Prawn Managed Fishery operates along the western part of the NWS and predominantly target banana prawns (*Penaeus merguiensis*) (WAFIC 2022d). Total catch in 2019 was 254 tonnes of which 216 tonnes were banana prawns (Gaughan & Santoro 2021).
Pilbara Trap Managed Fishery and Pilbara Fish Trawl Interim Managed Fishery (WA)	The main species landed by the Pilbara Trap Managed Fishery and Pilbara Fish Trawl Interim Managed Fishery are blue spotted emperor (*Lethrinus punchtulatus*), red emperor (*Lutjanus sebae*) and rankin cod (*Epinephelus multinotatus*). Of the total commercial catches of demersal scalefish in the Pilbara in 2019 (2,980 tonnes), 72% (2,152 tonnes) were landed by the trawl sector and 23% (680 tonnes) taken by the trap sector with the remaining 5% (148 tonnes) taken by the line sector – see below Pilbara Line Fishery (Gaughan & Santoro 2021).

Commercial fishery **(BOLD denotes overlap with permit areas)**	**Fishery summary**
Pilbara Line Fishery (WA)	The Pilbara Line Fishery uses a drop line fishing method. The fishery is made up of 9 fishing boat licences allowing them to fish for any nominated 5-month block period during the year (WAFIC 2022f). The indicator species blue spotted emperor (*Lethrinus punchtulatus*), red emperor (*Lutjanus sebae*) and rankin cod (*Epinephelus multinotatus*). and ruby snapper (*Etelis carbunculus*) are used to assess stock status. In 2019, 148 tonnes were landed. (Gaughan & Santoro 2021).
Kimberley Gillnet and Barramundi Fishery (WA)	The Kimberley Gillnet and Barramundi Fishery extends from the WA/NT border to the northern end of Eighty Mile Beach, covering the river systems and tidal creek systems of the Cambridge Gulf, the Ria coast of the northern Kimberley, King Sound (Gaughan & Santoro 2021). The fishery targets barramundi (*Lates calcarifer*) and is limited to four licences. Fishing is now prohibited between the southern boundary to north of Willie Creek and in King Sound. Barramundi catch in 2019 was 47 tonnes comprising 64% of the fishery total catch with the remainder comprising of Threadfin, Tripletail, Black Jewfish and sharks (Gaughan & Santoro 2021).
Onslow Prawn Managed Fishery (WA)	The Onslow Prawn Fishery predominantly targets banana prawns (*Penaeus merguiensis*) but also catches tiger prawns (*Penaeus esculentus*), endeavour prawns (*Metapenaeus endeavouri*) and western king prawns (*Penaeus latisulcatus*) (WAFIC 2022d). Area 3 of the fishery slightly overlaps the PEZ; however, areas trawled in 2019 do not overlap the PEZ with total landings in 2019 less than 50 tonnes undertaken by one boat over 28 days of fishing effort (Gaughan & Santoro 2021).
Timor Reef Fishery (NT)	The Timor Reef Fishery primarily targets the higher-valued gold-band snapper (*Pristipomoides multidens*) and other Pristipomoides species. Significant quantities of red snappers (*Lutjanus malabaricus, L. erythropterus*), red emperors (*L. sefcae*) and cods (Family Serranidae) are also harvested. In 2018, 382 tonnes of gold-band snapper and 391 tonnes of red snapper were landed (AFMA 2022f). The fishery operates from north-east of Darwin to the WA/NT border and to the outer limit of the Australian Fishing Zone (NTSC 2022a).
Demersal (multigear) Fishery (NT)	The Demersal (multigear) Fishery targets mainly red snappers (*Lutjanus malabaricus, L. erythropterus*) and gold-band snappers (*Pristipomoides spp.).* Drop lines, traps and trawl are the main gear types used in the fishery and catch data recorded 2526 tonnes of red snapper landed in 2018 (AFMA 2022f). The fishery extends 15 nm from the LWM to the outer boundary of the Australian Fishing Zone (NTSC 2022b).

Commercial fishery (BOLD denotes overlap with permit areas)	**Fishery summary**
Barramundi Fishery (NT)	The Barramundi Fishery extends from the high water mark out to 3 nm and targets barramundi (*Lates calcarifer*) and king threadfin (*Polydactylus macrochir*) using gillnets, with the season running from 1 February to 30 September. The area covered by the fishery covers some parts of the PEZ; namely, around the Tiwi Islands. According to the Northern Territory Seafood Council (NTSC), many areas are excluded from the fishery defined by fishery closure lines, protection zones and various National Parks and MPs (NTSC 2022c).
Bait Net Fishery (NT)	Commercial fishers within the Bait Net Fishery are allowed to take all fish for use as bait except barramundi, threadfin salmon, Spanish mackerel or mud crab. Commercial fishing for bait is allowed from the high-water mark to the 3 nm seaward of the LWM but excluding Darwin Harbour and Shoal Bay. The fishery is currently restricted to two licences which are both allocated (NTG 2022a).
Coastal Net Fishery (NT)	The Coastal Net Fishery targets a range of species, particularly mullet (*Mugil* spp.), blue threadfin (*Eleutheronema tetradactylum*), shark and queenfish (*Scomberoides commersonnianus*). As with the Coastal Line Fishery, the Coastal Net Fishery operates inshore, extending from the high-water mark out to 3 nm. There are five current licences with mullet being the primary species taken in the fishery (NTG 2022b).
Coastal Line Fishery (NT)	The NT Coastal Line Fishery mainly targets black jewfish (*Protonibea diacanthus*) and golden snapper (*Lutjanus johnii*). The fishery extends along the NT coast between the high-water mark and 15 nm out from the LWM (NTG 2022c). The western zone extends from the WA border to the Cobourg Peninsula. It is restricted to 52 licences. The main species taken are black jewfish and golden snapper with the total catch limited to 145 tonnes and 4.5 tonnes respectively (NTG 2022c)
Trepang Fishery (NT)	The NT Trepang Fishery area extends from the NT high-water mark out to 3 nm. There are 6 licences in the Trepang Fishery, with only one or two boats active over the past few years. Trepang are typically harvested by hand from the intertidal and subtidal zones within the PEZ. The main species targeted is the sandfish (*Holothuria scabra*), commonly found in coastal areas with soft sediments and seagrass beds (NTSC 2022d).
Aquaculture (NT)	The two major aquaculture activities include Pearl Oyster (*Pinctada maxima*) culture and Barramundi farming (*Lates calcarifer*). Other products include sea cucumber (trepang), giant clams and freshwater plants. Sea cucumber 'ranching' occurs on Goulburn Island and Groote Eylandt, with hatchery-produced juveniles used to restocked suitable areas at sea (NTSC 2022e).

Commercial fishery **(BOLD denotes overlap with permit areas)**	**Fishery summary**
Aquarium Fishery (NT)	The Aquarium Fishery extends from the NT inland estuarine and marine waters out to the outer boundary of the Australian Fishing Zone, excluding Aboriginal sacred sites and other closed areas. The fishery targets freshwater and marine species including fish, plants and invertebrates using hand collections or small scoop nets. In 2016, there were 11 licences with only 3 boats active. (NTSC 2022f).
Jigging Fishery (NT)	The Jigging Fishery is currently closed.
Mollusc Fishery (NT)	The Mollusc Fishery operates in intertidal waters from the high-water mark out to the low water mark. Molluscs are collected by hand and only shellfish can be taken with no collection of pearl oysters or cephalopods allowed. There is only one commercial licence allocated by the NT Government (NTG) (NTG 2022d).
Mud Crab Fishery (NT)	The Mud Crab Fishery targets mud crabs (*Scylla serrata*). The fishery operates in NT tidal waters year-round but most activity stops during the wet season (NTSC 2022g). As of 2016, 49 licences were active across 35 operators, with most working from a single dinghy (NTSC 2022g).
Offshore Net and Line Fishery (NT)	The Offshore Net and Line Fishery targets blacktip sharks (*Carcharhinus tilstoni*, *C. limbatus* and *C. sorrah*) and grey mackerel (*Scomberomorus semifasciatus*) (AFMA 2022f). The fishery extends from the NT high water mark out to the Australian Fishing Zone. However, most fishing occurs in the coastal zone within 12 nm of the coast, and immediately offshore in the Gulf of Carpentaria (NTG 2022e). The 2018 landings comprised of 42 and 499 tonnes of blacktip sharks and grey mackerel respectively (AFMA 2022f).
Pearl Oyster Fishery (NT)	The Pearl Oyster Fishery extends from the NT high water mark to the outer boundary of the Australian Fishing Zone. A total of 138,000 oysters can be collected by hand only each year (NTG 2022f). There are currently 5 licences in the fishery.
Spanish Mackerel Fishery (NT)	The Spanish Mackerel Fishery targets narrow-barred Spanish mackerel (*Scomberomorus commerson*) within Territory waters from the high-water mark out to the outer boundary of the Australian Fishing Zone; however, most effort is generally focused around reefs, headlands and shoals. The fishery is restricted to 15 licences and most Spanish mackerel are caught off the western and eastern mainland coasts and near islands including Bathurst Island in the PEZ (NTG 2022g).

Commercial fishery **(BOLD denotes overlap with permit areas)**	**Fishery summary**
Small Pelagic Developmental Fishery (NT)	The Small Pelagic Developmental Fishery targets Blacktip sharks (*Carcharhinus tilstoni*, *C. limbatus* and *C. sorrah*). There are currently three active licences with a commercial catch of 0.1 tonnes reported in 2017 (NTG 2019).
Fishing Tour Operator Fishery (NT)	Commercial fishing tour operators are managed by the NTG and operate under specific licence conditions including reporting of catch and effort statistics. The fishery operates in non-tidal and tidal NT waters to the outer limit of the Australian Fishing Zone generally in areas that are accessible to the general public. They predominately operate near to population centres. The most common species include barramundi, golden snapper, stripey snapper, saddletail snapper and grass emperor caught primarily using hook and line (NTG 2019).
Cocos (Keeling) Islands Marine Aquarium Fish Fishery	The Cocos (Keeling) Islands Marine Aquarium Fishery covers waters of the Australian Fishing Zone within the 12 nm territorial waters of Cocos (Keeling) Islands, excluding the waters of North Keeling National Park and the AMP. The fishery is managed by WA DPIRD and is the only regulated fishery operating within the 12 nm boundary around the Cocos (Keeling) Islands (Hourtson 2010). The target species is the Yellowheaded Angelfish (*Centropyge joculator*) which is endemic to the Cocos (Keeling) Islands and Christmas Island (Gaughan & Santoro 2021). The angelfish are collected using hand or scoop net or seine net of specific dimensions. There is only one licence issued for the fishery and catch data is not reportable due to confidentiality provisions (Gaughan & Santoro 2021).
Christmas Island Line Fishery	The Christmas Island Line Fishery operates within the 12 nm territorial waters of Christmas Island and is managed by WA DPIRD on behalf of the Commonwealth government. The fishery primarily targets pelagic species, mainly wahoo (*Acanthocybium solandri*) and yellowfin tuna (*Thunnus albacares*) however demersal fishing activities are also undertaken for mainly deepwater snappers (Gaughan & Santoro 2021). The commercial catch for the fishery usually consists of catch data from only two vessels and the exact catch data in many years is not reportable due to confidentiality provisions. The total reported catch for this fishery has been less than 10 tonnes per annum over the last ten years (Gaughan & Santoro 2021).

Commercial fisheries – International waters

Within the international waters of the PEZ, Indonesian capture fisheries contribute significantly to the national economy’s income, foreign exchange, and employment. In 2010, the industry produced 5.4 million tons of fish. To manage the fishery areas, the Indonesian government established 11 fishery management areas covering Indonesia’s territorial sea and EEZ (ADB 2014).

Although there are 11 fisheries management areas, lack of enforcement and lack of awareness of the need for sustainable fisheries management have resulted in the degradation of fish stocks in several areas. The use of unsuitable fishing gear has further declined fish stocks in certain areas, especially the coastal zone, which is exploited by 85% of Indonesian fishers. Additionally, foreign fleets threaten fisheries, although it is difficult to obtain accurate data on the number of vessels and their mode of operations (ABD 2014).

As described in Section 4.5.1 approximately 65% of the East Nusa Tenggara regional fisheries production comes from the Savu Sea (Perdanahardja & Lionata 2017) where unsustainable fisheries practices are known to pose a threat to marine fauna in the region.

Recreational fishing

There is no evidence that recreational fishing occurs within WA-285-P or WA-343-P due to the distance from land and a lack of features of interest. A wide range of recreational activities do occur within the NWMR and NMR. Recreational fishing activities peak in winter and are concentrated in coastal waters along the Kimberley and NT coastlines, generally around the population centres of Broome, Wyndham and Darwin. Fishing charters operate along parts of the mainland coast, including some locations within the PEZ, such as the Tiwi Islands and Flat Top Bank, all of which are readily accessible from Darwin. Some of the recreationally important species of the coastal areas include barramundi (*Lates calcerifer*), mangrove jack (*Lutjanus argentimaculatus*), jewfish (*Argyrosomus hololepidotus*) and bream.

Fishing methods typically involve rod and line gear and approximately three quarters of fish caught by fishing tour operators are released (NTG 2019). While the survivorship of released barramundi is high, the same is not true for reef-associated species, such golden snapper and black jewfish. Both species are susceptible to pressure-induced injuries (barotrauma), with the rate of injury and post-release mortality proportional to capture depth. Concerns regarding the impacts of barotrauma on reef fishes (and other factors) have led to the development of new management controls on the harvest of these species (NTG 2019).

Offshore islands, coral reef systems and continental shelf waters are increasingly targeted by fishing-based charter vessels (Gaughan & Santoro 2021). Extended fishing charters are known to operate during certain times of the year to fishing spots off the WA and NT coast, including Scott Reef, Tiwi Islands and Flat Top Bank.

Christmas Island and the Cocos (Keeling) Islands are popular tourist destinations for recreational fishing, snorkelling, and diving. Recreational and artisanal fishing are undertaken around the Cocos (Keeling) and Christmas Islands targeting both finfish and invertebrate species (Gaughan & Santoro 2021). Christmas Island recreational boat fishers troll for pelagic species including wahoo (*Acanthocybium solandri*), dog tooth tuna (*Gymnosarda unicolor*), yellowfin tuna (*Thunnus albacares*) and mahi mahi (dolphin fish) (*Coryphaena hippurus*) (DoF 2007). Recreational boat fishers target the near-shore waters around the Island by trolling using surface lures for giant trevally. Shore-based fishing is also popular with fishers mostly targeting rainbow runner (*Elagatis bipinnulata*) and giant trevally (*Caranx ignobilis*) off the rocky shoreline. Free diving for rock lobster is also a popular fishing activity on the limited fringing reefs around Christmas Island (DoF 2007).

Traditional fishing

Australian traditional fishing

Traditional fishing occurs along the majority of the Kimberley and NT coastline. The practice of traditional fishing includes taking turtles, dugong, fish and other marine life (DAWE 2022x). The EPBC Act Protected Matters database search (Appendix A; NIAA 2022) identified the following six IPAs:

- Balanggarra IPA (located in the Kimberley region near the WA border including Cape Londonderry)
- Bardi Jawi IPA (located on Dampier Peninsula)
- Dambimangari IPA (located in the Buccaneer Archipelago/Prince Regent area)
- Karajarri IPA (located at the northern end of Eighty Mile Beach)
- Marri-Jabin IPA and Thamurrurr Rangers (located around the Moyle and Little Moyle River area NT)
- Uunguu IPA (600 km north-east of Derby on the far north-west coast of the Kimberley)
- Yawuru IPA (located in Roebuck Bay).

These IPAs are all expected to have traditional fishing activities ongoing. Other non-designated areas along the WA and NT coastline may also be used for traditional fishing.

Aboriginal communities on the Tiwi Islands, such as Wurrumiyanga on Bathurst Island have been actively involved in managing their own sea turtle stocks in consultation with the NTG. Anecdotal evidence indicates that green turtles are harvested in the water, while eggs of any turtle species are taken periodically. Dugongs are also sometimes taken (DEWR 2006).

Indigenous harvest of traditional marine resources (e.g. turtles, whale sharks and dugong) adjacent to the NWMR is a pressure of potential concern for the carbonate bank and terrace system of the Sahul Shelf, the pinnacles of the Bonaparte Basin, and the Commonwealth waters surrounding Ashmore Reef and Cartier Island (DSEWPaC 2012a).

Indonesian traditional fishing

The Australian and Indonesian governments signed a memorandum of understanding (MoU) in 1974 (DSEWPaC 2012a) which permits fishing by Indonesian and Timorese fishers, using traditional fishing methods only, in an area of Australian waters in the Timor Sea. The MoU area, which has become known as the "MoU Box", covers Scott Reef and its surrounds, Seringapatam Reef, Browse Island, Ashmore Reef, Cartier Island and various banks and shoals (Figure 4-2).

The MoU requires fishers to use traditional sail-powered fishing vessels and non-motorised equipment, and prohibits them from taking protected species, such as turtles, dugongs and clams. Fishers target a range of animals, including trepang, trochus, reef fish and sharks. Indonesian fishing effort is high at Scott Reef and also takes place at Browse Island.

Although both permit areas fall within the MoU Box, due to the nature of traditional fishing activities, the actual fishing effort generally only occurs in the shallow subtidal / intertidal habitats of the reefs and islands within the PEZ.

Traditional Indonesian fishing effort is intense at Seringapatam Reef and Commonwealth waters in the Scott Reef complex. Depending on the intensity of effort and composition of catch, the extraction of living resources from these KEFs may affect trophic structures and ecological functioning (DSEWPaC 2012a).

Other traditional activities

As described in Section 4.4, several State and Territory reserves and MPs contain places of cultural and spiritual importance. The establishment of such places within the reserves and MPs will contribute to the conservation and protection of these important sites. The majority of these cultural heritage values occur on land (above the high-water mark) and are therefore considered not to be directly impacted by the petroleum activity described in this EP; however, some do have sea-related aspects.

4.11.4 Aquaculture

There are no aquaculture operations in WA-285-P or WA-343-P. Aquaculture development in the region is dominated by the production of pearls from the species *Pinctada maxima.* A large number of pearl oysters for seeding is obtained from wild stocks and supplemented by hatchery-produced oysters with major hatcheries operating at Broome and the Dampier Peninsular (Gaughan & Santoro 2021). The wild shell collection occurs in shallow coastal waters (WAFIC 2022b). All the leases are within 35 m diving depth. Pearl farm sites within the PEZ are located mainly along the Kimberley coast, particularly in the Buccaneer Archipelago, in Roebuck Bay and at the Montebello Islands.

Marine aquaculture initiatives in the Kimberley region include farming barramundi (*Lates calcarifer*) in the Cone Bay Kimberley Aquaculture Development Zone, situated approximately 200 km north-east of Broome comprising of 20 km^2 that was declared in 2014 (Gaughan & Santoro 2021).

A commercial pearl oyster hatchery and the Kimberley Training Institute aquaculture facility are located within the Broome Tropical Aquaculture Park (Gaughan & Santoro 2021). The Ardyaloon Hatchery is located on the Dampier Peninsula at One Arm Point and hatches the *Trochus niloticus* shell to create a commercially sustainable industry harvesting the shell.

An analysis by WorldFish has indicated that aquaculture will overtake capture fisheries as the major source of fish in Indonesia before 2030 (Phillips et al. 2015). By volume, Indonesian aquatic production is dominated by seaweeds due to the simple farming techniques required, low capital and material inputs, and short production cycles. However, by value, domestically consumed species such tilapia (*Oreochromis* spp.) and milkfish (*Chanos chanos*), together with export-orientated commodities such as shrimp and tuna, are of greater importance (Phillips et al. 2015).

4.11.5 Shipping and ports

Vessel tracking data from AMSA‘s Craft Tracking System (CTS) for January 2022 is presented in Figure 4-9. The CTS collects vessel traffic data from a variety of sources, including terrestrial and satellite shipborne Automatic Identification System (AIS) data sources. Figure 4-9 highlights the presence of commonly used transit routes in the vicinity of the permit areas used by supply vessels routinely supporting offshore developments in the Browse Basin including the INPEX Ichthys and Shell Prelude floating liquified natural gas (FLNG) facility. The major shipping lanes linking WA to Indonesia are situated over 180 km to the west of both permit areas (Figure 4-9).

The closest ports to WA-285-P and WA-343-P are Derby, Broome and Wyndham. These are small ports, exporting nickel, lead, zinc and cattle, and importing products to support their local communities. The Port of Broome provides supply facilities for the petroleum industry operating in the Browse Basin.

By comparison, the ports along the north-west and north coast, such as Onslow, Dampier, Cape Lambert, Port Hedland, and Darwin handle much larger tonnages of iron ore, and petroleum exports, with shipping routes throughout the region.

The main supply bases for vessels supporting the petroleum activity are Darwin, Broome and Dampier. As all vessels have the potential to act as vectors for marine pests to these ports, a brief description of the current and historical IMS status of these ports is provided below.

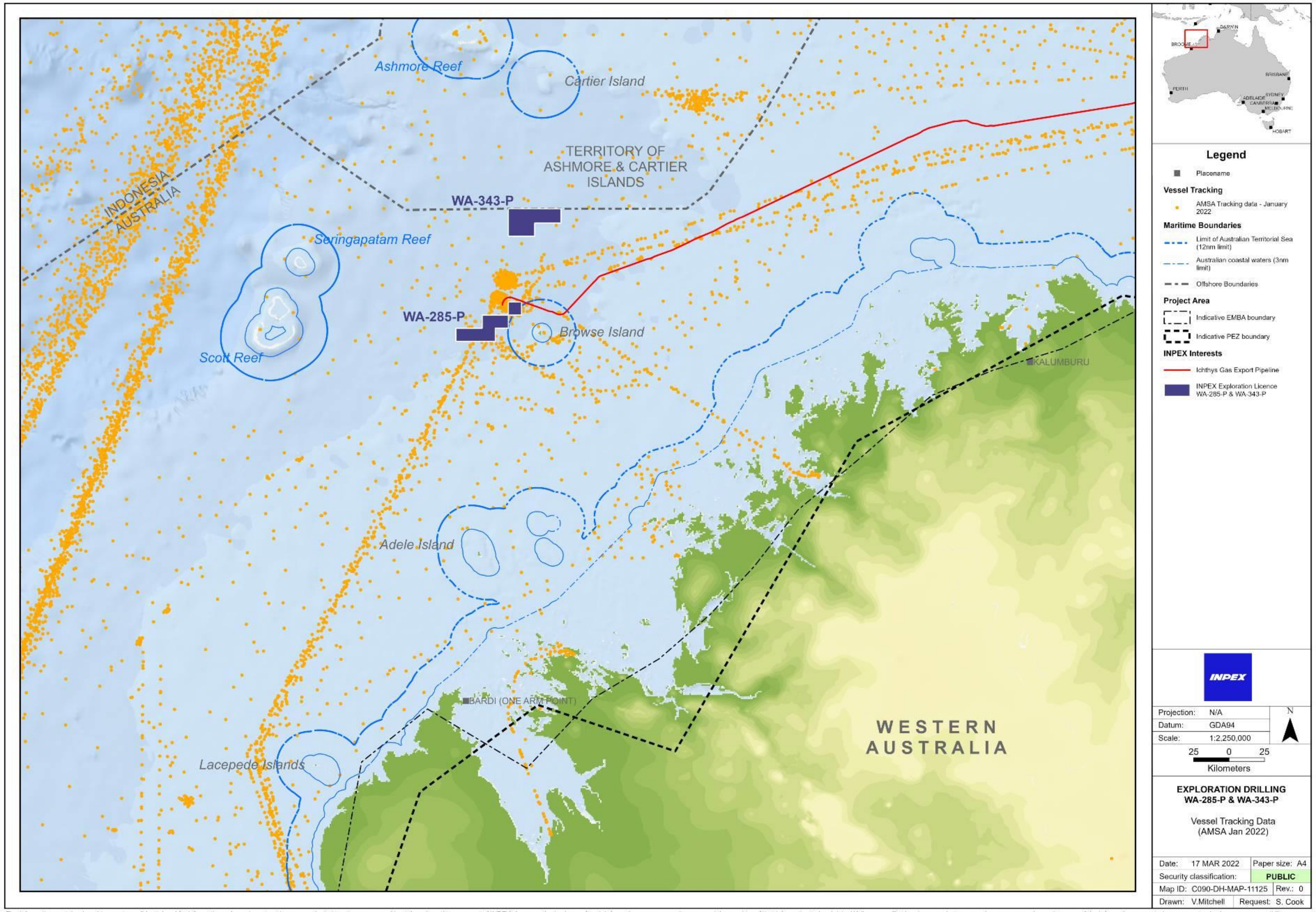

Figure 4-9: Vessel tracking data in the Browse Basin (January 2022)

Darwin Port

Darwin Port, located in Darwin Harbour in the NT, is a major service centre for the mining and energy sectors. Darwin Port operations consist of marine traffic of non-commercial vessels (e.g. recreational anglers) and trading vessels, including commercial ships carrying cargo and passengers, PSVs and AHSVs, tankers and bulk-cargo vessels.

A number of targeted marine pest monitoring programs have been executed in Darwin Port since 2010 (Cardno 2015, Golder Associates 2010), and through the course of these programs the following IMS have been detected; however, none of these are listed as noxious species by the NTG: *Magallana gigas* (presence of one shell valve) and *Caulerpa racemosa var. lamourouxii* (Golder Associates 2010) *Amphibalanus amphitrite* (barnacle), *Bugula neritina* (bryozoan) and the ascidians *Botryllus schlosseri, Botrylloides leachi* and *D. perlucidum* (Cardno 2015). While *M. gigas* was detected during a survey, as this was based on the presence of one shell valve, Golders Associates (2010) determined it was likely to be a discarded shell from oysters imported and purchased for human consumption and therefore its presence did not confirm this species had established in Darwin Port. *C. racemosa var. lamourouxii* is common in tropical and warm temperate seas and has previously been recorded in warmer waters in Australia including Darwin Harbour (Golders Associates 2010).

A marine pest monitoring program managed by NT Aquatic Biosecurity officers is currently ongoing. Artificial settlement units are located throughout Darwin Port, including on the INPEX Ichthys liquified natural gas (LNG) and liquified petroleum gas (LPG) jetties. These settlement units are photographed monthly and collected, replaced and analysed every four months.

In addition to monitoring program outcomes, in 1999 an outbreak of black stripped mussels was recorded in three Darwin Port marinas. Following, a national response to the outbreak this species was successfully eradicated from invaded locations (Ferguson 2000).

In summary, numerous IMS monitoring studies have been undertaken at Darwin Port with IMS identified. Therefore, Darwin Port is considered to be an operationally active environment rather than a pristine environment.

Broome Port

Broome Port is the largest deepwater port in the Kimberly region of WA and is managed by the Kimberley Ports Authority. Broome Port facilities comprise a single 650 m jetty from the shore to deep-water, with almost 600 m of berth space, which is designated into 12 berths. Aside from the main jetty, there are approximately 160 moorings in the port (Bridgwood and McDonald 2014). The port is the main fuel and container hub port for the Kimberley region, and in recent years its principal exports have been livestock and offshore drilling rig equipment and materials (Kimberley Ports Authority 2021).

Broome Port waters are dominated by the tidal regime of the region, with spring tidal range in excess of 9.5 m. Substrates within Broome Port are predominantly soft mud tidal flats but some rocky substrates do occur with large expanses of substrate exposed at low tide. Submerged artificial substrates include the steel jetty piles as well as the boat moorings, although most of these are intertidal. Areas of mangroves exist within and nearby to Broome Port, particularly in Dampier Creek to the north-east, and in Willie Creek directly to the north (Bridgwood and McDonald 2014).

At Broome Port, the presence of IMS is monitored through the WA DPIRD's State-wide Array Surveillance Program (SWASP) (Kimberley Ports Authority 2021). The SWASP program involves the deployment of passive settlement arrays to monitor for growth and shoreline searches to identify potential IMS with surveillance occurring in ports every six months.

Previous incursions of IMS reported at Broome Port include black-striped mussel (*Mytilopsis sallei*) on illegal Indonesian fishing boats (McDonald 2008) and the colonial sea squirt (*D. perlucidum*) first reported in WA waters in 2010 (DPIRD 2021).

In comparison to Darwin Port, less information is available with respect to IMS that may be present in Broome Port. However, from the information presented it can be concluded that IMS have been identified in Broome Port and therefore it is not considered as a pristine environment.

Dampier Port

Dampier Port is managed by the Pilbara Ports Authority with the main exports including iron ore, salt, LNG, anhydrous ammonia as well as project cargo, break bulk and general cargo. The port consists of ten port terminals with four separate navigational channels and includes inshore, relatively calm and turbid environments that are sheltered by the 42 islands of the Dampier Archipelago and Murujuga. Offshore areas of Dampier Port are influenced by clearer oceanic waters and rougher seas. With its variety of conditions, Dampier Port supports a wide range of marine habitat types including mangroves, rocky shores, sand and mud shores, macroalgal communities and coral reefs (Pilbara Ports Authority 2021).

Since 2016, Dampier Port has been part of the SWASP and undertakes surveillance every six months as part of the program. In comparison to Darwin Port and Broome Port, less information is available with respect to marine pests that may be present in Dampier Port. However, it is reasonable to conclude that given it is an operationally active port, it is not considered as a pristine environment.

4.11.6 Other industries

The existing INPEX Ichthys facility (subsea and on the surface) is present within WA-50-L (adjacent to WA-285-P and approximately 60 km south of WA-343-P) consisting of a subsea production system, CPF Explorer and FPSO Venturer.

The next closest operational production facility to the permit areas, is the Shell Prelude FLNG facility located approximately 25 km to the north-east of WA-285-P and approximately 50 km south of WA-343-P.

The North West Cable System (NWCS) is a purpose-built, submarine fibre cable system designed to serve Australia's onshore and offshore resources industry. The NWCS has been providing connectivity (high-speed data and voice communication services) to INPEX's Ichthys facility since 2017 when the NWCS became operational.

4.12 Summary of values and sensitivities

4.12.1 WA-285-P

Table 4-9: Particular values and sensitivities potentially within WA-285-P

Value and sensitivity	Description
Receptors that are considered socially important as identified during stakeholder engagement (including social and cultural heritage).	Fisheries (traditional and commercial).

<table>
<tr><th colspan="2">Value and sensitivity</th><th>Description</th></tr>
<tr><td colspan="2">Benthic primary producer habitat, defined by the Western Australian Environmental Protection Authority (WA EPA) Environmental Assessment Guideline No. 3 Environmental Assessment Guidelines for Protection of Benthic Primary Producer Habitat in Western Australia's Marine Environment as functional ecological communities that inhabit the seabed within which algae (e.g. macroalgae, turf and benthic microalgae), seagrass, mangroves, corals, or mixtures of these groups, are prominent components.</td><td>None identified within WA-285-P.</td></tr>
<tr><td colspan="2">Regionally important areas of high diversity (such as shoals and banks).</td><td>WA-285-P overlaps the continental slope demersal fish communities KEF.</td></tr>
<tr><td colspan="2">World heritage values of a declared World Heritage property within the meaning of the EPBC Act.</td><td>None identified within WA-285-P.</td></tr>
<tr><td colspan="2">National heritage values of a National Heritage place within the meaning of the EPBC Act.</td><td>None identified within WA-285-P.</td></tr>
<tr><td colspan="2">Ecological character of a declared Ramsar wetland within the meaning of the EPBC Act.</td><td>None identified within WA-285-P.</td></tr>
<tr><td colspan="2">Presence of a listed threatened species or listed threatened ecological community within the meaning of the EPBC Act.</td><td rowspan="2">A number of threatened species or migratory species have been identified as having the potential to transit through WA-285-P.
These have been categorised as marine fauna:
• marine mammals
• marine reptiles
• fishes and sharks
• marine avifauna.
Also refer to Appendix A (EPBC Act Protected Matters database search report – WA-285-P).</td></tr>
<tr><td colspan="2">Presence of a listed migratory species within the meaning of the EPBC Act.</td></tr>
<tr><td rowspan="2">Any values and sensitivities that exist in, or in relation to, part or all of:</td><td>a Commonwealth marine area within the meaning of the EPBC Act.</td><td>Productivity and diversity associated with planktonic communities and benthic communities.</td></tr>
<tr><td>Commonwealth land within the meaning of the EPBC Act.</td><td>None identified within WA-285-P.</td></tr>
<tr><td colspan="2">BIAs associated with EPBC-listed species.</td><td>The north eastern corner of WA-285-P overlaps the boundary of a 20 km internesting buffer at Browse Island which provides critical habitat for green turtles.</td></tr>
</table>

4.12.2 WA-343-P

Table 4-10: Particular values and sensitivities potentially within WA-343-P

<table>
<tr><th colspan="2">Value and sensitivity</th><th>Description</th></tr>
<tr><td colspan="2">Receptors that are considered socially important as identified during stakeholder engagement (including social and cultural heritage).</td><td>Fisheries (traditional and commercial).</td></tr>
<tr><td colspan="2">Benthic primary producer habitat, defined by the Western Australian Environmental Protection Authority (WA EPA) Environmental Assessment Guideline No. 3 Environmental Assessment Guidelines for Protection of Benthic Primary Producer Habitat in Western Australia's Marine Environment as functional ecological communities that inhabit the seabed within which algae (e.g. macroalgae, turf and benthic microalgae), seagrass, mangroves, corals, or mixtures of these groups, are prominent components.</td><td>None identified within WA-343-P.</td></tr>
<tr><td colspan="2">Regionally important areas of high diversity (such as shoals and banks).</td><td>WA-343-P overlaps the continental slope demersal fish communities KEF</td></tr>
<tr><td colspan="2">World heritage values of a declared World Heritage property within the meaning of the EPBC Act.</td><td>None identified within WA-343-P.</td></tr>
<tr><td colspan="2">National heritage values of a National Heritage place within the meaning of the EPBC Act.</td><td>None identified within WA-343-P.</td></tr>
<tr><td colspan="2">Ecological character of a declared Ramsar wetland within the meaning of the EPBC Act.</td><td>None identified within WA-343-P.</td></tr>
<tr><td colspan="2">Presence of a listed threatened species or listed threatened ecological community within the meaning of the EPBC Act.</td><td rowspan="2">A number of threatened species or migratory species have been identified as having the potential to transit through WA-343-P.
These have been categorised as marine fauna:
• marine mammals
• marine reptiles
• fishes and sharks
• marine avifauna.
Also refer to Appendix A (EPBC Act Protected Matters database search report – WA-343-P).</td></tr>
<tr><td colspan="2">Presence of a listed migratory species within the meaning of the EPBC Act.</td></tr>
<tr><td rowspan="2">Any values and sensitivities that exist in, or in relation to, part or all of:</td><td>a Commonwealth marine area within the meaning of the EPBC Act.</td><td>Productivity and diversity associated with planktonic communities and benthic communities.</td></tr>
<tr><td>Commonwealth land within the meaning of the EPBC Act.</td><td>None identified within WA-343-P.</td></tr>
<tr><td colspan="2">BIAs associated with EPBC-listed species.</td><td>There are no known BIAs or critical habitats associated with listed threatened species or migratory species that overlap WA-343-P.</td></tr>
</table>

4.12.3 PEZ

Table 4-11: Particular values and sensitivities potentially within the PEZ

Value and sensitivity	Description
Receptors that are considered socially important as identified during stakeholder engagement (including social and cultural heritage).	Fisheries (commercial, traditional and recreational).
Benthic primary producer habitat, defined by the Western Australian Environmental Protection Authority (WA EPA) Environmental Assessment Guideline No. 3 *Environmental Assessment Guidelines for Protection of Benthic Primary Producer Habitat in Western Australia's Marine Environment* as functional ecological communities that inhabit the seabed within which algae (e.g. macroalgae, turf and benthic microalgae), seagrass, mangroves, corals, or mixtures of these groups, are prominent components.	Benthic primary producer habitats are described in Section 4.9.2 and include the Commonwealth and state marine reserves and KEFs listed below.
Regionally important areas of high diversity (such as shoals and banks).	KEFs: • Continental slope demersal fish communities • Ancient coastline at 125 m depth contour • Ashmore Reef and Cartier Island and surrounding Commonwealth waters • Canyons linking the Argo Abyssal Plain with Scott Plateau • Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula • Carbonate bank and terrace system of the Sahul Shelf • Mermaid Reef and Commonwealth waters surrounding the Rowley Shoals • Pinnacles of the Bonaparte Basin • Seringapatam Reef and Commonwealth waters in the Scott Reef complex • Carbonate bank and terrace system of the Van Diemen Rise • Shelf break and slope of the Arafura Shelf • Tributary canyons of the Arafura Depression • Exmouth Plateau • Glomar Shoals. Benthic habitats: • Various banks and shoals, and coral reefs (Section 4.9.2) • Seagrasses (Ashmore Reef), Buccaneer Archipelago, dugong foraging BIA north of Broome and along the Indonesian coastline. Shoreline habitats:

<table>
<tr><th colspan="2">Value and sensitivity</th><th>Description</th></tr>
<tr><td colspan="2"></td><td>• Islands, mangroves and sandy beaches (Section 4.9.3).</td></tr>
<tr><td colspan="2">World heritage values of a declared World Heritage property within the meaning of the EPBC Act.</td><td>None identified within this area.</td></tr>
<tr><td colspan="2">National heritage values of a National Heritage place within the meaning of the EPBC Act.</td><td>The West Kimberley is identified as natural National Heritage Places (Section 4.11.2).</td></tr>
<tr><td colspan="2">Ecological character of a declared Ramsar wetland within the meaning of the EPBC Act.</td><td>Seven Ramsar sites (Section 4.6):
• Ashmore Reef National Nature Reserve
• Coburg Peninsula
• Eighty Mile Beach
• Hosnies Spring
• Pulu Keeling National Park
• Roebuck Bay
• The Dales.</td></tr>
<tr><td colspan="2">Presence of a listed threatened species or listed threatened ecological community within the meaning of the EPBC Act.</td><td rowspan="2">A number of threatened species or migratory species have been identified as having the potential to transit through the PEZ.
These have been categorised as marine fauna (Section 4.9.4):
• marine mammals
• marine reptiles
• fishes and sharks
• marine avifauna.
Also refer to Appendix A (EPBC Act Protected Matters database search report - PEZ).</td></tr>
<tr><td colspan="2">Presence of a listed migratory species within the meaning of the EPBC Act.</td></tr>
<tr><td rowspan="2">Any values and sensitivities that exist in, or in relation to, part or all of:</td><td>a Commonwealth marine area within the meaning of the EPBC Act.</td><td>Productivity and diversity associated with planktonic communities and benthic communities.</td></tr>
<tr><td>Commonwealth land within the meaning of the EPBC Act.</td><td>Commonwealth land identified includes Christmas Island National Park and Pulu Keeling National Park (Section 4.1.2) and Yampi Sound Training Area (Section 4.6.10).
Quail Island Bombing Range, Mt Goodwin Radar Site and Norforce Depot – Derby were also identified (Appendix A); however, these are not marine sensitivities and therefore are not discussed further.</td></tr>
<tr><td colspan="2">BIAs associated with EPBC-listed species.</td><td>A large number of BIAs are present within the PEZ including:
<u>Marine mammals</u>
• humpback whale migration route and aggregation/calving areas
• pygmy blue whale foraging and migration route
• dugong foraging at Ashmore Reef and near Broome</td></tr>
</table>

Value and sensitivity	Description
	• coastal dolphins breeding, calving and foraging areas. <u>Marine reptiles</u> Turtle nesting, internesting and adjacent foraging areas including Browse Island, Ashmore Reef, Cartier Island, Lacepede Islands, Sandy Islet (Scott Reef), Joseph Bonaparte Gulf and Tiwi Islands. <u>Fish and sharks</u> • whale shark foraging area • green sawfish BIA • KEFs associated with increased species diversity and abundance (i.e. continental slope demersal fish communities and the ancient coastline at 125 m depth contour). <u>Marine avifauna</u> • a number of resting and breeding areas associated with shoreline habitats (e.g. Adele Island, Ashmore Reef, Browse Island, Cartier Island, Sandy Islet (Scott Reef), Lacepede Islands and nearshore waters and islands of the WA and NT coastline) including nationally important wetlands (Section 4.6) • a large number of offshore foraging areas that are adjacent to these shoreline habitats.

5 STAKEHOLDER CONSULTATION

INPEX has been a member of the Australian business community since 1986 and during this time has engaged on a regular basis with stakeholders in WA and in federal jurisdictions on a broad range of activities. INPEX maintains a corporate webpage (http://www.inpex.com.au) to provide company and project-related information to the public. INPEX also participates in industry forums, conferences and community meetings in order to facilitate opportunities for meaningful engagement about current and future activities.

INPEX acknowledges the importance of consultation to ensure that persons who may be affected by a proposed activity ('relevant persons') are informed about the proposed activity and have the opportunity to advise INPEX of any functions, interests or activities that could be impacted by the proposed activity.

INPEX's awareness of the functions, interests or activities of relevant persons supports the development of management plans that consider and address any environmental, social or economic objections or claims about the proposed activity.

INPEX's process for stakeholder engagement (consultation) in the development and implementation of an EP and relevant management plans is shown in Figure 5-1 and further described in this section.

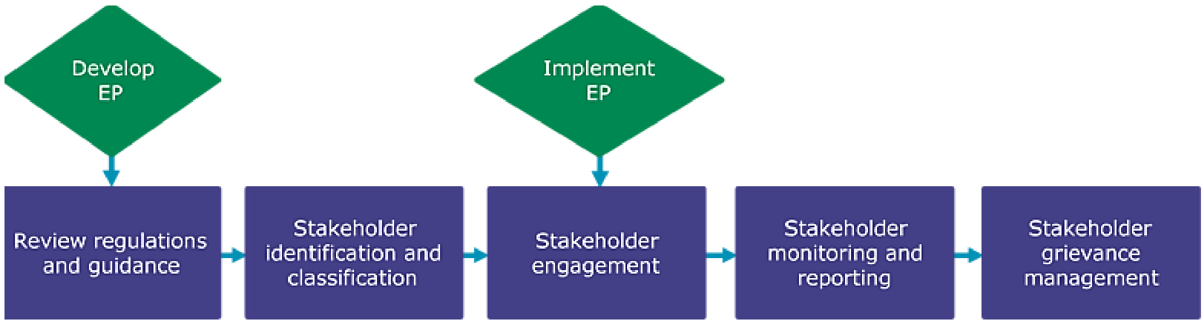

Figure 5-1: Process for stakeholder engagement (consultation) for development and implementation of an EP

5.1 Regulatory requirements and guidelines

As a first step in EP development, INPEX reviewed the following documents to prepare for stakeholder consultation on the proposed activity:

- Offshore Petroleum Greenhouse Gas Storage (Environment) Regulations
- NOPSEMA policies, guidance and information papers related to environment plan development, including:
  - PL1347 – Environment plan assessment policy – 19 May 2020
  - GL1721 - Environment plan decision making – 10 June 2021
  - GL1887 – Consultation with Commonwealth agencies with responsibilities in the marine area – 3 July 2020
  - GN1344 - Environment plan content requirements - 11 September 2020
  - GN1488 - Oil pollution risk management - 7 July 2021
  - GN1785 – Petroleum activities and Australian marine parks - 3 June 2020

  - GN1847 – Responding to public comment on environment plans – 11 September 2020
  - IP1411 - Consultation requirements under the OPGGS (E) Regulations 2009 - Rev 2 - 2014
- Guidance issued by relevant stakeholders (as known or provided to INPEX), including:
  - Australian Government Guidance: Offshore Petroleum and Greenhouse Gas Activities: Consultation with Australian Government agencies with responsibilities in the Commonwealth Marine Area
  - Australian Fisheries Management Authority (AFMA): Petroleum industry consultation with the commercial fishing industry
  - WA DPIRD: Guidance statement for oil and gas industry consultation with the Department of Fisheries
  - WA Department of Transport (WA DoT): Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements
- INPEX stakeholder engagement procedures and guidelines.

INPEX acknowledges its responsibility under the various legislative instruments and other guidance to ensure that relevant persons are appropriately identified and consulted in the development of its EPs and in the conduct of its offshore activities.

5.2 Stakeholder identification and classification

With an understanding of the general requirements and expectations for consultation, INPEX conducted stakeholder identification and classification activities.

As an initial exercise, 'relevant persons' were identified, then classified, to determine a suitable engagement priority and method. Key INPEX personnel undertook discussions to outline the requirement for engagement, established the context of the proposed activities, and identified relevant persons in accordance with Regulation 11A(1) of the OPPGS (E) Regulations and NOPSEMA's additional clarifications of Regulation 11A(1) as provided in Issues Paper IP1411 (NOPSEMA 2014).

INPEX treats stakeholder identification (and subsequent activities) as an iterative process whereby INPEX may become aware of relevant persons both during the process of consultation and also after the development and submission of an EP. INPEX acknowledges that relevant persons may be identified during an EP assessment period and also during the proposed activity.

5.2.1 Definition of 'relevant persons'/relevant stakeholders

In identifying relevant persons to be consulted on the proposed activity, INPEX prescribes to the definition provided under Subregulation 11A(1) of the OPGGS (E) Regulations, being:

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

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

c. *the Department of the responsible State Minister, or the responsible Northern Territory Minister*

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

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

5.2.2 Relevant activity

In determining who is a relevant stakeholder, it was necessary for INPEX to determine what constitutes a relevant activity, and for which activities a stakeholder should be engaged.

Petroleum activity (planned activity)

The OPGGS (E) Regulations require that consultation be undertaken to ensure that persons who may be affected by a petroleum activity are given the opportunity to inform the titleholder how they may be affected and to allow the titleholder to assess and address any objections or claims about that activity in the preparation of environment submissions.

Regulation 4 of the OPGGS (E) Regulations defines a petroleum activity as *"any operations or works in an offshore area carried out for the purpose of:*

a. *exercising a right conferred on a petroleum titleholder under the Act by a petroleum title; or*

b. *discharging an obligation imposed on a petroleum titleholder by the Act or a legislative instrument under the Act."*

When identifying relevant persons, INPEX considers which stakeholders perform a function in the relation to – or have a function, activity or interest that may be impacted by – the planned activity.

The planned activity for this EP is exploration drilling to be undertaken in Commonwealth waters. Therefore, in determining who is a relevant person for engagement, INPEX sought to identify and engage with stakeholders whose functions, interests or activities could be affected by the exploration drilling activities described in Section 3 of this EP.

Unplanned event/activity (emergency conditions)

INPEX undertakes a more targeted approach to consultation with stakeholders in relation to unplanned and highly improbable emergency conditions, e.g. a loss of containment of hydrocarbons during the exploration drilling activity.

Stakeholders who may perform a function in INPEX's planning for, or management of an unplanned activity, and whose information is integral to the development of those management plans, are engaged during the development of this EP and the INPEX *Browse Regional OPEP*.

Stakeholders whose functions, interests or activities otherwise overlap the PEZ for the unplanned activity are not engaged during the development of those plans but may be engaged in the event of an unplanned emergency condition.

This approach has been adopted to reduce consultation fatigue for stakeholders who will not be impacted by the planned activity.

INPEX will engage contrary to this approach where a stakeholder has expressed a significant (high to very high) level of concern about loss of containment events and wishes to understand more about the potential impact and planned response activities.

INPEX maintains an extended stakeholder list which includes stakeholders who may have a function, activity or interest that falls within for the PEZ, but for the purpose of the development of these plans, engages with stakeholders as outlined in Table 5-1.

Table 5-1: Classification and method of engagement with stakeholders in relation to an unplanned oil spill event and oil spill response

Stakeholder category	Method of engagement	Stakeholders
Government departments, agencies or organisations with functions or roles directly relevant to emergency and oil spill preparedness and response	Involve / consult regarding the proposed activity and potential unplanned emergency conditions during the preparation of the EP and INPEX *Browse Regional OPEP*.	Australian Maritime Safety Authority (AMSA) WA Department of Transport (DoT) WA Department of Primary Industries and Regional Development (WA DPIRD) WA Department of Biodiversity, Conservation and Attractions (DBCA) NT Department of Infrastructure, Planning and Logistics (NT DIPL) Australian Marine Oil Spill Centre (AMOSC)
Stakeholders where land access is required to be agreed prior to the activity commencing	Involve / consult regarding the proposed activity and potential unplanned emergency conditions during the preparation of the EP and INPEX *Browse Regional OPEP*.	Landowners Native title holders Aboriginal and Torres Strait Islander communities
Stakeholders whose level of interest (or expectation) in relation to a potential oil spills and oil spill response for the planned activity is high or very high.	Inform regarding the proposed activity and potential unplanned emergency conditions during the preparation of the EP and INPEX *Browse Regional OPEP*.	As determined during stakeholder identification process.
Stakeholders whose level of interest (or expectation) in relation to a potential oil spills and oil spill response for the planned activity is low or medium.	To be informed only in the event of an unplanned emergency condition (i.e. oil spill) that has the potential to affect their functions, activities or interests.	As determined during stakeholder identification process.

5.2.3 Commercial fishery stakeholder identification and classification

In addition to the process outlined above for planned activities and unplanned events, identification of relevant commercial fishing stakeholders distinguishes between:

- fisheries that overlap the planned activity; and
- fisheries that overlap the PEZ but not the location of the planned activity.

INPEX used a variety of resources (e.g. data files and fishery reports) to identify and classify stakeholders according to these criteria.

With the view to minimise stakeholder fatigue, INPEX restricted engagement activities to licence holders in fisheries that overlap the area (location) of the planned activity. INPEX also considered if and where licence holders are active (or potentially active) within a fishery to assess whether that licence holder should be engaged.

In summary, identification of and engagement with commercial fishing stakeholders was conducted as follows:

- Government authorities (AFMA, DAWE, WA DPIRD and NT Department of Industry, Trade and Tourism (DITT)) were engaged regarding the proposed activity and engagement with commercial fishing stakeholders. Materials made available by government authorities, e.g. WA FishCube (fishing effort) data files and fishing reports, were used in fisheries determinations.
- Fishing industry associations that represent fisheries with licence areas that overlap the proposed activity (e.g. WA Fishing Industry Council (WAFIC), Commonwealth Fisheries Association, etc.) were consulted regarding the proposed activity and engagement with their members.
- Licence holders in commercial fisheries were engaged/not engaged according to the following criteria:
  - Active or potentially active licence holders in commercial fisheries whose activities overlap or are very close to the proposed activity <u>were considered to be relevant stakeholders</u>, and were accordingly engaged during the development of the EP.
  - Licence holders in commercial fisheries that overlap or are close to the planned activity, but whose activities or interests are not expected to be affected by the proposed activity <u>are not considered to be relevant stakeholders</u>. Such licence holders were not engaged during the development of the EP, but the industry associations representing these fisheries were informed. An example would be where the licence holder fishes in a distant part of that fishery, e.g. off the southern coast of Australia.
  - Licence holders in commercial fisheries that overlap the broader PEZ but not the area of the proposed activity <u>are not considered affected parties/relevant stakeholders</u> and were therefore not informed during the development of the EP.

Licence holders that are not considered to be relevant to the planned activity are included in the expanded list of stakeholders who would be informed in the event of an unplanned emergency condition.

Table 5-2 presents the commercial fisheries classified according to their relevance to the planned activity or an unplanned emergency condition. The Northern Demersal Scalefish Fishery (WA) and the North West Slope Trawl Fishery (Cwth) fish close to the planned activity areas in WA-285-P and WA-343-P and so licence holders of these two fisheries were determined to be relevant stakeholders. No other commercial fisheries fish in or close to the location of the planned activity.

Table 5-2: Classification of commercial fishery licence holders

Fishery	Relevance and process of engagement
Commercial fisheries overlapping or close to the planned activity area and with licence holder activities or interests that may be affected by the planned activity.	
Northern Demersal Scalefish Fishery – Area 2 (WA)	Relevant.

North West Slope Trawl Fishery (Cwth)	Licence holders directly consulted.
Commercial fisheries overlapping the planned activity area, but licence holder activities or interests are not expected to be affected by the planned activity.	
Mackerel Managed Fishery – Area 1 (WA)	Not affected. Licence holders not consulted during the development of the EP; however, representative industry associations were informed, and each fishery's interests considered in the development of the EP. Licence holders to be informed in the event of an unplanned emergency condition.
North Coast Shark Fishery (Northern Zone) (WA)	
Pearl Oyster Managed Fishery - Zone 3 (WA)	
Western Tuna and Billfish Fishery (Cwlth)	
Southern Bluefin Tuna Fishery (Cwlth)	
Western Skipjack Tuna Fishery (Cwlth)	
West Coast Deep Sea Crustacean Managed Fishery (WA)	
Commercial fisheries overlapping the PEZ but not the planned activity area.	
Northern Prawn Fishery (Cwlth)	Not affected. Licence holders not consulted during the development of the EP, but each fishery's interests considered in the development of the EP. Licence holders to be informed in the event of an unplanned emergency condition.
Broome Prawn Managed Fishery (WA)	
Kimberley Prawn Managed Fishery (WA)	
Nickol Bay Prawn Managed Fishery (WA)	
Pilbara Trap Managed Fishery (WA)	
Pilbara Fish Trawl Interim Managed Fishery (WA)	
Pilbara Line Fishery (WA)	
Pilbara Crab Managed Fishery (WA)	
Specimen Shell Managed Fishery (WA)	
Abalone Managed Fishery – Area 8 (WA)	
Hermit Crab Fishery (WA)	
Kimberley Crab Managed Fishery (WA)	
Kimberley Gillnet and Barramundi Fishery (WA)	
Mackerel Managed Fishery – Area 2 (WA)	
Marine Aquarium Fish Managed Fishery (WA)	
Northern Demersal Scalefish Managed Fishery – Area 1 (WA)	
Onslow Prawn Managed Fishery (WA)	
Pearl Oyster Managed Fishery – Zones 1 and 2 (WA)	

Trochus Fishery (WA)	
Joint Authority Northern Shark Fishery (Cwlth/WA)	
South West Coast Salmon Managed Fishery (WA)	
Timor Reef Fishery (NT)	
Demersal (multigear) Fishery (NT)	
Barramundi Fishery (NT)	
Bait Net Fishery (NT)	
Coastal Net Fishery (NT)	
Coastal Line Fishery (NT)	
Trepang Fishery (NT)	
Aquaculture (NT)	
Aquarium Fishery (NT)	
Mollusc Fishery (NT)	
Mud Crab Fishery (NT)	
Offshore Net and Line Fishery (NT)	
Pearl Oyster Fishery (NT)	
Spanish Mackerel Fishery (NT)	

5.2.4 Stakeholder classification

Stakeholders were then classified based on their level of interest in/potential impact by, and influence over, the proposed activity. The purpose of this activity was to determine a 'priority' for consultation that was appropriate to the classification. Priority levels are shown in Table 5-3.

Table 5-3: Engagement classification

Priority	Interest/potential impact level and/or Influence level	Stakeholder classification (engagement priority)
Level 1	(Both) High to very high	**Collaborate/empower**: partner with stakeholder on each aspect of the decision; allow stakeholder (regulatory or approvals bodies) to make the final decision
Level 2	(Either) High to very high	**Consult/involve**: ensure stakeholder concerns and expectations are consistently understood and considered, and obtain feedback from stakeholders on analysis, alternatives and/or decisions

Priority	Interest/potential impact level and/or Influence level	Stakeholder classification (engagement priority)
Level 3	(Both) Low to medium	**Inform**: provide balanced, objective, timely and consistent information to stakeholder

Stakeholders who are relevant only in the event of unplanned emergency conditions were classified separately based on their role or function in relation to unplanned emergency conditions or based on their level of interest and influence such unplanned emergency conditions.

5.3 Stakeholder engagement

Following the stakeholder identification and classification exercise, an engagement plan was developed to register identified stakeholders and the following information:

- the activity/ies (planned and unplanned) for which they have been identified as relevant
- the activities on which they should be engaged
- the function, activity or interest that may be affected by the relevant activity
- their assigned classification (priority for engagement)
- the proposed manner of engagement (i.e. modes, timing, and by whom).

Those INPEX personnel responsible for engagement were provided with a copy of the plan and instructions on how to carry out the necessary engagement.

INPEX prepared a consultation information sheet to provide relevant stakeholders with important details of the proposed activity. The information sheet included the following information:

- description of the activity, including location and map
- schedule
- methodology (i.e. how the activity will be undertaken, as well as general logistics and safety information)
- environmental management approach
- enquiries and feedback information.

The accompanying email (or cover letter) may provide more information relevant to the functions, activities or interests of the stakeholder receiving the information sheet. Additional information was also sent to stakeholders in subsequent communications, as requested by the stakeholder and/or as the information became available.

5.4 Stakeholder monitoring and reporting

Using the stakeholder engagement plan as a guide, INPEX retains a record of all communications sent and received as part of the stakeholder engagement activity. This includes email correspondence, telephone call logs, letters and minutes of meetings.

All queries and feedback from stakeholders were logged, and where applicable, forwarded for follow up. All responses provided to stakeholders were appropriate to the nature of their communication, e.g. technical queries were investigated by area experts and responses provided.

5.4.1 Relevant matters, objections and claims

During stakeholder consultation, each meeting, phone call or piece of correspondence received from a stakeholder was assessed by INPEX for relevant information or for objections, claims or concerns raised regarding the activity. The INPEX assessment of relevance and assessment of merit considered four broad categories:

- objection, claim or concern has merit – the objection, claim or concern raised is relevant to both the planned activity and the stakeholder's functions, activities or interests. The matter has merit if there is a reasonable / scientific basis for related effects or impacts to occur and/or there is reasonable basis for the matter to be addressed in the EP.
- objection, claim, or concern does not have merit – the objection, claim or concern raised may be relevant to the planned activity or the stakeholder's functions, activities or interests, however, the matter raised has no credible or scientific basis.
- relevant matter – the matter raised does not fit the criteria descriptions for objections, claims or concerns with/without merit. However, the matter raised is relevant to the planned activity, comprises a request to INPEX for further relevant information, or provides information to INPEX that is relevant to the activity or the EP.
- not a relevant matter – Correspondence does not relate to the planned activity or the stakeholder's functions; interests or activities being affected by the activity. Non-relevant matters may also be generic in nature with no specific issues raised (e.g. salutations, acknowledgements, meeting arrangements, etc.).

A summary of all stakeholder consultation undertaken, and the full assessment of relevance and merit are provided in Appendix B. The actual records of correspondence are provided in a 'Sensitive Matters Report' that is submitted to the NOPSEMA separately to this EP.

An overview of feedback received from stakeholders that resulted in material inputs to the EP is provided in Table 5-4.

Table 5-4: Summary of relevant matters, objections, claims or concerns from stakeholder consultation

Stakeholder	Summary of material stakeholder feedback	Summary of INPEX action
Australian Maritime Safety Authority (AMSA) – Nautical Advice	AMSA raised no concerns with proposed activities and requested: • INPEX continue to provide timely maritime safety information • Vessel lighting was managed in accordance with COLREG requirements.	INPEX will provide the requested notifications AHO and JRCC (refer to Section 9.8.3). Vessel navigational lighting is managed in accordance with the *Navigation Act* and associated Marine Orders, which align with COLREGS requirements (refer Table 7-1, Table 7-15 and Table 8-9).
Australian Fisheries Management Authority (AFMA) (Cwth)	AFMA advised to continue consulting with all fishers who have entitlements to fish within the proposed areas through fishing industry representatives. INPEX will continue to relevant licence holders on any future developments associated with petroleum activity.	INPEX will notify relevant licence holders of any future developments associated with the Project, as required (refer Section 9.8.3).

Stakeholder	Summary of material stakeholder feedback	Summary of INPEX action
Department of Biodiversity Conservation and Attractions (DBCA) - Environmental Management Branch (WA)	DBCA requested INPEX to provide further detail in relation to the following topics: • baseline data • light pollution • notification process for oiled wildlife response	INPEX provided a summary of INPEX's capability in relation to the topics raised and described how the topics are addressed within the EP and other business management documents. Specifically: • existing environment for the region is described in Section 4. • INPEX has considered the National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (DEE 2020) during its assessment of impacts and identification of controls (refer to Table 7-1). • Requirement to notify DBCA in relation to oiled wildlife response is included in oil spill response documents.
Department of Mines, Industry Regulation and Safety (DMIRS) (WA)	The stakeholder raised no concerns with the proposed activity and requested that they were informed of any relevant updates.	INPEX will notify DMIRS of any future developments associated with the Project, as required (refer to Section 9.8.3).
Office of the Director of National Parks (DNP) (Cwlth)	DNP confirmed that the planned activities associated with the EP do not overlap any AMPs and therefore there no authorisation requirements from DNP. DNP do not require further notification of progress made in relation to this activity unless details regarding the activity changes and result in an overlap with a marine park or for emergency responses. In emergency situations, DNP requested to be made aware as soon as possible of oil/gas pollution incidences which occur within or are likely to impact on a marine park.	Information provided from the DNP with respect to the values associated with the closest AMPs have been described in Section 4 of the EP and considered in Sections 7 and 8 with respect to control measures that will ensure the activity is managed in accordance with AMP management plans. In the event of a spill, INPEX oil spill notifications are aligned with the DNP requirements as described in Section 4.3, Section 9.11.3 and the INPEX *Browse Regional OPEP*).
Western Australian Department of Transport (WA DoT)	WA DoT requested that if there is a risk of a spill impacting State waters from the activity, that the DoT be consulted as outlined in the DoT Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (July 2020).	INPEX will notify WA DoT of any spills impacting State waters (refer Section 9.11.3).

Stakeholder	Summary of material stakeholder feedback	Summary of INPEX action
Western Australian Fishing Industry Council (WAFIC)	WAFIC requested, in the event of unplanned discharge incident INPEX confirm the following: • established baseline scientific data on aquatic organisms and the aquatic environment • communication strategy and scenario/exercise training that considers the commercial fishing industry in the event of an incident • a draft framework to temporarily close a fishery either via a voluntary process or formally through legislation • support to the commercial fishing industry with regards to traceability of fish products to manage tainting risks. • a detailed process for post spill scientific monitoring of aquatic organism and aquatic environment • commitment for financial adjustment to the commercial fishing industry.	INPEX provided a summary of INPEX's capability in relation to the topics raised specifically: • existing environment for the region is described in Section 4 of this EP and INPEX continues to maintain readiness of Operational and Scientific Monitoring Programs (OSMP) in accordance with the relevant OPEPs, which in the event of a major spill, would be activated to assess impacts. • requirements to engage with commercial fishing industry in relation to oiled wildlife response is included in oil spill response documents • INPEX understands that the closure of a fishery would be managed via the relevant State, Territory or Commonwealth agency, responsible for the permits/licences associated with the potentially affected fisheries. INPEX would work in consultation with the relevant government agencies in the event of an oil spill. • INPEX's OSMP includes a Scientific Monitoring program (SM12) to determine the impact of the oil spill on commercial, traditional and recreational fisheries, which may include assessment of contamination and tainting in fish products and reproductive impairment, depending on type, nature and scale of the spill. • as a requirement of the OPGGS(E) Regulations, INPEX has arrangements in place for a suitable OSMP for the purposes of determining impacts and monitoring the recovery of the marine environment. • INPEX maintains financial assurance to ensure the costs of implementing a response and implementing the OSMP will be met. The monitoring will determine impacts to the environment inclusive of SM12, the outcomes of which will inform further discussions with the commercial fishing industry if appropriate.

Stakeholder	Summary of material stakeholder feedback	Summary of INPEX action
Department of Agriculture, Water and Environment (DAWE) Biosecurity (Marine pests)	DAWE Biosecurity (Marine pests) requested INPEX ensure all operators of vessels involved with the exploration activities contact the department to ensure they are aware of biosecurity requirements, particularly when interacting with any Australian domestic conveyance (helicopters and supply vessels).	INPEX has described the controls in place to manage biosecurity risks in Section 7 of this EP (refer Table 7-12 and Section 9.6.2). Vessel operators will comply with biosecurity requirements as shown in Figure 9-5.
Australian Communications and Media Authority (ACMA)	ACMA requested INPEX to note that the project is in the vicinity of the North West Cable System a domestic submarine cable owned by Nextgen Networks/Vocus Group. ACMA encouraged INPEX to contact the operator of any submarine cables in the identified waters.	INPEX contacted Vocus who confirmed there are no other cables in the proposed area of the activity. The existing environment described in Section 4 of this EP includes the NWCS (refer Section 4.11.6).

5.5 Stakeholder grievance management

A grievance is a complex stakeholder objection or claim ('relevant matter') which has progressed beyond management through the Stakeholder Monitoring and Reporting process.

In line with grievance management as described in the INPEX Community Grievance Management Procedure, a relevant matter that cannot be resolved with the concerned stakeholder (grievant) by the applicable contact person (supported by area experts where required) will be referred to the INPEX Community Relations Working Group (CRWG) for advice and resolution before a response is made to the grievant.

If the resolution proposed by the INPEX CRWG is unacceptable to the grievant, a third-party mediator may become involved to facilitate a resolution between the parties.

In relation to engagement activities for this EP, all stakeholder enquiries were either dealt with as outlined above or are ongoing due to the iterative process of engagement being applied.

5.6 Ongoing consultation

Ongoing consultation activities ensure that INPEX develops and maintains a current and comprehensive view of stakeholder functions, interests and activities, and provide a forum for enquiries, objections or claims by relevant persons in the lead up to and during the conduct of a planned activity.

Ongoing consultation for the proposed activity described in this EP is outlined in the implementation strategy (Section 9.8.3).

6 ENVIRONMENTAL IMPACT AND RISK ASSESSMENT METHODOLOGY

In accordance with Division 2.3, Regulation 13(5) of the OPGGS (E) Regulations 2009, an environmental risk assessment was undertaken to evaluate impacts and risks arising from the activities described in Section 3. This section describes the process in which impacts and risks were identified. A summary of the outcomes from this process are included in Section 7 and Section 8.

An environmental hazard identification workshop was undertaken for the activity. The workshop involved environmental, compliance, health, safety, emergency response, drilling engineering and well test personnel.

The workshop was undertaken in accordance with INPEX HSE Risk Management processes. The approach generally aligned to the processes outlined in International Organisation for Standardisation (ISO) 31000:2009 *Risk Management – Principles and guidelines* (Standards Australia/ Standards New Zealand, 2009) and Handbook 203:2012 *Managing environment-related risk* (Standards Australia/Standards New Zealand 2012).

The environmental impact and risk evaluation process has been undertaken in nine distinct stages:

- the establishment of context
- the identification of aspects, hazards and threats
- the identification of potential consequences (severity)
- the identification of existing design safeguards and control measures
- proposal of additional safeguards (ALARP evaluation)
- an assessment of the likelihood
- an assessment of the residual risk
- an assessment of the acceptability of the residual risk
- the definition of environmental performance outcomes, standards and measurement criteria.

6.1 Establishment of context

The first stage in the process involved a review of legislative requirements including government policies and guidelines (Section 2 *Environmental Management Framework*). Following this the scope of the activity was defined and the existing environment reviewed to identify particular values and sensitivities of that environment. The outcomes of these exercises are presented in Section 3 *Activity Description* and Section 4 *Existing Environment*, of this EP.

6.2 Identification of aspects, hazards and threats

An assessment was undertaken to identify the aspects associated with the activity. An aspect is defined by ISO 14001: 2015 *Environmental Management Systems (EMS)* as:

"An element or characteristic of an activity, product, or service that interacts or can interact with the environment".

The aspects were grouped to align with the INPEX BMS environment standards. A summary of the aspects identified for the activity were as follows:

- emissions and discharges
- waste management

- noise and vibration
- loss of containment
- biodiversity and conservation protection
- land disturbance (or seabed disturbance)
- social and cultural heritage protection.

Hazards are defined by the *INPEX HSE Hazard and Risk Management Standard* as:

"A physical situation with the potential to cause harm to people, damage to property, damage to the environment".

As the definition suggests, for an environmental risk or impact to be realised, there needs to be a chance of exposing an environmental value or sensitivity to a hazard. If there is no credible exposure of the value or sensitivity, there is no risk of harm or damage. Subsequently, there is no potential for impact (or consequence).

Given the various receptors present in the environment, they have been refined to environmentally sensitive or biologically important receptors (values and sensitivities). They have been selected using regulations, government guidance and stakeholder feedback.

For the purposes of the evaluation, environmental values and sensitivities to be considered include the following:

- receptors that are considered socially important as identified during stakeholder engagement (including social and cultural heritage)
- benthic primary producer habitat, defined by the Western Australian Environmental Protection Authority (WA EPA) Environmental Assessment Guideline No. 3 *Environmental Assessment Guidelines for Protection of Benthic Primary Producer Habitat in Western Australia's Marine Environment* as functional ecological communities that inhabit the seabed within which algae (e.g. macroalgae, turf and benthic microalgae), seagrass, mangroves, corals, or mixtures of these groups, are prominent components
- regionally important areas of high diversity (such as shoals and banks)
- particular values and sensitivities as defined by Regulation 13(3) of the OPGGS(E) Regulations 2009:
  - the world heritage values of a declared World Heritage property within the meaning of the EPBC Act
  - the national heritage values of a National Heritage place within the meaning of the EPBC Act
  - the ecological character of a declared Ramsar wetland within the meaning of the EPBC Act
  - the presence of a listed threatened species or listed threatened ecological community within the meaning of the EPBC Act
  - the presence of a listed migratory species within the meaning of the EPBC Act
  - any values and sensitivities that exist in, or in relation to, part or all of:
    - a Commonwealth marine area within the meaning of the EPBC Act – Note that this value and sensitivity includes receptors (e.g. planktonic and benthic communities) that, when exposed, have the potential to affect regionally significant ecological diversity and productivity from benthic and planktonic communities

  - Commonwealth land within the meaning of the EPBC Act.
- biologically important areas associated with EPBC-listed species.

6.3 Identify potential consequence

In sections 7 and 8, for each aspect, the greatest consequence (or potential impact) of an activity, is evaluated with no additional safeguards or control measures in place. This allows the assessment to be made on the maximum foreseeable exposure of identified values and sensitivities to the hazard taking into account the extent and duration of potential exposure. The consequence is defined using the INPEX Risk Matrix (Figure 6-1).

Given that the receptors, identified as particular values and sensitivities are the most regionally significant or sensitive to exposure, these are considered to present a credible worst-case level of consequence to assess against for environmental impact and impacts to cultural and social heritage.

6.4 Identify existing design safeguards/controls

Control measures associated with existing design are then identified to prevent or mitigate the threat and/or its consequence(s). These controls may relate to the implementation strategy of this EP and have relevant environmental performance outcomes and standards presented in Section 9.

6.5 Propose additional safeguards (ALARP evaluation)

Where existing safeguards or controls have been judged during the evaluation as inadequate to manage the identified hazards (on the basis that the criteria for acceptability is not met as defined in Section 6.8), additional safeguards or controls are proposed.

The INPEX *HSE Hazard and Risk Management Standard* describes the process in which additional engineering and management control measures are identified, taking account of the principle of preferences illustrated in Figure 6-2. The options were then systematically evaluated in terms of risk reduction. Where the level of risk reduction achieved by their selection was determined to be grossly disproportionate to the “cost” of implementing the identified control measures, the control measure will not be implemented, and the risk is considered ALARP. Cost includes financial cost, time or duration, effort, occupational health and safety risks, or environmental impacts associated with implementing the control.

6.6 Assess the likelihood

The likelihood (or probability) of a consequence occurring was determined, taking into account the control measures in place. The likelihood of a particular consequence occurring was identified using one of the six likelihood categories shown in Figure 6-1.

6.7 Assess residual risk

Once any additional controls/safeguards have been considered, the residual risk is then evaluated and ranked.

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Risk Matrix

Refer to the Risk Management Guideline [0000-A0-GLN-60010] for guidance on how to apply the risk matrix.

LIKELIHOOD TABLE

Time Frame Could be experienced	100 year timeframe or less	50 year timeframe	10 - 20 year timeframe	5 year strategic planning time frame	1 - 2 year budget timeframe	Once or more during the next year
Experience History of occurrence in Company or Industry	Unheard of in the industry or in Projects	Has occurred once or twice in the industry or rarely occurs in Projects	Has occurred many times in the industry but not in the company or in <1 out of 100 Projects	Has occurred once or twice in the company or in <1 out of 10 Projects	Has occurred frequently in the company or in many Projects	Has occurred frequently at the location or in every Project
Frequency Continuous Operation	Once every 10 000 – 100 000 years at location	Once every 1,000 – 10 000 years at location	Once every 100 - 1000 years at location	Once every 10 - 100 years at location	Once every 1 - 10 years at location	More than once a year at location or continuously
Probability Single activity	1 in 100 000 – 1 000 000	1 in 10 000 – 100 000	1 in 1000 – 10 000	1 in 100 - 1000	1 in 10 - 100	>1 in 10

CONSEQUENCE TABLE

Severity Level	Financial NPV (USD)	Health & Safety	Environment	Reputation	Cultural & Social Heritage	Legal	Severity	6 Remote	5 Highly Unlikely	4 Unlikely	3 Possible	2 Likely	1 Highly Likely
A	>$1B	>20 fatalities or permanent total disabilities	Regional scale event, permanent impact on environment. Eradication of local populations of protected species	Prolonged international multi-NGO and media and by public protests. Loss of host government support and/ or social licence to operate. Company reputation severely tarnished	Permanent, long-term impact on social structure, and destruction of highly valued heritage, aesthetic, economic or recreational items	Criminal prosecution, potential jail sentences for directors and senior officers. Civil prosecution, class actions. Heavy fines, threat to licence to operate or future approvals	A Catastrophic	6	5	4 Critical Risk	3	2	1
B	$100M – $1B	2 – 20 fatalities or permanent total disabilities	Large scale event, long term impact on environment. Extensive impact on populations of protected species	International multi-NGO and media condemnation. Host government registers concerns. Prolonged large protests. Company reputation seriously impacted	Widespread disruption to a number of communities with damage to highly valued heritage, aesthetic, economic or recreational items	Criminal prosecution for directors and senior officers. Civil prosecution and class actions. Heavy fines, threat to licence to operate	B Major	7	6	5	4	3	2
C	$10M – $100M	Single fatality or Permanent Total Disability	Medium to large scale event, medium term impact on environment. No threat to overall population viability of protected species	Serious public or national media outcry. Damaging NGO campaign. Large protests. Company reputation impacted	Significant impact to regional communities, and to heritage, aesthetic, economic or recreational items of significant value	Significant, multiple breaches of regulation or licence conditions. Significant litigation and fines	C Significant	8	7	6 High Risk	5	4	3
D	$1M – $10M	Major injury or illness, permanent partial disability, lost time injury	Local to medium scale event with short to medium term impact on environment. No threat to overall population viability of protected species	Major adverse national media, public or NGO attention. Significant protests. Asset reputation impacted	Regional community disruption with moderate impact on heritage, aesthetic, economic or recreational values	Serious breach of regulation. Investigation by regulatory authorities. Potential litigation and moderate fines	D Moderate	9	8	7	6	5	4
E	$100K – $1M	Minor injury or illness, alternative duties injury, medical treatment injury	Local scale event with short term impact on the environment. Minor and temporary impact on a small portion of the population of protected species	Attention from regional media with heightened concern with local community. Criticism by community or NGOs	Isolated community disruption with limited adverse impact on heritage, aesthetic, economic or recreational values	Minor legal issues. Report provided to regulatory authorities. Potential for minor fines	E Minor	10	9	8 Moderate Risk	7	6	5
F	<$100K	Slight injury or illness, first aid injury	Local scale event with temporary impact on environment. Behavioural responses inconsequential ecological significance to protected species	Short term local concern or complaints. Low level media or regulatory issue	Minor impact on heritage, aesthetic, economic or recreational values	Breach of internal standards. Potential scrutiny by regulatory authorities	F Insignificant	10	10	9 Low Risk	8	7	6

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Figure 6-1: INPEX risk matrix

Most Preferred	**Elimination**		Removal of the hazard or sensitive receptor
	Substitution		Replacement of highly hazardous materials / approaches with less hazardous materials / approaches
	Engineering	**Prevention**	Design measures that reduce the likelihood of a hazardous event occuring
		Detection	Design measures that facilitate early detection of a hazardous event
		Control	Design measures that limit the extent/escalation potential of a hazardous event
		Mitigation	Design measures that protect the environment should a hazardous event occur
		Response Equipment	Design measures or safeguards that enable clean-up / response following the realisation of a hazardous event
Least Preferred	**Procedures & Administration**		Management systems and work instructions used to prevent or mitigate environmental exposure to hazards

Figure 6-2: ALARP options preferences

6.8 Assess residual risk acceptability

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.

INPEX has determined that risks rated as "Critical" are considered too significant to proceed and are therefore, in general, unacceptable. In alignment with NOPSEMA's *Environment Plan Decision Making Guideline* (NOPSEMA 2021a), INPEX considers that when a risk rating of "Low" or "Moderate" applies, where the consequence does not exceed "C" (Significant) and where it can be demonstrated that the risk has been reduced to ALARP, that this defines an acceptable level of impact.

Through implementation of this EP, impacts to the environment will be managed to ALARP and acceptable levels and will meet the requirements of Section 3A of the EPBC Act (principles of ecologically sustainable development) as shown in Table 6-1.

Table 6-1: Principles of ecological sustainable development (ESD)

Principles of ESD	Demonstration
a) decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations;	The INPEX environmental policy (Figure 9-2) INPEX HSE Hazard and Risk Management Standard and the INPEX BMS (Section 9) consider both long-term and short-term economic, environmental, social and equitable considerations.
(b) if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;	No threat of serious or irreversible environmental damage is expected from the activity. Scientific knowledge is available to support this, and processes are in place to ensure that INPEX remains up-to-date with scientific publications (Section 9.13).
(c) the principle of inter-generational equity - that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations;	The health, diversity and productivity of the environment shall be maintained and not impacted by the activity.
(d) the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making;	Biological diversity and ecological integrity will not be compromised by the activity.
(e) improved valuation, pricing and incentive mechanisms should be promoted.	N/A

Consequently, the potential environmental impacts and risks associated with implementing the activity were determined to be acceptable if the activity:

- complies with relevant environmental legislation and corporate policies, standards, and procedures specific to the operational environment
- takes into consideration stakeholder feedback
- takes into consideration conservation management documents
- does not compromise the relevant principles of ESD; and
- the predicted level of impact does not exceed the defined acceptable level, in that the environmental risk has been assessed as "Low" or "Moderate", the consequence does not exceed "C – Significant" and the risk has been reduced to ALARP.

6.9 Definition of performance outcomes, standards and measurement criteria

As defined in Regulation 4 of the OPGGS (E) Regulation, INPEX has used environmental performance outcomes and performance standards to address potential environmental impacts and risks identified during the risk assessment.

Environmental performance outcomes, standards, and measurement criteria that relate to the management of the identified environmental impacts and risks are defined as follows:

- environmental performance outcome (EPO) means a measurable level of performance required for the management of environmental aspects of an activity to ensure that environmental impacts and risks will be of an acceptable level.
- environmental performance standard (EPS) means a statement of the performance required of a control measure.
- measurement criteria are used to determine whether each environmental performance outcome and environmental performance standard has been met.

7 IMPACT AND RISK ASSESSMENT

Following the environmental impact and risk assessment methodology described in Section 6, the aspects, hazards and threats have been systematically identified. The aspects (and associated hazards) with the potential for impact or risk in relation to the relevant identified values and sensitivities are discussed in the following section and in Section 8.

7.1 Emissions and discharges

7.1.1 Light emissions

Table 7-1: Impact and risk evaluation – change in ambient light levels from flaring and navigational lighting on MODU and vessels

<table>
<tr><th colspan="2">Identify hazards and threats</th></tr>
<tr><td colspan="2">Light emissions have the potential to disturb light-sensitive marine fauna, specifically marine turtles, seabirds and migratory bird species, through localised attraction to light that may result in behavioural changes.

Flaring will occur during the DST (Section 3.3.2 Drill stem test) for each well. A multi-rate DST will be conducted at various gas flow rates to establish baseline well deliverability and to obtain reservoir fluid samples and estimate key formation parameters. The estimated timing for DST operations will be approximately 72 – 96 hours per test in total. Continuous flaring will not occur for the entire duration of the test but is expected to last for approximately 36 hours. A DST will be undertaken per primary target in each well (up to two per well). In addition to flaring, light emissions will also be generated from MODU and vessel lighting (necessary for navigational and safe working condition requirements).

It should be noted that the INPEX Ichthys interlinked facility (CPF and FPSO) is present within WA-50-L, located adjacent to WA-285-P and located approximately 45 km south of WA-343-P. The facility is equipped with flares that are permanently lit with a limited amount of pilot gas. During normal production operations, continuous operational flaring does not occur. However, there are some circumstances under which flaring is required in order to protect the integrity of the facility and to prevent harm to personnel, the environment and equipment. The levels of flaring (gas flow rates and duration) associated with DSTs to be undertaken on the MODU in WA-285-P and WA-343-P is considerably lower than flaring events associated with process upset/manual or emergency blowdown at the Ichthys facility.</td></tr>
<tr><th>Potential consequence</th><th>Severity</th></tr>
<tr><td>The particular values and sensitivities identified as having the potential to be impacted by light emissions from flaring and navigational lighting are:
• marine turtles (including the 20 km internesting green turtle BIA at Browse Island)
• marine avifauna.</td><td>Insignificant (F)</td></tr>
</table>

Behavioural changes reported in marine turtles exposed to increases in artificial lighting can include disorientation and interference during nesting (Pendoley 2005; DEE 2020). Disorientation of adult marine turtles or hatchlings has been known to result in risks to the survival of some individuals through excess energy expenditure or increased likelihood of predation (Witherington & Martin 2000; Limpus et al. 2003). The effect of light emissions resulting in disruption to turtle orientation and behaviour has been observed from up to 18 km away (DEE 2020) and the National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (DEE 2020) recommends that a 20 km buffer for assessment of impacts be considered around important habitat for turtles. Browse Island (listed as a C-class reserve) is the closest turtle-nesting area (located approximately 19 km south-east of WA-285-P and 68 km south of WA-343-P at the closest points) and is surrounded by a 20 km internesting buffer for green turtles between November and March (DEE 2017a) as described in Section 4.9.4. The location of the well in WA-285-P will be in the south-west of the permit area, approximately 40 km from Browse Island. Therefore, although light may be visible to green turtles within the internesting buffer it isn't expected to result in any behavioural responses given the light source will be approximately 20 km from the boundary of the BIA. Satellite tracking data reviewed in recent studies (Ferreira et al 2020; Thums et al, 2021) concluded that the spatial extent of internesting areas was adequately covered by the defined internesting buffers and therefore afforded an appropriate level of protection. However, the spatial extents of foraging BIAs are considered to potentially underestimate the distribution of foraging turtles. The closest turtle foraging BIAs relate to Ashmore Reef, Cartier Island and Scott Reef (Figure 4-6). Shell (2009) estimated that light from production flaring activities can be detected as far as 51 km from the source. Similarly, an assessment by Woodside (2014) for the Browse FLNG development reported that the maximum distance at which production flaring under routine operational conditions was detectable was 47.9 km. However, in the event of emergency flaring, Woodside's assessment reported that light may be visible up to ten kilometres further than during normal operating conditions. The potential effect of direct light from a flare tip is mitigated by the reduction in intensity of light, which diminishes with the square of the distance (i.e. light is reduced to one-hundredth of the initial intensity after 10 m, one ten thousandth after 100 m, etc.) and by the spectral range of the emitted light. Gas flares emit measurable light energy over the whole range of visible and near infrared wavelengths, with peak intensities in the spectral range from 750 to 900 nanometers (Hick 1995), while the most disruptive wavelengths to turtles are reported to be in the range of 300 to 600 nanometers (Tuxbury & Salmon 2005; Witherington 1992; DEE 2020). Therefore, light emissions that may be visible to turtles at Browse Island or in the surrounding 20 km internesting BIA from temporary flaring during DST operations is primarily of the wrong spectral range to cause any disturbance are not expected to affect the behaviour of the marine turtle population in this area. Turtle hatchlings primarily use light cues to orient to water but may also use other secondary cues such as beach slope (DEE 2020), once in the water they generally maintain seaward headings by using wave propagation direction as an orientation cue (Lohmann & Fittinghoff-Lohmann 1992). Adult turtles undertaking internesting, migration, mating or foraging activities do not use light cues to guide these behaviours and there is no evidence, published or anecdotal, to suggest that internesting, mating, foraging or migrating turtles are impacted by light emissions (Woodside 2020).	

The light emissions associated with flaring during DST operations will be on an infrequent basis (up to two occasions per well) and short duration (< 36 hours). As with light emissions generated from flaring, MODU and vessel navigational and deck lighting is also not expected to cause any discernible effect on adult turtles' or hatchlings' abilities to orientate to water at Browse Island. The potential for light from flaring on the MODU to attract marine turtles once they are at sea is expected to be temporary with an inconsequential ecological significance (Insignificant F). If concurrent drilling operations were to occur during the activity, including the ongoing Ichthys drilling campaign in nearby WA-50-L, increased light emissions would be associated with MODU/vessel lighting or flaring and is not expected to result in significantly increased light emissions. The Recovery Plan for Marine Turtles in Australia (DEE 2017a) states that based on the long-life span and highly dispersed life history requirements of marine turtles, they may be subject to multiple threats acting simultaneously across their entire life cycle, such as increases in background noise levels and vessel strike. In considering cumulative impacts of threats on small or vulnerable stocks of marine turtles, it is possible that light emissions may act as contributor to a stock level decline. As described in Section 4.9.4, the permit areas are located within the EAA Flyway, an internationally recognised migratory bird pathway that covers the whole of Australia and its surrounding waters. The migration of marine avifauna through the EAA Flyway generally occurs at two times of year, northward between March and May and southward between August and November (Bamford et al. 2008; DEE 2017b). Artificial light can attract and disorient seabirds, disrupt foraging and potentially cause injury and/or death through collision with infrastructure (DEE 2020). Nocturnal birds are at much higher risk of impact (Wiese et al. 2001; DEE 2020); however, there are no threatened nocturnal migratory seabirds that use the EEA Flyway (DEWHA 2010). Marine avifauna are highly, visually orientated and where bird collision incidents have been reported by industry, low visibility weather conditions (cloudy, overcast and foggy nights) are usually implicated as the major contributing factor and there are seldom collision incidents on clear nights (Wiese et al. 2001). Conditions in the permit areas are not conducive to fog formation with most rainfall associated with the monsoon season between December and March which is outside the periods of bird migration (Bamford et al. 2008). Where there is important habitat for seabirds within 20 km of a project, the National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (DEE 2020) recommends that consideration be given as to whether light is likely to have an effect on those birds. There are no BIAs for marine avifauna that overlap WA-285-P or WA-343-P. However, the PEZ overlaps several Ramsar sites, with the closest located at Ashmore Reef and several nationally important wetlands (Section 4.6). While not an identified BIA, the closest habitat for seabirds from the permit areas is Browse Island. Browse Island is not a regionally significant habitat for seabirds, with previous surveys finding a lack of diversity of seabirds breeding there (Clarke 2010). Colonies of nesting crested terns (>1,000 birds) have been observed on Browse Island (Olsen et al. 2018).	

Migratory shorebirds travelling the EAA Flyway may fly over the permit areas, before moving on to the mainland (south) in the spring or Indonesia/Australian External Territories (north) in the autumn. It is possible that migratory birds may use ships and other offshore facilities in order to rest. However, the possibility of this occurring on the MODU or vessels associated with the activity in WA-285-P and WA-343-P is considered to be low due to the short duration of flaring and the presence of alternative habitat for resting and foraging at Browse Island and Ashmore Reef/Cartier Island, resulting in minimal deviation from migratory pathways and limited potential for behavioural disruption. Therefore, any impact to seabirds or migratory birds from light emissions associated with the MODU (including flaring) and vessels is considered to be of inconsequential ecological significance (Insignificant F).	

Identify existing design and safeguards/controls measures
• Vessel personnel will receive an induction/training to inform them of the requirements to minimise external artificial lighting in accordance with Table 9-3.

Propose additional safeguards/control measures (ALARP Evaluation)			
Hierarchy of control	Control measure	Used?	Justification
Elimination	Do not use lighting at night-time.	No	Lighting is required for navigational and safety purposes and cannot be eliminated. This is in accordance with the *Navigation Act 2012* and associated Marine Orders (which are consistent with COLREGS requirements). Unnecessary outdoor/deck lighting is already eliminated.
	No flaring during DST	No	Given the expected gas flow rates resulting during the DST, there is no other mechanism for the safe disposal of gas on the MODU other than flaring. The gas could be disposed by venting; however, this is considered to have a higher environmental impact than flaring with respect to greenhouse gas emissions.
Substitution	Exclude vessel lighting during sensitive periods for marine avifauna and turtles (internesting November – April)	No	In general, bird migrations occur over several months of the year: between March and May (northward) and between August and November (southward) (Bamford et al., 2008). Internesting at Browse Island (20 km buffer) occurs between November to March for green turtles (DEE 2017a).

			Lighting of MODU/vessels is required year-round to ensure the safety of workers and the environment and cannot be eliminated for certain periods during the year. Therefore, substituting the timing of activities would offer no benefit as it is possible that there will be sensitive periods for marine avifauna and turtles on a year-round basis.
	Exclude flaring during key periods for bird migration.	No	Flaring during the DST is required to safely dispose of the gas. The duration of each well's flaring event is limited (expected to be approximately 36 hours per well on up to two occasions) and is relatively short-term. DST timing will be dictated by the MODU drilling schedule and it is not considered practicable to exclude flaring during bird migrations (March and May (northward) and between August and November (southward)) based on the short duration of flaring and inconsequential ecological significance.
	Exclude flaring during key periods for marine turtles	No	The effect of light emissions resulting in disruption to turtle orientation and behaviour has been observed from up to 18 km away (DEE 2020). WA-285-P, at its closets point is approximately 19 km from Browse Island and therefore a small portion of the permit overlaps the 20 km internesting buffer. The well location within WA-285-P is to the south-west of the permit area, approximately 40 km from Browse Island. Although light from flaring during the DST in WA-285-P may be visible to turtles in the internesting BIA at Browse Island, research has indicated that turtles generally stay within 10 km of their nesting beaches and given the short duration of flaring (approximately 36 hours) any impacts to green turtles in the BIA are expected to be temporary. Therefore, excluding flaring during key periods (November to March) is not considered practicable given the requirement to flare as a mechanism for the safe disposal of gas. DST timing will be dictated by the MODU drilling schedule and flaring is a short duration event (approximately 36 hours).
Engineering	Reduce light intensity and/or frequencies which may attract turtles.	No	Lighting will be designed in accordance with the relevant Australian and international standards to ensure that worker and MODU/vessel safety is not compromised.

			The deployment of low-pressure sodium vapour lamps or other technologies which reduce/eliminate frequencies which have been shown to attract turtles would not result in any significant benefit regarding turtle hatchling attraction from the nesting beaches given the wave-front orientation cues (rather than light cues) of hatchlings once they are in the ocean.
	Light shielding.	No	The deployment of light shielding on MODUs/vessels to reduce light spill would not result in any significant benefit regarding turtle hatchling attraction from the nesting beaches given the wave front orientation cues (rather than light cues) of hatchlings once they are in the ocean.
Procedures & administration	Limit the duration and frequency of planned night-time-based activities such as flaring associated with DST operations during key sensitive periods for marine turtles and avifauna.	No	DST timing will be dictated by the MODU drilling schedule and it is not considered practicable to exclude night-time flaring during key sensitive periods for marine turtles and avifauna as it is possible that there will be sensitive periods for these receptors on a year-round basis. Flaring during DST operations is already limited to up to two tests per well and for a short duration (approximately 36 hours). The duration of flaring cannot be scheduled to only occur during daylight hours (thereby avoiding light emissions at night) as flaring needs to be continuous in order to evaluate the rate dependent skin, which is key information for gas-condensate development. At least three consecutive flow periods with different flow rates are required for the firm evaluation and this data cannot be collected if flaring is limited to daylight hours only.
	Premobilisation review and planning of MODU/vessel lighting to be undertaken prior to activities (pre-drill survey and exploration drilling) commencing.	Yes	MODUs/vessels will maintain the minimum navigational and deck lighting to provide safe working conditions. The worst-case consequence of light impacts for all identified receptors at all times of the year has been assessed as Insignficant (F).

			Given artificial light sources in proximity to the permit areas (notably WA-285-P), such as the Ichthys facility permanently located in neighbouring WA-50-L, and the lighthouse on Browse Island (Section 4.4.2), flaring or external MODU/vessel lighting will not result in additional light impacts. Nevertheless, a review of deck lighting will be undertaken during the premobilisation HSE inspection of MODU/vessels to ensure external lighting is minimised where practicable.
	Implementation of a seabird management plan to prevent seabird landings on MODUs/vessels due to attraction from artificial lighting.	No	A seabird management plan to prevent seabird landings on MODUs/vessels and to help manage birds appropriately is a recommendation as a consideration for vessels working in seabird foraging areas during breeding season (DEE 2020). As shown in Figure 4-8, WA-343-P and WA-285-P do not overlap any avifauna foraging areas and the closest areas are situated around Ashmore Reef/Cartier Island to the north, Adele Island to the south and Scott Reef to the west. There have been no reported issues with seabirds interacting with Ichthys facilities in WA-50-L. Therefore, this control is not considered necessary.
	Implementation of a light management plan to prevent impacts to marine turtles from artificial lighting on MODU/vessels.	No	The effect of light emissions resulting in disruption to turtle orientation and behaviour has been observed from up to 18 km away (DEE 2020). The well in WA-285-P will be located approximately 40 km from Browse Island. Although light from flaring and MODU/vessels in WA-285-P may be visible to turtles in the internesting BIA at Browse Island, research has indicated that turtles generally stay within 10 km of their nesting beaches. Given the short duration of activities (pre-drill survey approximately 10 days; exploration drilling approximately 95 days; flaring during DST approximately 36 hours) any impacts to green turtles in the BIA are expected to be temporary and this control is not considered necessary.
Identify the likelihood			

Although light may potentially be visible, given the distance from the proposed well locations within WA-343-P and WA-285-P to the closest turtle nesting beaches (approximately 68 km and 40 km to Browse Island respectively) and short duration of the activities (pre-drill survey, exploration drilling and flaring during DST), impacts to turtles from light emissions is Highly Unlikely (5). While impacts to seabirds from lighting of offshore platforms and vessels have been reported in the industry (Birdlife International 2012), given the presence of alternative resting/foraging habitat (Browse Island) and that there are several other permanently moored offshore installations in the vicinity such as the Ichthys facility in WA-50-L, with no records published on the attraction of seabirds or negative impacts to migratory seabirds from lighting, the likelihood of impact to these receptors from the lighting of the MODUs/vessels is considered Highly Unlikely (5).		
Residual risk summary		
Based on a consequence of Minor (E) and a worst-case likelihood of Highly Unlikely (5) the residual risk is Low (9).		
Consequence	Likelihood	Residual risk
Minor (E)	Highly Unlikely (5)	Low (9)
Assess residual risk acceptability		
Legislative requirements Navigational lighting is required under the *Navigation Act 2012* (which is consistent with COLREGS requirements) for the safe operation of facilities and vessels. The MODU and vessels have been designed to meet Australian and international standards for safety purposes, including the requirements of the *Navigation Act 2012*. The National Light Pollution Guidelines for Wildlife including Marine Turtles, Seabirds and Migratory Shorebirds (DEE 2020), has been used to ensure that the activities covered by this EP align with the guideline (see below conservation management plans/threat abatement plans). Stakeholder consultation During EP stakeholder consultation, the WA DBCA recommended that INPEX refer to the Commonwealth Department of Agriculture, Water and the Environment's National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds as a best-practice industry standard for managing potential impacts of light pollution on marine fauna. The guidelines have been used to ensure that the activities covered by this EP align with the outcomes and recommendations outlined in the guidelines. In addition, AMSA identified that lighting of vessels should be consistent with the requirements of the COLREGS requirements. As noted above all vessels are required to comply with the *Navigation Act 2012*, and associated Marine Orders, which are consistent with the COLREGS requirements. There were no other stakeholder concerns raised regarding potential impacts and risks from light emissions due to flaring or MODU/vessel lighting. Conservation management plans / threat abatement plans		

Several conservation management plans have been considered in the development of this EP (refer Appendix A). DEE (2020) states that "natural darkness has a conservation value in the same way that clean water, air and soil has intrinsic value" and that artificial light has the potential to stall the recovery of a threatened species. The activities covered by this EP align with the guideline.

ALARP summary

Although the level of environmental risk is assessed as Low, a detailed ALARP evaluation was undertaken to determine what additional control measures could be implemented to reduce the level of impacts and risks. No additional controls, beyond those identified during the detailed ALARP assessment can reasonably be implemented to further reduce the risk of impact.

Acceptability summary

Based on the above assessment, the risk of impacts is managed to acceptable levels because:

- the activity demonstrates compliance with legislative requirements/industry standards
- the activity takes into account stakeholder feedback
- the activity is managed in a manner that is consistent with the intent of conservation management documents
- the activity does not compromise the relevant principles of ESD
- the predicted level of impact does not exceed the defined acceptable level in that the environmental risk has been assessed as "low", the consequence does not exceed "C – significant" and the risk has been reduced to ALARP.

Environmental performance outcomes	Environmental performance standards	Measurement criteria
Activities are managed in a manner that minimises potential light impacts to marine avifauna and turtles.	Premobilisation and ongoing HSE inspections confirm that MODU and vessel lighting is reviewed to reduce unnecessary lighting.	Premobilisation HSE inspection records Monthly environmental checklist
Refer to Table 9-3		

7.1.2 Atmospheric emissions

Table 7-2: Impact and risk evaluation – atmospheric emissions from flaring, MODU and vessels

Identify hazards and threats	
Atmospheric emissions (greenhouse gas (GHG) such as CO_2 and CH_4; non-GHG such as sulphur dioxide and nitrogen oxides) will be generated through flaring during DST operations (approximately 36 hours per test, up to two tests per well), the use of combustion engines, compressors, steam generators and ODS containing equipment on board the MODU and vessels. In addition to these sources, emissions associated with venting of gas from the reservoir may occur during drilling operations (Section 3.2.2), venting may also occur to avoid emergency conditions e.g. in the event of a well-kick. Atmospheric emissions from the petroleum activity will contribute to overall GHG concentrations and have the potential to result in localised changes in air quality and subsequent exposure of marine avifauna to air pollutants.	
Potential consequence	**Severity**
The particular values and sensitivities identified as having the potential to be impacted by atmospheric emissions are: • climate • marine avifauna. The various sources of atmospheric emissions generated from the activity will add to overall global GHG concentrations. The contribution arising from vessels and the MODU (such as from fuel use) and from flaring will be relatively short term and temporary in duration and insignificant in volume on a global scale. Therefore, the potential consequence is considered to be Insignificant (F). As described in Section 4.9.4, the permit areas are located within the EAA Flyway, an internationally recognised migratory bird pathway that covers the whole of Australia and its surrounding waters. The migration of marine avifauna through the EAA Flyway generally occurs at two times of year, northward between March and May and southward between August and November (Bamford et al. 2008; DEE 2017b). There are no BIAs for marine avifauna that overlap either WA-285-P or WA-343-P. However, the PEZ overlaps several Ramsar sites, with the closest located at Ashmore Reef and several nationally important wetlands (Section 4.6). Additionally, a large number of BIAs for many marine avifauna species are present within the region (Figure 4-8), the closest of which relate to foraging around Adele Island, where the BIA boundary is 35 km south of WA-285-P at its closest point, and Ashmore Reef and Cartier Island where the foraging BIA boundary is 10 km north of WA-343-P at its closest point. While not an identified BIA, the closest habitat for seabirds for both permit areas is Browse Island. Browse Island is not a regionally significant habitat for seabirds, with previous surveys finding a lack of diversity of seabirds breeding there (Clarke 2010). Colonies of nesting crested terns (>1,000 birds) have been observed on Browse Island (Olsen et al. 2018).	Insignificant (F)

In the absence of air quality standards or guidelines specifically for marine avifauna, human health air quality standards and guidelines have previously been used as a proxy for the assessment of atmospheric emissions from offshore production facilities and potential impacts to marine avifauna. The outcome of such assessments concluded that NO_2 concentrations may typically exceed long term (annual average) concentrations within a few km of the emissions source and that short-term (1-hour average) exposure levels may be exceeded within a few hundred metres (i.e. 200-400 m) of the emission source (RPS APASA 2014). This assessment was undertaken for a production facility and therefore any changes in air quality resulting from the MODU/vessel, short-term flaring (< 36 hours per well during DST) and equipment emissions in WA-285-P and WA-343-P are also predicted to be highly localised given the nature of the emissions are less than those from a production facility. There may be temporary increases in emissions (e.g. hydrocarbon gases and H_2S) as a result of venting during drilling operations, DST operations or a well-control event. This is not expected to result in a significant increase in exposure to marine avifauna as emissions will rapidly disperse following release in the open marine environment and the potential for exposure remains limited to the immediate vicinity of the vents. A review of the human health and environmental effects of the various air pollutants, as described in the National Pollutant Inventory, indicates that short-term exposures to significant concentrations of pollutants such as CO, NO_X, SO_2, VOCs, and fine particles, could cause symptoms such as irritation to eyes and respiratory tissues, breathing difficulties, and nausea (Manisalidis et al. 2020). Limited literature has been published on the vulnerability of avian species to air pollutants. The avian respiratory system, unlike the mammalian respiratory system, is characterised by unidirectional airflow and cross-current gas exchange, features that improve the efficiency of respiration. Therefore, birds are more likely to be susceptible to high concentrations of reactive gases, aerosols and particles in the air than mammals; and are considered to be useful indicators of air quality (Sanderfoot & Holloway 2017). Exposure to air pollutants may cause respiratory distress in birds, increasing their susceptibility to respiratory infection and may impair the avian immune response (Sanderfoot & Holloway 2017). As a worst case, it is conservatively assumed that a small number of individual marine avifauna may develop some short-term symptoms if they remain in the immediate vicinity of an emissions source where the pollutants are most concentrated. However, rapid recovery is expected after individuals move away from the source and any symptoms are not expected to occur. Chronic exposures are not considered plausible given that marine avifauna would move away (i.e. continue migration or undertake foraging activities elsewhere). Concurrent drilling operations may occur during the activity either with MODUs operating in both WA-285-P and WA-343-P and also the continued Ichthys drilling operations in the nearby in WA-50-L production licence area. Given the distance (tens of km) between any concurrently operating MODUs, localised atmospheric emissions are not expected to result in cumulative impacts to marine avifauna. If marine avifauna are exposed at all, they are only expected to be exposed to changes in air quality for short periods as they pass close to emissions sources. Chronic exposures are not considered plausible. Overall, the consequence of temporary, localised changes in air quality may result in short-term, sublethal effects to a small number of transient marine avifauna individuals and is therefore considered Insignificant (F).	
Identify existing design and safeguards/controls measures	

• MODUs and vessels will comply with the air emission requirements of Marine Order 97 (as applicable to vessel and engine size, type and class) including sulfur content of fuel oil • MODUs and vessels (as applicable to vessel and engine size, type and class) will comply with ODS requirements of Marine Order 97 • MODUs and vessels (as applicable to vessel, engine/propulsion size, type and class) will comply with energy efficiency requirements of Marine Order 97.			
Propose additional safeguards/control measures (ALARP Evaluation)			
Hierarchy of control	Control measure	Used?	Justification
Elimination	Eliminate the use of MODU/vessels	No	The use of MODU/vessels to undertake the activity cannot be eliminated.
	No flaring during DST operations	No	Given the expected gas flow rates resulting during DST operations, there is no other mechanism for the safe disposal of gas on the MODU other than flaring. The gas could be disposed by venting; however, this is considered to have a higher environmental impact than flaring with respect to GHG emissions.
Substitution	Replace any ODS systems	No	In accordance with MARPOL Regulation 12, no CFC or halon containing system or equipment is permitted to be installed on ships constructed on or after 19 May 2005 and no new installation of the same is permitted on or after that date on existing ships. Similarly, no HCFC containing system or equipment is permitted to be installed on ships constructed on or after 1 January 2020 and no new installation of the same is permitted on or after that date on existing ships. Therefore, only older vessels are considered to potentially have ODS systems installed as confirmed on the IAPP certificate. The costs to retrofit ODS equipment and replace systems are not considered to be warranted given they are being phased out in accordance with MARPOL and it may restrict vessel selection and availability in the short term.
Engineering	None identified	N/A	N/A

Procedures & administration	Preventative maintenance system	Yes	MODU/vessel contractors have a preventative maintenance system in place to ensure diesel powered, power generation equipment is maintained and operated within original equipment manufacturers' (OEM) specification.
	Implement International Finance Corporation (IFC) Environment, Health and Safety (EHS) Guidelines – Offshore Oil and Gas Development (2015) applicable for flaring activities.	Yes	INPEX will verify that the contractor will comply with IFC EHS guidelines with respect to maximising flaring efficiency and thereby reducing potential atmospheric emissions associated with flaring during DST operations.
	DST procedure (well test package) implemented for flaring operations.	Yes	This procedure includes a continuous 24/7 flare watch to observe and monitor flaring operations and function testing of ignition and pilot systems to ensure burning efficiency thereby reducing potential atmospheric emissions. Function testing of continuous ignition system and pilot system is also covered by the procedure.
	NOPSEMA accepted WOMP and accepted MODU safety case and safety case revision includes aspects relevant to controls in place to minimise gas venting in the event of a well-kick.	Yes	INPEX and MODU contractor will comply with the regulatory requirements of the OPGGS (Resource Management and Administration) Regulations 2011 (Cwlth) and the OPGGS (Safety) Regulations 2009 by ensuring the drilling activity is carried out in accordance with the accepted WOMP and safety case.
	MODU contractor Well Control Manual will cover all aspects of primary and secondary well control for drilling operations that includes aspects relevant to controls in place to minimise gas venting in the event of a well-kick.	Yes	INPEX will ensure the Well Control Bridging Document aligns requirements of the contractor’s Well Control Manual with the requirements of the INPEX Well Integrity Standard and INPEX Well Operations Standard. This will ensure that in the event of a requirement to vent gas (e.g. from a well-kick), the influx volume can be minimised and therefore reduce the overall volume of gas vented to atmosphere.
Identify the likelihood			

The likelihood of marine avifauna approaching and/or resting on exhaust vents on MODU/vessels during the activity and remaining in close enough proximity to be exposed to concentrations of air pollutants that result in symptoms such as irritation of eyes and respiratory tissues and breathing difficulties is considered Unlikely. Marine avifauna that may pass by near the MODU and vessels during the activity are unlikely to be in close enough proximity to be exposed to the emissions sources and are therefore unlikely to have any discernible symptoms. It is considered likely that they would move away from any emissions source if they began to experience discomfort or symptoms. No marine avifauna BIAs or critical habitats overlap WA-285-P or WA-343-P. Given the presence of alternative resting/foraging habitat (Browse Island) and with the control measures described above in place, the potential for changes to air quality and associated impacts to marine avifauna are reduced. Therefore, the likelihood of the described consequences to marine avifauna occurring is considered Unlikely (4).
Residual risk summary
Based on a consequence of Insignificant (F) and a likelihood of Unlikely (4) the residual risk is Low (9).

Consequence	Likelihood	Residual risk
Insignificant (F)	Unlikely (4)	Low (9)

Assess residual risk acceptability
Legislative requirements The activities and proposed management measures are compliant with industry standards, relevant international conventions and Australian legislation, specifically AMSA Marine Order 97: Marine Pollution Prevention – Air Pollution, the POTS Act, the Navigation Act 2012, and MARPOL, Annex VI. The above controls are aligned to the IFC EHS Guidelines – Offshore Oil and Gas Development (2015) with respect to flaring. Stakeholder consultation No specific stakeholder concerns have been raised regarding potential impacts and risks associated with atmospheric emissions in WA-285-P and WA-343-P. Conservation management plans / threat abatement plans Several conservation management plans have been considered in the development of this EP (refer Appendix A). None of the recovery plans or conservation advice documents have specific threats relating to atmospheric emissions from MODUs and vessels operating offshore. ALARP summary

Although the level of environmental risk is assessed as Low, a detailed ALARP evaluation was undertaken to determine what additional control measures could be implemented to reduce the level of impacts and risks. No additional controls, beyond those identified during the detailed ALARP assessment can reasonably be implemented to further reduce the risk of impact. Acceptability summary Based on the above assessment, the proposed controls are expected to effectively reduce the risk of impacts to acceptable levels because: • the activity demonstrates compliance with legislative requirements/industry standards • the activity takes into account stakeholder feedback • the activity is managed in a manner that is consistent with the intent of conservation management documents • the activity does not compromise the relevant principles of ESD • the predicted level of impact does not exceed the defined acceptable level in that the environmental risk has been assessed as "low", the consequence does not exceed "C – significant" and the risk has been reduced to ALARP.		
Environmental performance outcomes	Environmental performance standards	Measurement criteria
Planned emissions and discharges from MODU and vessels undertaking the petroleum activity are in accordance with MARPOL requirements and industry good practice.	MODU and vessels pre-mobilisation audits undertaken by a registered organisation confirm that marine diesel engines on board MODUs and vessels >400 GT meet the requirements of Marine Order 97, (as applicable to the vessel, engine/propulsion size, type and class).	EIAPP certificate IAPP certificate Bunker delivery notes IMO type approval for waste incinerators where installed Training records for personnel responsible for operating waste incinerators IEE certificate SEEMP
	Fuel oil and marine diesel with 0.5% m/m sulfur content will be used.	INPEX fuel specification records confirm that fuel provided to the facility and vessels has 0.5% m/m sulfur content

	Where present equipment or systems on board MODUs or vessels >400 GT which contain ODS will be recorded and managed in accordance with MARPOL, Annex VI, Regulation 12 (as appropriate to vessel size, type and class.	ODS Record book
	MODU and vessel contractor has a preventative maintenance system to ensure diesel powered, power generation equipment is maintained and operated within OEM specification.	Preventative maintenance system records
	INPEX and the MODU contractor will comply with IFC EHS guidelines relating to flaring, specifically: • maintenance program to ensure maximum flare efficiency • use of a reliable pilot ignition system • minimum volume of hydrocarbons required for DST to be flared and durations reduced to the extent practical.	DST testing records and pre-flow checklist.
	DST procedure (well test package) implemented including: • Continuous (24/7) flare watch during flaring operations • Function testing of continuous ignition system and pilot system.	Pre-flow checklist.
	INPEX and the MODU contractor will comply with the requirements of the OPGGS (Resource Management and Administration) Regulations 2011 (Cwlth) and the Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2009, including: • NOPSEMA accepted WOMP • preparation and acceptance of the MODU Safety Case and Safety Case Revision.	WOMP approval received from NOPSEMA. MODU Safety Case acceptance received from NOPSEMA.

	INPEX will verify that the MODU contractor complies with the requirements of the approved Well Control Bridging Document which aligns requirements (and clarifies if conflicts exist, which standard takes precedence) between the Contractor Well Control Manual, and INPEX policies and standards including INPEX Well Integrity Standard (0000-AD-STD-60003), Well Operations Standard (0000-AD-STD-60004) and Well Operations Manual (0000-AD-MAN-60002), which covers primary and secondary well control for drilling operations, including: • planned mud weight overbalance to stop ingress potential (i.e. inflow of formation fluids) into the well. • leak off or limit testing to confirm that the formation has sufficient strength for planned mud weight with adequate kick tolerance. • two independent well barriers in place at all times and tested in situ to ensure the system is capable of holding pressure in the well-bore or annulus.	Summary of compliance with primary and secondary well control in the Well Integrity Standard (0000-AD-STD-60003); Well Operations Standard (0000-AD-STD-60004) and Well Operations Manual (0000-AD-MAN-60002) reported in the daily drilling report.

7.1.3 Routine discharges to sea

Sewage, grey water and food waste

Table 7-3: Impact and evaluation – MODU and vessels sewage, grey water and food waste discharges

Identify hazards and threats	
Discharging treated sewage effluent, grey water and food waste has the potential to expose planktonic communities to changes in water quality from the introduction of nutrients. Such a decline in water quality has the potential to result in reduced ecosystem productivity or diversity. These intermittent discharges will occur at the proposed well locations in WA-285-P and WA-343-P, which are both located in the open ocean and more than 12 nm from the nearest land. The average volume of sewage and greywater expected from the MODU and vessels (including domestic wastewater) generated by a person per day is approximately 230 L (based on calculations in Huhta et al 2009), therefore based on the maximum personnel on board (POB) of up to 180 on the MODU would equate to approximately 41 m^3 per day.	
Potential consequence	Severity
The particular values and sensitivities identified as having the potential to be impacted by sewage, grey water and food waste discharges are: • planktonic communities. A study undertaken to assess the effects of nutrient enrichment from the discharge of sewage in the ocean found that the influence of nutrients in open marine areas is much less significant than that experienced in enclosed, poorly mixed water bodies. The study also found that zooplankton composition and distribution in areas associated with sewage dumping grounds were not affected (McIntyre & Johnston 1975). When sewage effluent, grey water and food waste is discharged there is the potential for localised and temporary, changes in water quality within the permit areas. The potential consequence on planktonic communities is a localised impact on plankton abundance in the vicinity of the point of discharge. If concurrent drilling operations were to occur, sewage effluent, grey water and food waste discharge plumes associated with the MODU and support vessels would not overlap based on the distance between operating MODUs in the permit areas (tens of km). Therefore, no cumulative impacts to planktonic communities from such discharges are expected. Given the water depths (ranging from approximately 290 m in WA-285-P to approximately 350 m in WA-343-P), oceanic currents will result in the rapid dilution and dispersion of these discharges. Therefore, the consequence is considered to be of inconsequential ecological significance (Insignificant F).	Insignificant (F)
Identify existing design and safeguards/controls measures	
• MODU and vessels will manage the discharge of sewage effluent and grey water in accordance with Marine Order 96 (as appropriate to class)	

• MODUs will be equipped with an approved sewage treatment plant (STP) compliant with Marine Order 96 • MODUs and vessels will manage the discharge of garbage in accordance with Marine Order 95 (as appropriate to class) • MODUs and vessels will macerate food waste to a particle size of <25 mm before disposal.			
Propose additional safeguards/control measures (ALARP Evaluation)			
Hierarchy of control	Control measure	Used?	Justification
Elimination	Eliminate discharges from MODU and vessels by storage of sewage, grey water and food waste on board and ship to the mainland.	No	The significant financial cost and health risks associated with storing sewage, grey water and food waste on board MODU/vessels and transporting it to the mainland for the duration of operations is grossly disproportionate to the low level of risk associated with this discharge, permitted under legislation. Additional environmental impacts would also be generated in terms of air emissions and onshore disposal. In the event that food waste is not macerated it will be transferred for onshore disposal. No unmacerated food waste will be disposed at sea.
Substitution	None identified	N/A	N/A
Engineering	STP installed and used on all vessels	No	While the MODUs have a STP, a requirement for all vessels to have STPs installed is not practicable and costs are considered to be grossly disproportionate for what is a permitted discharge under relevant legislation.
Procedures & administration	Preventative maintenance system	Yes	MODU/vessel contractors have a preventative maintenance system in place to ensure STP is maintained and operated within OEM specification.
Identify the likelihood			
Sewage and garbage discharges for the MODU and vessels will be in accordance with legislative requirements (MARPOL Annex IV & V, Marine Orders 95 and 96). Maceration of sewage and food waste to a particle size <25 mm prior to disposal will increase the ability of the discharges to disperse rapidly.			

The effects of sewage discharged to the ocean have been relatively well studied (Gray et al. 1992; Weis et al. 1989) and toxic effects generally only occur where high volumes are discharged into a small and poorly mixed waterbody. The volumes discharged within the permit areas are unlikely to cause toxic effects, especially considering the rapid dilution provided by the deep water and ocean currents. Based on the expected high dispersion due to the open-ocean environment of the permit areas, localised impacts to plankton at the point of the planned discharge are considered to be Unlikely (4).		
Residual risk summary		
Based on a consequence of Insignificant (F) and a likelihood of Unlikely (4) the residual risk is Low (9).		
Consequence	Likelihood	Residual risk
Insignificant (F)	Unlikely (4)	Low (9)
Assess residual risk acceptability		
Legislative requirements Sewage, grey water and food waste discharges are standard practice in the offshore environment and the disposal at sea is permitted under AMSA (2018) Marine Order – Part 96: Marine Pollution Prevention – Sewage, which gives effect to MARPOL, Annex IV and Marine Order – Part 95: Marine Pollution Prevention – Garbage, which gives effect to MARPOL, Annex V. Stakeholder consultation No stakeholder concerns have been raised regarding potential impacts and risks from planned discharges (sewage, grey water and food waste). Conservation management plans / threat abatement plans Several conservation management plans have been considered in the development of this EP (refer Appendix A). Emissions and discharges are listed as threatening processes; however, none of the recovery plans or conservation advice documents has specific actions relating to discharges of sewage, grey water and food waste. The maceraters will assist in reducing impacts from the discharge stream, consistent with the intent of the conservation management documents. ALARP summary Although the level of environmental risk is assessed as Low, a detailed ALARP evaluation was undertaken to determine what additional control measures could be implemented to reduce the level of impacts and risks. No additional controls, beyond those identified during the detailed ALARP assessment can reasonably be implemented to further reduce the risk of impact. Acceptability summary		

Based on the above assessment, the proposed controls are expected to effectively reduce the risk of impacts to acceptable levels because: • the activity demonstrates compliance with legislative requirements/industry standards • the activity takes into account stakeholder feedback • the activity is managed in a manner that is consistent with the intent of conservation management documents • the activity does not compromise the relevant principles of ESD • the predicted level of impact does not exceed the defined acceptable level in that the environmental risk has been assessed as "low", the consequence does not exceed "C – significant" and the risk has been reduced to ALARP.		
Environmental performance outcomes	**Environmental performance standards**	**Measurement criteria**
Planned emissions and discharges from MODUs and vessels undertaking the petroleum activity are in accordance with MARPOL requirements and industry good practice.	Comply with Marine Order 96 including: • Current ISPPC.	ISPPC
	Comply with Marine Order 95 including: • Garbage that has been ground or comminuted to particles <25 mm discharged >3 nm from the nearest land. • Garbage disposal record book maintained.	Garbage disposal record book
	MODU contractor has a preventative maintenance system to ensure STP is maintained.	Preventative maintenance system records

Deck drainage, bilge, PW and firefighting foam

Table 7-4: Impact and evaluation – MODU and vessels deck drainage, bilge, PW and firefighting foam discharges

<table>
<tr><th colspan="2">Identify hazards and threats</th></tr>
<tr><td colspan="2">Contaminated deck drainage and bilge discharges or failure to treat oily water to suitable OIW concentrations before discharge, have the potential to expose marine fauna to changes in water quality and/or result in impacts through direct toxicity. Deck drainage discharge volumes on the MODU and vessels will be intermittent and are dependent on weather conditions and frequency of deck washing. Volumes of bilge water from engines and other mechanical sources found throughout the machinery spaces will also vary between vessels.

In general, the capacities of oil-water separators (OWS) on vessels range from 100–1000 litres per hour. Therefore, conservatively based on maximum rates, each vessel present in the permit areas could potentially discharge 1 m^3 per hour.

During DST operations, reservoir fluids (hydrocarbons and PW) are sent to the flare resulting in atmospheric emissions. In the event PW cannot be sent to the flare due to poor burn and potential drop out, it is separated and treated prior to overboard discharge.

The MODU and vessels are equipped with firefighting foam that is a safety critical requirement. The foam systems supply 3% alcohol resistant aqueous film-forming foam (AR-AFFF) and 3% film forming fluoroprotein foam (FFFP) concentrates which will be used in the event of an incident. Foam released on to the helideck will be routed to the open-drains system for discharge to sea.</td></tr>
<tr><th>Potential consequence</th><th>Severity</th></tr>
<tr><td>The particular values and sensitivities with the potential to be impacted by deck drainage, bilge, PW and fire foam discharges are:
• EPBC-listed species
• planktonic communities
• fish (demersal fish community KEF and commercial species).

Discharges of oily water will be treated to <15 ppm (v) in accordance with MARPOL requirements. This could introduce hazardous substances (mixture of water, oily fluids, lubricants, cleaning fluids (rig wash), etc.) into the water column, albeit in low concentrations. Temporary PW discharge during DST operations may be required due to the poor burn quality observed during flaring. PW will be treated using a PW filtration system to an OIW concentration of <30 ppm prior to discharge to the marine environment. These discharges could result in a reduction in water quality, and impacts to EPBC-listed species, plankton and other pelagic organisms such as fish species (demersal fish community KEF or those species targeted by commercial fisheries).</td><td>Insignificant (F)</td></tr>
</table>

There are no known BIAs or aggregation areas that would result in sedentary behaviour in WA-285-P and WA-343-P. The outer extent of the green turtle internesting buffer at Browse Island overlaps the far north eastern boundary of WA-285-P (Figure 4-6); however, the well location, and hence location of the discharge, is in the south-west of the permit area approximately 40 km from Browse Island. Additionally, a whale shark foraging BIA is located approximately 5 km from WA-285-P and approximately 10 km from WA-343-P at its closest point (Figure 4-7). However, based on the levels of whale shark abundance observed in numerous studies (as described in Section 4.9.4), the likelihood of whale shark presence within this BIA is considered very low, with no specific seasonal pattern of migration. Given the highly mobile and transient nature of marine fauna the potential exposure is likely to be limited to individuals close to the discharge point at the time of the discharge. Worst case impacts to exposed marine fauna may include direct toxic effects, such as damage to lungs and airways, and eye and skin lesions from exposure to oil at the sea surface (Gubbay & Earll 2000). Considering the low concentrations of oil and the location of the discharges in the dispersive open ocean environment, a surface expression is not anticipated; therefore, impacts are considered to be of inconsequential ecological significance to EPBC-listed species and are therefore considered Insignificant (F). Planktonic communities in close proximity to the discharge point may be affected if exposed to oily water. Such exposure may result in lethal effects to plankton. The potential consequence on planktonic communities is a localised impact on plankton abundance in the vicinity of the point of discharge with inconsequential ecological significance (Insignificant F). There is the potential for individual fishes to be exposed to the discharge; however, this would be limited to those fish present at the sea surface rather than those associated with the demersal fish community KEF. Such exposure is not expected to result in any significant impacts to fishes based on the low toxicity, low volume and high dilution levels; in addition, the highly mobile nature and ability of fishes to move away from the intermittent discharge. The potential consequence on the demersal fish community KEF or commercially targeted fish species will be short-term and highly localised with inconsequential ecological significance (Insignificant F).	

Firefighting foams generally contain organic and fluorinated surfactants, which can deplete dissolved oxygen in water (Schaefer 2013; IFSEC Global 2014). However, in their diluted form (as applied in the event of a fire), these foams are generally considered to have a relatively low toxicity to aquatic species (Schaefer 2013; IFSEC Global 2014) and further dilution of the foam mixtures in dispersive aquatic environments may then occur before there is any substantial demand for dissolved oxygen (Schaefer 2013; IFSEC Global 2014). To date, limited research regarding the potential impacts of firefighting foam to the marine environment has been undertaken with respect to bioaccumulation and persistence (Suhring et al 2017). Toxicological effects from these types of foams are typically only associated with prolonged or frequent exposures, such as on land and in watercourses near firefighting training areas (McDonald et al. 1996; Moody and Field 2000). As toxicological effects from foams are associated with frequent or prolonged exposures, and any discharges during the activity will be as a result of an incident and therefore infrequent and expected to rapidly disperse. Subsequently, it is not expected that any impacts will occur to EPBC-listed species or fish. It is also expected that effects on planktonic communities, if any, would be localised and of a short-term nature (Insignificant F). Additionally, the potential consequences are also considered to be countered by the net environmental benefit that would be achieved through mitigating the potential for a fire resulting in harm to people and the environment. If concurrent drilling operations were to occur, deck drainage, bilge, PW and firefighting foam discharges associated with the MODU and support vessels are not expected to overlap based on the distance between operating MODUs in the permit areas (tens of km). Therefore, no cumulative impacts to EPBC listed species, planktonic or fish communities from such discharges are expected.	

Identify existing design and safeguards/controls measures

- MODUs and vessels are equipped with OWS which remove traces of oil from the bilge and drainage water prior to discharge to sea.
- MODUs and vessels will have equipment to ensure OIW discharges meet <15 ppm in accordance with Marine Order 91. Bilge water and waste that does not meet the discharge requirements will be retained onboard for controlled disposal at a port reception facility.
- Spill kits will be available on-board MODUs and vessels.
- Vessel crew will receive an induction/training to inform them of deck spill response requirements in accordance with Table 9-3.
- INPEX chemical, assessment and approval procedure for selection of rig wash and firefighting foam in accordance with Section 9.6.1 and Table 9-5.
- Well test packages used during DST operations will include equipment to separate PW from the reservoir fluid and treat to <30 ppm prior to discharge.

Propose additional safeguards/control measures (ALARP Evaluation)

Hierarchy of control	Control measure	Used?	Justification

Elimination	No discharges of contaminated deck drainage or bilge to sea.	No	Discharge of deck drainage, stormwater runoff, or bilge discharges cannot be eliminated from the MODU or vessels. There is not sufficient space on board for storage, and onshore disposal is not practicable given the distance to the mainland (18-hour transit time to the closest port facility). Further, the associated emissions and discharges associated with such frequent transfers would have a negative impact.
	No discharge of PW to sea	No	Reservoir fluids (hydrocarbons and PW) are sent to the flare; however, for wells with poor quality burn this may result in hydrocarbon drop out. To mitigate this risk, PW will be separated and treated for overboard discharge.
	Storage and backload of PW to avoid discharge to sea	No	MODU safety case requirements and personnel safety considerations do not permit for PW to be returned to the MODU mud pits for temporary storage.
	No discharge of firefighting foams to sea.	No	Firefighting foams are safety critical and are required in the event of a fire to prevent potential loss of human life or the occurrence of a significant environmental incident. It is not possible to retain and dispose of foam during an incident by any other practicable means. Infrequent controlled discharges of small quantities of firefighting foams cannot be completely eliminated as regulatory assurance activities necessary to determine that Safety Critical Systems onboard meet their performance standards for fire protection must be carried out.
Substitution	None identified	N/A	N/A
Engineering	Treatment of PW to <15 ppm OIW	No	Industry standard for PW discharge is currently <30 ppm OIW. Treatment via any MODU OIW separator equipment is not permitted under the MODU safety case. Available deck space for additional filtration equipment is limited.

	Discharge separation and containment system for firefighting foams.	No	Given the limited (insignificant) consequence of potential impacts that may arise from such a discharge and the low potential for occurrence, implementing separate drainage systems on MODUs and vessels for firefighting foams is not considered practicable. Implementation of additional engineering measures and procedures to reroute firefighting foams is not practicable in a situation when firefighting systems must be activated as soon as possible to contain a fire and the decks adequately drained to ensure the safety of personnel and integrity of MODUs and vessels.
Procedures & administration	MODU/vessel contractors will implement specific procedures to reduce the potential for deck spills reaching the sea.	Yes	To reduce potential for deck spills entering the marine environment contractors will ensure deck drainage systems are in place and maintained. This includes implementation of maintenance procedures and the use of plugs/scuppers etc.

Identify the likelihood
Deck drainage and bilge discharges are treated to a maximum concentration of 15 ppm (v) OIW prior to discharge as specified in MARPOL, Annex 1; Marine Order 91: Marine Pollution Prevention - Oil. PW is treated by a PW filtration system to a concentration of <30 ppm OIW prior to discharge. Impacts to the abundance of plankton in the vicinity of the discharge (oily water and firefighting foam) are not expected and are considered Unlikely (4) and will be ecologically insignificant based on the naturally high spatial and temporal variability of plankton distribution in Australian tropical waters. Given the mobile nature of EPBC-listed species potentially in the permit areas, the likelihood of impacts from the discharge after treatment and subsequent dilution and dispersion is considered Unlikely (4) and is not expected to result in a threat to population viability of protected species.
Residual risk summary
Based on a consequence of Insignificant (F) and a worst-case likelihood of Unlikely (4) the residual risk is Low (9).

Consequence	Likelihood	Residual risk
Insignificant (F)	Unlikely (4)	Low (9)

Assess residual risk acceptability
Legislative requirements

MODU and vessel OWS meet relevant international regulatory requirements, including MARPOL; Marine Order 91: Marine Pollution Prevention - Oil. For MODU and vessel bilge the discharge of oil in water of <15 ppm (v) is permitted under MARPOL. Discharge of treated PW (<30 ppm) is standard industry practice. Although the previous regulations regarding OIW concentrations have been withdrawn. This limit aligns with other countries, including the USA and those covered by OSPAR (North-East Atlantic). There are no other relevant Australian environmental legislative requirements that relate specifically to the discharge of PW.

Stakeholder consultation

No stakeholder concerns have been raised regarding potential impacts and risks from deck drainage, bilge, PW or firefighting foam discharges.

Conservation management plans / threat abatement plans

Several conservation management plans have been considered in the development of this EP (refer Appendix A). Emissions and discharges are listed as threatening processes; however, none of the recovery plans or conservation advice documents has specific actions relating to deck drainage/bilge/PW/firefighting foam discharges. Managing OIW discharges in accordance with legislative requirements is consistent with the intent of the conservation management documents.

ALARP summary

Although the level of environmental risk is assessed as Low, a detailed ALARP evaluation was undertaken to determine what additional control measures could be implemented to reduce the level of impacts and risks. No additional controls, beyond those identified during the detailed ALARP assessment can reasonably be implemented to further reduce the risk of impact.

Acceptability summary

Based on the above assessment, the proposed controls are expected to effectively reduce the risk of impacts to acceptable levels because:

- the activity demonstrates compliance with legislative requirements/industry standards
- the activity takes into account stakeholder feedback
- the activity is managed in a manner that is consistent with the intent of conservation management documents
- the activity does not compromise the relevant principles of ESD
- the predicted level of impact does not exceed the defined acceptable level in that the environmental risk has been assessed as “low”, the consequence does not exceed “C – significant” and the risk has been reduced to ALARP.

Environmental performance outcomes	Environmental performance standards	Measurement criteria
	MODU and vessel contractors will comply with the *Navigation Act 2012* – Marine Order 91 including:	Record of current IOPP certificate.

Planned emissions and discharges from MODUs and vessels undertaking the petroleum activity are in accordance with MARPOL requirements and industry good practice.	• MODUs and vessels (of appropriate class) to have IOPP certificate to show they have passed structural, equipment, systems, fittings, and arrangement and material conditions. • OWS tested and approved as per IMO resolutions MARPOL (Annex I).	Calibration and maintenance records of the OWS.
	MODU and vessel liquids from drains will only be discharged if the oil in water content does not exceed 15 ppm.	Documented use of oil record book to record all oil disposal.
	MODU/vessel contractors will manage deck drainage systems including: • facility for plugging or closing of outboard drains. • inboard drains routed to oil water separator units, as required. • maintain MODU drainage systems to restrict leakages and small spills overboard.	Deck drainage plans confirm inboard/outboard drainage Documentation of operational status of MODU deck drainage systems
	Spill kits will be located on MODUs and vessels to allow clean-up of any spills to the deck.	Inspection records confirm spill kits are available and stocked.
Zero discharges of untreated PW to the marine environment.	PW discharged to the marine environment will achieve an oil in water concentration of <30 ppm.	Records demonstrate that PW has met discharge specification.

Cooling water

Table 7-5: Impact and evaluation – MODU and vessels cooling water discharges

<table>
<tr><th colspan="2">Identify hazards and threats</th></tr>
<tr><td colspan="2">Sea water is used as a heat exchange medium for the cooling of machinery engines on the MODU and vessels. It is pumped aboard and may be treated with biocide (e.g. hypochlorite) before circulation through heat exchangers. It is subsequently discharged from the MODU/vessels to the sea surface. Cooling water (CW) discharges to the marine environment will result in a localised and temporary increase in the ambient water temperature surrounding the discharge point. Elevated discharge temperatures may cause a variety of effects, including marine fauna behavioural changes and reduced ecosystem productivity or diversity through impacts to planktonic communities.

CW discharge rates vary largely depending on the vessel type. However, as a worst-case, the rate of CW discharge from the MODU during drilling is estimated to be approximately 10,000 – 20,000 m^3 per day on a continuous basis. The temperature of the CW discharge will be approximately 40 °C, in contrast to ambient surface-water temperatures of 26 °C to 30 °C as recorded in the Ichthys Field (Section 4.8.4).</td></tr>
<tr><th>Potential consequence</th><th>Severity</th></tr>
<tr><td>The particular values and sensitivities with the potential to be impacted by cooling water discharges are:
• EPBC-listed species
• planktonic communities.

Effects of elevation in seawater temperature may include a range of behavioural responses in EPBC-listed species including attraction and avoidance behaviour. There are no known BIAs or aggregation areas that would result in sedentary behaviour in WA-285-P and WA-343-P. The outer extent of the green turtle internesting buffer at Browse Island overlaps the far north eastern boundary of WA-285-P (Figure 4-6); however, the well location, and hence location of the discharge, is in the south-west of the permit area approximately 40 km from Browse Island. Additionally, a whale shark foraging BIA is located approximately 5 km from WA-285-P and approximately 10 km from WA-343-P at its closest point (Figure 4-7). However, based on the levels of whale shark abundance observed in numerous studies (as described in Section 4.9.4), the likelihood of whale shark presence within this BIA is considered very low, with no specific seasonal pattern of migration. Given the highly mobile and transient nature of marine fauna the potential exposure is likely to be limited to individuals close to the discharge point at the time of the discharge. The activity will occur in water depths of approximately 290 to 350 m in a dispersive, open ocean environment. Therefore, potential consequences to EPBC-listed species are potentially localised avoidance of thermally elevated water temperatures, with an inconsequential ecological significance to protected species (Insignificant F).</td><td>Insignificant (F)</td></tr>
</table>

Elevated seawater temperatures are known to cause alterations to the physiological (especially enzyme-mediated) processes of exposed biota (Wolanski 1994). These alterations may cause a variety of effects and potentially even mortality of plankton in cases of prolonged exposure. In view of the high level of natural mortality and the rapid replacement rate of many plankton species, UNEP (1985) indicates that there is no evidence to suggest that lethal effects to plankton from thermal discharges are ecologically significant. The potential consequence on planktonic communities is a localised impact on plankton abundance in the vicinity of the point of discharge with inconsequential ecological significance (Insignificant F). The use of biocide (hypochlorite) for the control of biofouling is considered an established and efficient technology for use in offshore environments and is used throughout the world (Khalanski 2002). The effects of chlorination on the marine environment have been summarised by Taylor (2006) who, based on a review of applications using hypochlorite as an antifoulant for the seawater cooling circuits, concluded that: • the chlorination procedure itself does cause the mortality of a proportion of planktonic organisms and the smaller organisms entrained through a cooling water system; however, only in very rare instances, where dilution and dispersion were constrained, were there any impacts beyond the point of discharge • long term exposure to chlorination residues on fish species did not impose any apparent ecotoxicological stress • studies of the impact of chlorination by-products on marine communities, population, physiological, metabolic and genetic levels, indicate that the practice of low-level chlorination on coastal receiving water is minor in ecotoxicological terms. These findings indicate that the toxicity of the CW discharge is negligible at the point of discharge, therefore impacts are limited to thermal effects. If concurrent drilling operations were to occur, cooling water discharge plumes associated with the MODUs and support vessels are not expected to overlap based on the distance between operating MODUs in the permit areas (tens of km). Therefore, no cumulative impacts to EPBC listed species or planktonic communities from such discharges are expected.	
Identify existing design and safeguards/controls measures	
None identified	
Propose additional safeguards/control measures (ALARP Evaluation)	

Hierarchy of control	Control measure	Used?	Justification

Elimination	No discharges of CW to sea	No	Engines and machinery require cooling to operate safely and efficiently, therefore CW cannot be eliminated. Storage and containment of CW to allow cooling on board the MODU and vessels prior to discharge is not considered practicable given the size/space requirements (i.e. large surface areas are required to sufficiently cool the water). Onshore disposal was also not considered practicable given the distance to the mainland, frequency of trips required, and the associated emissions and discharges generated by such transfers.
Substitution	Substitute hypochlorite with an alternative biofouling control/mechanism.	No	Hypochlorite is an established and efficient technology for use in offshore environments and is a recommended technique in the application of best available techniques (BAT) to industrial cooling systems (European Commission 2001). The retrofitting of alternative biofouling control mechanisms to all vessels is not considered to be practicable given the low environmental impact from vessel cooling water discharges.
Engineering	None identified	N/A	N/A
Procedures & administration	None identified	N/A	N/A

Identify the likelihood
CW discharges are expected to rapidly disperse in the open-ocean environment of WA-285-P and WA-343-P. MODU and vessel CW discharges may result in temporary, localised and ecologically insignificant avoidance behaviour in EPBC-listed species in response to elevated water temperatures. However, any avoidance or behavioural changes are not expected to result in a threat to the population viability of protected species and is considered to be Unlikely (4). Localised impacts to the abundance of plankton within the vicinity of the CW discharges are considered to be Unlikely (4) based on the naturally high spatial and temporal variability of plankton distribution in Australian tropical waters.
Residual risk summary
Based on a consequence of Insignificant (F) and a likelihood of Unlikely (4) the residual risk is Low (9).

Consequence	Likelihood	Residual risk
Insignificant (F)	Unlikely (4)	Low (9)

Assess residual risk acceptability

Legislative requirements The discharge of return seawater from cooling water systems to the marine environment is considered to be standard practice in industry and there are no relevant Australian environmental legislative requirements that relate specifically to the discharge specifications of cooling water. IFC EHS Guidelines – Offshore Oil and Gas Development (2015) state that cooling water discharges should be no more than 3 °C above the ambient seawater temperature at 100 m from the discharge point. CW discharge modelling for the Ichthys offshore facility located in the nearby WA-50-L, predicted a maximum 1.6 °C at 100 m from discharge point (this is based on higher discharge temperatures and greater discharge rates than would apply to a MODU/vessels undertaking this activity). Stakeholder consultation No stakeholder concerns have been raised regarding potential impacts and risks from CW discharges. Conservation management plans / threat abatement plans Several conservation management plans have been considered in the development of this EP (refer Appendix A), none of the recovery plans or conservation advice documents have specific threats or actions relating to discharges of cooling water in remote offshore waters. ALARP summary Although the level of environmental risk is assessed as Low, a detailed ALARP evaluation was undertaken to determine what additional control measures could be implemented to reduce the level of impacts and risks. No additional controls have been identified that can reasonably be implemented to further reduce the risk of impact. Acceptability summary Based on the above assessment, the risk of impacts is managed to acceptable levels because: • the activity demonstrates compliance with legislative requirements/industry standards • the activity takes into account stakeholder feedback • the activity is managed in a manner that is consistent with the intent of conservation management documents • the activity does not compromise the relevant principles of ESD • the predicted level of impact does not exceed the defined acceptable level in that the environmental risk has been assessed as "low", the consequence does not exceed "C – significant" and the risk has been reduced to ALARP.		
Environmental performance outcomes	Environmental performance standards	Measurement criteria
N/A no controls identified		

Desalination brine

Table 7-6: Impact and evaluation – MODU and vessels desalination brine discharges

<table>
<tr><th colspan="4">Identify hazards and threats</th></tr>
<tr><td colspan="4">Potable water will be generated on the MODU and vessels using a reverse osmosis (RO) plant which is supplied with sea water. Potable water is primarily supplied to the accommodation and domestic services areas. It is also supplied for other purposes such as the eyewash and safety shower systems and utilities water systems. Desalination brine produced from the RO process will be discharged to sea on a continuous basis.

Discharging desalination brine has the potential to cause changes in water salinity. The estimated volume of brine discharge for the vessels and MODU is estimated to be in the order of 60 - 140 m³ per day with salinity in the order of 45 to 50 parts per thousand (ppt) in comparison to ambient seawater with a salinity of 34 to 35 ppt (Section 4.8.4).</td></tr>
<tr><th colspan="3">Potential consequence</th><th>Severity</th></tr>
<tr><td colspan="3">The particular values and sensitivities with the potential to be impacted by desalination brine discharges are:
• planktonic communities.

The discharge of desalination brine from the MODUs and vessels has the potential to result in increased salinity within the receiving environment. Exposure to increased levels of salinity has the potential to result in impacts to planktonic communities. Azis et al. (2003) reported that effects on planktonic communities in areas of high mixing and dispersion, such as those found in the permit areas, are generally limited to the point of discharge only.

Given the water depths in WA-285-P (approximately 290 m) and WA-343-P (approximately 350 m) and the dynamic open ocean environment (i.e. tides and currents) it is expected that the brine discharge would rapidly disperse relatively close to the point of discharge. Therefore, the effects of a temporary and highly localised increase in salinity are not expected to result in any significant ecological impacts to planktonic communities (Insignificant F).

If concurrent drilling operations were to occur, desalination brine discharge plumes associated with the MODUs and support vessels are not expected to overlap based on the distance between operating MODUs in the permit areas (tens of km). Therefore, no cumulative impacts to planktonic communities from such discharges are expected.</td><td>Insignificant (F)</td></tr>
<tr><th colspan="4">Identify existing design and safeguards/controls measures</th></tr>
<tr><td colspan="4">None identified</td></tr>
<tr><th colspan="4">Propose additional safeguards/control measures (ALARP Evaluation)</th></tr>
<tr><th>Hierarchy of control</th><th>Control measure</th><th>Used?</th><th>Justification</th></tr>
</table>

Elimination	Eliminate brine discharges from MODU and vessels	No	The significant financial cost and health risks associated with providing fresh water to support vessels from the mainland via vessel transfer or transiting directly to port for resupply is grossly disproportionate to the low level of risk associated with this discharge. Steaming time to the closest port facilities for resupply is approximately 18 - 24 hours. This would also generate additional environmental impacts in terms of air emissions and increased demands to the onshore supply.
Substitution	None identified	N/A	N/A
Engineering	Use of a diffuser on vessels/MODU to increase mixing in the receiving environment.	No	Given the water depth and oceanic currents in the permit areas and the small volumes of discharges, retrospective installation of a diffuser on the MODU and all vessels is not considered practicable, given the insignificant consequence from brine discharges.
Procedures & administration	None identified	N/A	N/A

Identify the likelihood
Direct effects on plankton from desalination brine discharges may occur in the permit areas near the point of discharge but are not expected to result in an ecological impact to planktonic communities in the wider region. Therefore, the likelihood of impact to planktonic communities from these planned discharges is considered Highly Unlikely (5).
Residual risk summary
Based on a consequence of Insignificant (F) and a likelihood of Highly Unlikely (5) the residual risk is Low (10).

Consequence	Likelihood	Residual risk
Insignificant (F)	Highly Unlikely (5)	Low (10)

Assess residual risk acceptability
Legislative requirements

The discharge of desalination brine to the marine environment is considered to be standard practice in industry and there are no relevant Australian environmental legislative requirements that relate specifically to the discharge of desalination brine.

Stakeholder consultation

No stakeholder concerns have been raised regarding potential impacts and risks from desalination brine discharges.

Conservation management plans / threat abatement plans

Several conservation management plans have been considered in the development of this EP (refer Appendix A), none of the recovery plans or conservation advice documents have specific threats or actions relating to discharges of desalination brine in remote offshore waters.

ALARP summary

Although the level of environmental risk is assessed as Low, a detailed ALARP evaluation was undertaken to determine what additional control measures could be implemented to reduce the level of impacts and risks. No additional controls have been identified that can reasonably be implemented to further reduce the risk of impact.

Acceptability summary

Based on the above assessment, the risk of impacts is managed to acceptable levels because:

- the activity demonstrates compliance with legislative requirements/industry standards
- the activity takes into account stakeholder feedback
- the activity is managed in a manner that is consistent with the intent of conservation management documents
- the activity does not compromise the relevant principles of ESD
- the predicted level of impact does not exceed the defined acceptable level in that the environmental risk has been assessed as "low", the consequence does not exceed "C – significant" and the risk has been reduced to ALARP.

Environmental performance outcomes	Environmental performance standards	Measurement criteria
N/A no controls identified		

Drill fluids and drill cuttings

Table 7-7: Impact and evaluation – discharges of drill fluids and drill cuttings

<table>
<tr><th colspan="2">Identify hazards and threats</th></tr>
<tr><td colspan="2">During drilling operations, drill cuttings consisting of crushed rock fragments are generated. Along with the cuttings, drill fluids (used to lubricate/ cool the drill bit, stabilise the borehole and control pressure) are brought to the surface. The main constituents of drill fluids are either WBM or SBM, and a weighting material (typically barite) (Section 3.3.2). Barium sulphate (barite) is considered to be relatively inert in the marine environment, and unlikely to be toxic (Neff 2002). The acute toxicity of WBM is also considered to be low (Neff 1987). Various additives may also be added to improve the technical performance of the drill fluids such as viscosifiers, emulsifiers and pH control agents. The chemicals used as additives in the drill fluids are mostly classified as PLONOR (Pose Little or No Risk to the Environment) by the OSPAR Commission (2012) or have an OCNS rating of D or E or HQ rating of silver or gold.

Routine discharges of drill fluids and drill cuttings will occur during the exploration drilling activity. Sources of discharge are listed below, and quantities discharged are shown in Table 3-1:
• WBM drill cuttings and drill fluids discharge at the seabed during riserless well sections
• WBM drill cuttings discharge at the sea surface (overboard from the MODU) including bulk discharges of WBM fluid and cuttings at the end of drilling/pit washing and cleaning
• SBM drilling cuttings with ≤7% oil-on-cuttings (OoC) discharged at the sea surface.

Discharged drill fluids and drill cuttings may impact benthic communities, water quality and associated pelagic receptors within the discharge plume (Bakke et al. 2013).</td></tr>
<tr><th>Potential consequence</th><th>Severity</th></tr>
<tr><td>The particular values and sensitivities with the potential to be impacted by drilling discharges (drill fluids/cuttings) are:
• benthic communities (ancient coastline KEF)
• fish (demersal fish community KEF and commercial species).

The main impact pathways from the discharge of drill fluids and drill cuttings are associated with smothering of benthic communities and an increase in turbidity within the water column potentially impacting on water quality. Cuttings in suspension may also affect pelagic organisms, sponges, corals and other sessile fauna within the discharge plume (Bakke et al. 2013).

Smothering</td><td>Minor (E)</td></tr>
</table>

Smothering of benthic fauna may occur in locations where the rate of cuttings deposition exceeds the rate at which in situ fauna are able to move up through the sediments. There is generally no agreed threshold point for tolerance to sedimentation as it depends on the species and the structure of the accumulating material. Smit et al. (2008) conducted an extensive literature review of species sensitivity distributions for sediment burial in the marine environment. They reported that the 50% hazardous level for burial of deep-water epibenthic fauna, such as found in WA-285-P and WA-343-P, was 54 mm. The discharge of drill fluids and cuttings may result in the smothering of benthic communities in the immediate vicinity of the wells in the permit areas. This may result in burial and low sediment oxygen concentrations caused by increased oxygen consumption and organic enrichment (Neff 2008). Monitoring in the North Sea has not revealed any in situ effects of WBM cuttings on sediment macrofauna community structure, implying that any such effects, if present, will be confined to within 25–250 m from the discharge point (Bakke et al. 2013 and references within). Effects on filter feeding bivalves were reported to be limited to within a distance of 0.5 to 1 km from the discharge (Bakke et al. 2013). Further studies also indicate impacts from drilling (fluids/cuttings) discharges are localised to within 1 km of the wells (Ellis et al. 2012; Purser 2015). If concurrent drilling operations were to occur, drill fluids and cuttings discharge plumes associated with the MODUs are not expected to overlap based on the distance between the MODUs operating in the permit areas or the continued Ichthys drilling operations in the nearby in WA-50-L. Therefore, no cumulative impacts to benthic communities from such discharges are expected. Parts of the ancient coastline KEF, particularly where it exists as a rocky escarpment, are thought to provide biologically important habitats in areas otherwise dominated by soft sediments (DSEWPaC 2012a). It is considered that the hard substrate of the escarpment is likely to support a range of sponges, corals, crinoids, molluscs, echinoderms and other benthic invertebrates (DSEWPaC 2012a). The ancient coastline KEF is located, approximately 10 km south of WA-285-P and approximately 50 km south of WA-343-P at its closest point. Therefore, benthic communities associated with the KEF are not expected to be impacted by drilling discharges 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. While complete smothering of corals in sediment or drill cuttings will cause suffocation, conditions typically generated during the discharge of drill cuttings are unlikely to cause coral death, although this will be dependent on coral morphology (branching) and the capacity to shed sediment through the release of mucus (Allers et al. 2013). The nearest submerged coral communities to WA-285-P are located at Echuca and Heywood Shoals, located approximately 80 km and 95 km respectively. For WA-343-P these coral communities are located approximately 75 km and 60 km respectively. As such these are not expected to be impacted by smothering effects due to the drilling discharges.	

The closest coral reef to WA-285-P is located at Browse Island (19 km); however, this includes an intertidal reef platform and fringing reef and is therefore not expected to be contacted by drilling fluids/cuttings discharges given the distance from the permit area. This is also the case for WA-343-P which is located approximately 68 km north of Browse Island. As described in Section 4.8.3, seabed conditions in the nearby Ichthys Field are suggestive of strong near-seabed currents and mobile sediments that do not favour the development of diverse epibenthic communities. The presence of sand waves are also expected to limit the development of infaunal communities in this habitat due to substrate instability associated with changes in the currents. Any potential impacts to benthic communities from drilling discharges are expected to be at a local scale and short-term, therefore the consequence is considered to be Minor (E); particularly given the expected re-colonisation through the recruitment of new colonists from planktonic larvae and adjacent sediments. As part of the Ichthys Project Environmental Impact Statement (2010), INPEX made a commitment to investigate potential impacts of drill cuttings discharges on benthic communities in the offshore project area through environmental monitoring. A baseline 'before' study, conducted in June 2018 indicated the seabed in WA-50-L, situated between WA-285-P and WA-343-P, comprised of flat and unconsolidated sand/mud substrate with sparse biota (BMT 2019a). These results are similar to other studies in the Northwest Shelf and Timor Sea (BMT 2019b). Follow up 'after' ROV video surveys were undertaken in October 2018 and in July 2019, following the drilling of a well. The benthic substrate surrounding the well was classified as unconsolidated sand/mud (<2 mm) in both the before and after drilling surveys (BMT 2019b). Distribution of drill cuttings was wider during the after survey, which was to be expected post-drilling, with cuttings observed up to 100 m from the well centre (BMT 2019 b, c). Therefore, within WA-285-P and WA-343-P it is possible that drill cuttings could extend up to 100 m from the well locations. Biota were sparsely distributed during the surveys (before and after) but differences in abundance may have been due to natural factors such as temporal variability or the natural movement pattern of biota in the area (BMT 2019b). Sediment sampling undertaken in 2019 indicated that post drilling the concentration of metals and hydrocarbons had increased and therefore this may also have had an influence on the abundance of biota (BMT 2019c). *Turbidity and water quality* Disposal of drill fluids and cuttings discharge overboard at the sea surface may affect other parts of the marine ecosystem such as pelagic organisms and other submerged receptors that may be present within the discharge plume. Discharged drill cuttings and fluids will create a temporary and localised turbid plume, which will gradually dilute as it disperses through the water column as a result of the action of currents. Field observations from drilling campaigns on the NWS have found that plumes associated with drilling discharges at the seabed and sea surface were visible in the upper water column for up to approximately 1 km from the discharge location and for a short time (approximately 24 hours) after discharge (INPEX 2010). Exposure to increased turbidity and potential toxicity is expected to be short term, and intermittent depending on plume behaviour (Bakke et al. 2013). The seabed in both WA-285-P and WA-343-P is below the photic zone (water depths approximately 290 m and 350 m respectively) and benthic communities are expected to be largely unaffected from the presence of a discharge plume (reducing light exposure levels), due to the high dispersion and mixing of the drilling cuttings and fluids within the water column.	

Pelagic species including the demersal fish community KEF which overlaps WA-285-P and WA-343-P, fish species targeted by commercial fisheries, and EPBC-listed species transiting the area, are unlikely to be significantly impacted as they are likely to exhibit avoidance behaviour. There is the potential for individual fishes to be exposed to the discharge; however, this would be limited to those fish present at the sea surface rather than those associated with the demersal fish community KEF. Pelagic receptors may be impacted by increased TSS in the water column as an increase in particle load could adversely affect the respiratory efficiency of fish. However, most visual orientated fish/fauna species would likely relocate to an unaffected area to avoid the plume or simply pass unaffected through turbid waters. There is limited evidence that drilling discharges affect fishes in the natural environment, other than references to laboratory experiments, such as those undertaken by Gagnon and Bakhtyar (2013) that reported that acute toxicity of SBMs was generally low for pink snapper (*Pagrus auratus*). The barite to be used for the wells in WA-285-P and WA-343-P has very low concentrations of mercury and cadmium (less than 1 mg/kg and 3 mg/kg respectively). A study investigating barite solubility and the release of trace metal compounds to the marine environment recorded that <1% of the mercury and 15% of the cadmium dissolved from the barite after one-week exposure in sea water (Crecelius et al. 2007). Considering the low levels of these metals released to sea, and the small initial amounts of these metals present in the barite, it is considered that the discharge of drilling fluids will not have a significant environmental impact on water quality and the receptors present within the water column.

While turbidity and potential associated toxicity in the permit areas is likely to increase, up to approximately 1 km from the point of discharge, the plume is expected to rapidly disperse, and any impacts will be localised and of short-term duration (Minor E).

The discharge of drill fluids and cuttings in the permit areas will generate discharge plumes in the water column that may extend up to 1 km from the discharge locations. Due to the distance between operating MODUs in the permit areas (tens of km) no overlap of discharge plumes or cumulative impact to pelagic organisms or other submerged receptors is expected even if drilling operations were concurrent.

Identify existing design and safeguards/controls measures

- INPEX chemical, assessment and approval procedure for selection of drill fluids in accordance with Section 9.6.1 and Table 9-5.

Propose additional safeguards/control measures (ALARP Evaluation)

Hierarchy of control	Control measure	Used?	Justification
Elimination	Do not use drill fluids.	No	Drill fluids are a critical component for maintaining a stabilised well-bore and therefore cannot be eliminated.

	Do not discharge drill cuttings.	No	Containment of cuttings and centrifuge solids and shipping for onshore disposal was discounted due to excessive logistical costs, significant safety implications and transfer of potential environmental impact to an onshore location rather than reducing it.
	Reinject cuttings to avoid discharge to sea.	No	In cuttings reinjection, the cuttings are crushed and blended with water to create slurry. Typically, the slurry is then pumped to a suitable geological structure with an appropriate seal below the seabed through an annulus or tubing. This method of disposal is only an option if a suitable disposal well or disposal annuli are available which is not the case in the permit areas.
Substitution	Only use WBM in preference to SBM	No	Due to the expected temperature and pressure conditions in the wells, it is not technically feasible to only use WBM. In well sections with highly reactive claystones, the use of WBM is known to result in borehole breakout and collapse of the well-bore. The use of SBM results in a less reactive down-hole environment and lowers the potential for destabilisation of the well-bore. The expected reservoir intervals to be drilled are analogous to the Ichthys Development (WA-50-L) reservoirs which have been extensively tested comparing formation damage potential of both SBM & WBM. SBM has provided significantly better results to date and therefore provides the best environment to fully evaluate development potential in WA-285-P and WA-343-P. Ongoing development of high performance WBM systems will continue to be monitored with a view to possible inclusion in future wells if results indicate there will be no technical detriment.
Engineering	Use of SCE that is appropriately maintained for effective operation	Yes	Quantities of drilling fluids and cuttings discharged will be minimised through the use of SCE, which includes recirculation of the mud where possible.
	Treatment of SBM cuttings to <1% OoC	No	Drilling operations use a combination of cuttings dryers and dryer centrifuges to further reduce the amount of oil on cuttings leaving the shale shakers. Additional cuttings dryers and dryer centrifuges could further reduce the average concentration of oil on cuttings to 6–8% wt/wt. However, drying down to <1% would use significant amounts of energy and requires significant MODU deck space. Treating from <6-8% down to <1% to reduce cuttings pile biodegradation time is therefore not considered ALARP due to the energy consumption and resulting air emissions.

			Another option considered is the use of thermal desorption using a rotomill to pulverise and process the cuttings further. While this option reduces the discharge of residual SBM cuttings to the seabed, it is energy-intensive (i.e. consumes significant amounts of diesel fuel) and entails significant costs. Therefore, thermal desorption creates additional environmental impacts and has considerable practicability constraints associated with its use and has been discounted for this activity.
	Treatment of SBM cuttings to ≤7% OoC	Yes	The proposed discharge of WBM and treatment for SBM is considered to exceed current industry benchmarks. The additional control measure of installing a cuttings dryer to further reduce the concentration of oil on cuttings provides assurance that a suitable buffer can be maintained to ensure that the average concentration of SBM OoC is no greater than 7% wt/wt (averaged over the SBM sections of the well).
Procedures & administration	Concentrations of mercury and cadmium in stock barite will meet IFC EHS guidelines (2015) effluent levels.	Yes	The barite used for drilling operations in WA-285-P and WA-343-P will have low concentrations of mercury and cadmium (less than 1 mg/kg and 3 mg/kg respectively) in accordance with IFC EHS guidelines.

Identify the likelihood
Smothering of benthic communities may occur adjacent to the well site albeit limited to an extent ranging to within a couple of hundred metres. With the reported limited benthic community diversity in the permit areas (Section 4.8.3) and distances to sensitive benthic communities (Echuca and Heywood Shoals located over 60 km from either permit area at the closest points) any localised loss of benthic communities in the vicinity of the wells from smothering are predicted to be relatively temporary based on the expected recovery of benthic communities through recolonisation aided by seabed currents. Therefore, with the controls in place to minimise toxicity by selecting the least hazardous chemicals coupled with the likely recolonisation within WA-285-P and WA-343-P, impacts to benthic communities from smothering are considered to be Highly Unlikely (5). Based on the highly dispersive environment in the permit areas, short-term and intermittent nature of the discharges, the low levels of associated toxicity and the localised scale of potential impact (<1 km) it is Highly Unlikely (5) that drill fluids and cuttings will have a significant environmental impact on water quality, submerged receptors and marine fauna present within the water column.
Residual risk summary
Based on a consequence of Minor (E) and a likelihood of Highly Unlikely (5) the residual risk is Low (9).

Consequence	Likelihood	Residual risk
Minor (E)	Highly Unlikely (5)	Low (9)

Assess residual risk acceptability
Legislative requirements The Minimata Convention covers all aspects of the life cycle of mercury, controlling and reducing mercury across a range of products, processes and industries. Australia ratified the Minamata Convention on 7 December 2021. Countries that have ratified the Convention are bound by international law to put controls in place to manage emissions, releases and disposal of mercury and mercury compounds. At present there are no specific guidelines regarding acceptable levels of mercury waste in drilling fluids. The discharge of drill fluids and cuttings to the marine environment is considered to be standard practice in industry. Barite contamination, with mercury and cadmium, will be managed in accordance with IFC EHS Guidelines – Offshore Oil and Gas Development (2015) that represent good international industry practice. Stakeholder consultation No stakeholder concerns have been raised regarding potential impacts and risks from planned discharges of drill fluids and cuttings. Conservation management plans / threat abatement plans Several conservation management plans have been considered in the development of this EP (refer Appendix A). Emissions and discharges are listed as threatening processes; however, none of the recovery plans or conservation advice documents has specific actions relating to discharges of drill fluids or cuttings in remote offshore waters. ALARP summary Although the level of environmental risk is assessed as Low, a detailed ALARP evaluation was undertaken to determine what additional control measures could be implemented to reduce the level of impacts and risks. No additional controls, beyond those identified during the detailed ALARP assessment can reasonably be implemented to further reduce the risk of impact. Acceptability summary Based on the above assessment, the proposed controls are expected to effectively reduce the risk of impacts to acceptable levels because: • the activity demonstrates compliance with legislative requirements/industry standards • the activity takes into account stakeholder feedback • the activity is managed in a manner that is consistent with the intent of conservation management documents • the activity does not compromise the relevant principles of ESD • the predicted level of impact does not exceed the defined acceptable level in that the environmental risk has been assessed as "low", the consequence does not exceed "C – significant" and the risk has been reduced to ALARP.

Environmental performance outcomes	Environmental performance standards	Measurement criteria

All discharges to the marine environment of SBM drill cuttings will be ≤7% wt/wt oil on cuttings (averaged over the SBM sections).	Oil-on-cuttings for SBM cuttings will be ≤ 7%.	Daily OoC results recorded in the daily drilling report.
Limit planned discharges from drilling activities so that impacts to receptors will be localised.	Volumes of drill fluids discharged will be minimised through the use of SCE, which includes recirculation of the mud where possible.	Records of all operational discharges (planned and unplanned) of drilling fluids and cuttings are recorded on the MODU and demonstrate compliance with all requirements for operational discharge.
	Maintenance of SCE in accordance with the MODU preventive maintenance system.	Documentation of planned and completed maintenance and testing of SCE in accordance with the MODU preventive maintenance system.
	INPEX will verify that the drilling fluids contractor adheres to the following with respect to limits on mercury and cadmium concentration in drilling fluids including: • Mercury (Hg) – 1 mg/kg dry weight in stock barite (WBM and SBM) • Cadmium (Cd) – 3 mg/kg dry weight in stock barite (WBM and SBM).	Drilling fluids will have concentrations of mercury and cadmium less than 1 mg/kg and 3 mg/kg respectively in stock barite. Documentation of QA/QC acceptance process undertaken for all individual batches of barite used.

Cement, cementing fluids and additives

Table 7-8: Impact and evaluation – discharges of cement, cementing fluids and additives

Identify hazards and threats	
Planned cement discharges at the seabed during the cementing of conductors and casing, and during well abandonment operations, will occur as part of the drilling activity in WA-285-P and WA-343-P. Small volumes (1–2 m^3 of cement per section) may also be discharged as a slurry at the sea surface from circulating cement with the riser installed, or from cleaning of cementing tanks and equipment on the MODU. Contingency discharges of cement may also be required if a cementing job does not meet technical and safety standards. In this instance any remaining cement will be mixed and operationally discharged within the well bore or to the marine environment. As described in Section 3.3.2, it is standard practice to allow some excess cement slurry to overflow when cementing the top-hole section of a well to visually confirm that the annular space between the hole and the casing has been filled. This may typically cover an area of up to 10 m^2 per well. The discharge of cement, cementing fluids and additives has the potential to reduce water quality through increasing turbidity or toxicity which may affect organisms within the water column. Seabed cement discharges may result in smothering of benthic communities in the vicinity of the well.	
Potential consequence	**Severity**
The particular values and sensitivities with the potential to be impacted by cementing discharges (fluids/additives) are: • benthic communities • fish (demersal fish community KEF and commercial species). Impact pathways associated with the discharge of cement during drilling operations are associated with smothering of benthic communities in close proximity to the wells, and an increase in turbidity or toxicity within the water column potentially impacting on water quality. *Smothering* As described in Table 7-7, discharges at the seabed may result in the smothering of benthic communities in the immediate vicinity of the wells in WA-285-P and WA-343-P. Discharges of cement (potentially covering up to approximately 10 m^2 per well) will result in burial and loss of benthic communities immediately adjacent to the well, particularly for sessile epifauna.	Insignificant (F)

As described in Section 4.8.3, seabed conditions within the permit areas are suggestive of strong near-seabed currents and mobile sediments that do not favour the development of diverse epibenthic communities. The presence of sand waves are also expected to limit the development of infaunal communities in this habitat due to substrate instability associated with changes in the currents. Any potential impacts to benthic communities and loss of benthic habitat due to cement discharges are expected to be at a local scale, therefore the consequence is considered to be Insignificant (F); particularly given the context of the potential area impacted < 10 m^2 per well, in comparison to the total area of WA-285-P and WA-343-P. There are no sensitive or unique benthic habitats that would be impacted by seabed cement discharges. Concurrent drilling operations may occur during the activity either with MODUs operating in both WA-285-P and WA-343-P and also the continued Ichthys drilling operations in the nearby in WA-50-L. Given the distance (tens of km) between any concurrently operating MODUs, the discharge of cement, cementing fluids and additives that may result in smothering of benthic communities up to approximately 10 m^2 at each well will be highly localised. Therefore, no impacts from smothering due to cement discharges are predicted from concurrent drilling operations. *Turbidity* Disposal of cement discharges overboard at the sea surface may affect other parts of the marine ecosystem such as pelagic organisms and other submerged receptors that may be present within the discharge plume. Intermittent discharges of cement, albeit at small volumes (1–2 m^3) may create a temporary and localised turbid plume, which will gradually dilute as it disperses through the water column as a result of the action of currents. Data on the longevity of cement discharge plumes is not available; however, plumes associated with drilling muds have been reported to be visible in the upper water column for up to approximately 1 km from the discharge location and for a short time (approximately 24 hours) after discharge (INPEX 2010). Therefore, low volume cement discharges would also be expected to dissipate within this timeframe and exposure to increased turbidity and potential toxicity associated with the discharge is expected to be short term, and intermittent. The seabed in both WA-285-P and WA-343-P is below the photic zone (water depths approximately 290 m and 350 m respectively) and benthic communities are expected to be largely unaffected from the presence of a discharge plume (reducing light exposure levels), due to the high dispersion and mixing of the cement discharge within the water column.	

Pelagic species including the demersal fish community KEF which overlaps WA-285-P and WA-343-P, fish species targeted by commercial fisheries, and EPBC-listed species transiting the area, are unlikely to be significantly impacted as they are likely to exhibit avoidance behaviour. There is the potential for individual fishes to be exposed to the discharge; however, this would be limited to those fish present at the sea surface rather than those associated with the demersal fish community KEF. Pelagic receptors may be impacted by increased suspended solids in the water column as an increase in particle load could adversely affect the respiratory efficiency of fish. However, most visual orientated fish/fauna species would likely relocate to an unaffected area to avoid the plume or simply pass unaffected through turbid waters. The potential for toxicity effects to fish and pelagic organisms is expected to be limited given toxicity is mainly associated with cement additives that are used in minor quantities. Given the dispersive environment in the permit areas and expected high level of dilution, any exposure is expected to be limited to a few individuals within the immediate vicinity of the discharge. Therefore, the discharge of cement/cement slurry will not have a significant environmental impact on water quality and the receptors present within the water column (Insignificant F). The discharge of cement, cementing fluids and additives in the permit areas will generate discharge plumes in the water column that may extend up to 1 km from the discharge locations. Due to the distance between operating MODUs in the permit areas (tens of km) no overlap of discharge plumes or cumulative impact to pelagic organisms or other submerged receptors is expected even if drilling operations were concurrent.	

Identify existing design and safeguards/controls measures

- INPEX chemical, assessment and approval procedure for selection of cementing chemicals in accordance with Section 9.6.1 and Table 9-5.
- Records of all operational cement discharges will be monitored and maintained. Any remaining cement will be mixed and operationally discharged within the well bore or to the marine environment.

Propose additional safeguards/control measures (ALARP Evaluation)

Hierarchy of control	Control measure	Used?	Justification
Elimination	Do not cement well casing	No	Cementing of well casing is required and cannot be eliminated. Only the conductor hole section will result in the discharge of cement to the seabed. Through casing design of the lower well sections, no cement will be discharged to the seabed from the lower casings.
Substitution	None identified	N/A	N/A
Engineering	None identified	N/A	N/A

Procedures & administration	Dye used to provide a pre-indicator of cement overflow to seabed	Yes	A dye is used during cementing operations to indicate cement overflow, therefore minimising the volume discharged at the seabed.

Identify the likelihood
Localised smothering of benthic communities and habitats may occur immediately adjacent to the well site from seabed cement returns for an area of up to 10 m^2 at each well. With the reported limited benthic community diversity in the permit areas (Section 4.8.3) and the controls in place to minimise toxicity, the loss of sensitive benthic communities from smothering due to cement discharge is considered Highly Unlikely (5). Based on the highly dispersive environment in WA-285-P and WA-343-P, the short-term and intermittent nature of the discharges, the low levels of associated toxicity and the localised scale of potential impact (<1 km), it is Highly Unlikely (5) that cement discharges will have a significant environmental impact on water quality and the marine fauna present within the water column.
Residual risk summary
Based on a consequence of Insignificant (F) and a likelihood of Highly Unlikely (5) the residual risk is Low (10).

Consequence	Likelihood	Residual risk
Insignificant (F)	Highly Unlikely (5)	Low (10)

Assess residual risk acceptability
Legislative requirements The discharge of cement to the marine environment is considered to be standard practice in industry and there are no relevant Australian environmental legislative requirements that relate specifically to the discharge. Stakeholder consultation No stakeholder concerns have been raised regarding potential impacts and risks from planned discharges of cement. Conservation management plans / threat abatement plans Several conservation management plans have been considered in the development of this EP (refer Appendix A). Emissions and discharges are listed as threatening processes; however, none of the recovery plans or conservation advice documents has specific actions relating to discharges of cement in remote offshore waters. ALARP summary

Although the level of environmental risk is assessed as Low, a detailed ALARP evaluation was undertaken to determine what additional control measures could be implemented to reduce the level of impacts and risks. No additional controls, beyond those identified during the detailed ALARP assessment can reasonably be implemented to further reduce the risk of impact.

Acceptability summary

Based on the above assessment, the proposed controls are expected to effectively reduce the risk of impacts to acceptable levels because:

- the activity demonstrates compliance with legislative requirements/industry standards
- the activity takes into account stakeholder feedback
- the activity is managed in a manner that is consistent with the intent of conservation management documents
- the activity does not compromise the relevant principles of ESD
- the predicted level of impact does not exceed the defined acceptable level in that the environmental risk has been assessed as "low", the consequence does not exceed "C – significant" and the risk has been reduced to ALARP.

Environmental performance outcomes	Environmental performance standards	Measurement criteria
Limit planned discharges from drilling activities so that impacts to receptors will be localised.	Volumes of excess cement will be minimised through optimising operational cement discharges.	Records of all operational discharges (planned and unplanned) of cement are recorded on the MODU and demonstrate compliance with all requirements for operational discharge.
	Use dye to provide a pre-indicator of cement overflow to seabed	Daily drilling report End of well cementing report

BOP and hydraulic control fluids

Table 7-9: Impact and evaluation – subsea discharges of BOP and hydraulic control fluids

<table>
<tr><th colspan="2">Identify hazards and threats</th></tr>
<tr><td colspan="2">BOP function testing is undertaken approximately weekly or fortnightly during the drilling activity. Generally, an initial pre-deployment function testing is undertaken on deck with no resulting subsea discharge of BOP control fluid. However, function testing will occur subsea, with each test releasing approximately 0.25 m^3 of BOP control fluid. BOP control fluid generally consists of water mixed with a glycol based detergent, or equivalent water based, anti-corrosive additive suitable for open hydraulic systems. BOP control fluid is ranked as a Group E product by the OCNS and, therefore, considered PLONOR.

Water-based hydraulic fluids will also be discharged subsea (typically < 1 m^3) through the use of ROVs during the drilling activity which may result in a temporary and localised reduction in water quality.</td></tr>
<tr><th>Potential consequence</th><th>Severity</th></tr>
<tr><td>The particular values and sensitivities with the potential to be impacted by discharges of BOP and hydraulic control fluids are:
• EPBC-listed species
• fish (demersal fish community KEF and commercial species)
• benthic communities.

Discharges of BOP control fluids and other water-based hydraulic fluids could introduce hazardous substances into the water column, albeit in low concentrations, and in the majority of cases the chemicals are classified as PLONOR. However, this could result in a reduction in water quality, and impacts to EPBC-listed species and other pelagic organisms such as fish species (demersal fish community KEF or those species targeted by commercial fisheries) and benthic communities given some discharges may occur at or near the seabed.

There are no known BIAs or aggregation areas that would result in sedentary behaviour in WA-285-P and WA-343-P. The outer extent of the green turtle internesting buffer at Browse Island overlaps the far north eastern boundary of WA-285-P (Figure 4-6); however, the well location, and hence location of the discharge, is in the south-west of the permit area approximately 40 km from Browse Island. Additionally, a whale shark foraging BIA is located approximately 5 km from WA-285-P and approximately 10 km from WA-343-P at its closest point (Figure 4-7). However, based on the levels of whale shark abundance observed in numerous studies (as described in Section 4.9.4), the likelihood of whale shark presence within this BIA is considered very low, with no specific seasonal pattern of migration.</td><td>Insignificant (F)</td></tr>
</table>

Considering the low volumes and low levels of associated toxicity of the BOP and hydraulic control fluid discharges in the dispersive open environment and the highly mobile and transient nature of marine fauna, any potential exposure is likely to be limited to individuals close to the discharge point at the time of the discharge. Therefore, impacts are considered to be of inconsequential ecological significance to EPBC-listed species and are therefore considered Insignificant (F). There is the potential for individual fishes, directly adjacent to the discharge point to be exposed to the intermittent subsea discharges. Such exposure is not expected to result in any significant impacts to fishes based on the high dilution levels, low toxicity, low volumes and in consideration of the highly mobile nature and ability of fishes to move away. The potential consequence on the demersal fish community KEF and any species targeted by commercial fisheries will be short-term and highly localised with inconsequential ecological significance (Insignificant F). As described in Section 4.8.3, seabed conditions within the permit areas are suggestive of strong near-seabed currents and mobile sediments that do not favour the development of diverse epibenthic communities. The presence of sand waves is also expected to limit the development of infaunal communities in this habitat due to substrate instability associated with changes in the currents. Subsea discharges of BOP and hydraulic control fluids are expected to be highly influenced by natural dispersion and dilution processes associated with the currents experienced in the offshore environment. Potential impacts on benthic communities may include lethal and sub-lethal effects; however, impacts are expected to be limited both spatial and temporally due to intermittent nature, small volumes and low toxicity of the discharges. Therefore, the consequence of the exposure of benthic communities would be at a local scale with a temporary impact and is ranked as Insignificant (F). Concurrent drilling operations may occur during the activity either with MODUs operating in both WA-285-P and WA-343-P and also the continued Ichthys drilling operations in the nearby in WA-50-L. Given the distance (tens of km) between any concurrently operating MODUs, the discharge BOP and hydraulic control fluids would be highly localised with no overlap of discharges expected. Therefore, no impacts to EPBC listed species, fish or benthic communities from BOP and hydraulic controls fluid discharges are expected.			
Identify existing design and safeguards/controls measures			
• INPEX chemical, assessment and approval procedure for selection of drill fluids in accordance with Section 9.6.1 and Table 9 5. • Records of BOP and hydraulic control fluid discharges will be monitored and maintained.			
Propose additional safeguards/control measures (ALARP Evaluation)			
Hierarchy of control	Control measure	Used?	Justification

Elimination	No subsea discharges of BOP or hydraulic control fluids	No	Function and pressure testing of the BOP is required to ensure safe and effective operation. Therefore, the subsea discharge of BOP control fluids cannot be eliminated. Hydraulic fluid (water-based) discharges are inherent for the use of subsea equipment e.g. ROVs. There are no practicable ways to eliminate these small volume discharges (< 1 m^3). There are no practicable ways to capture the small volumes of such discharges and based on the chemical composition (water/glycol based) these discharges are considered to PLONOR when discharged to the marine environment.
Substitution	None identified	N/A	N/A
Engineering	None identified	N/A	N/A
Procedures & administration	None identified	N/A	N/A

Identify the likelihood

Impacts to the EPBC-listed marine fauna, fish and benthic communities in the vicinity of the BOP and hydraulic control fluid discharges are not expected to occur and are considered Unlikely (4). This is largely due to the water depth, low toxicity and low volumes of the discharged fluids. The open-ocean, highly dispersive environment in the permit areas will also result in high levels of dilution further reducing the likelihood of exposure to the identified receptors.

Residual risk summary

Based on a consequence of Insignificant (F) and a worst-case likelihood of Unlikely (4) the residual risk is Low (9).

Consequence	Likelihood	Residual risk
Insignificant (F)	Unlikely (4)	Low (9)

Assess residual risk acceptability

Legislative requirements

The majority of BOP and hydraulic control fluids are based on fresh water with additives. Subsea discharges of these fluids to the marine environment is considered to be standard practice in industry and there are no relevant Australian environmental legislative requirements that relate specifically to these discharges.

Stakeholder consultation No stakeholder concerns have been raised regarding potential impacts and risks from planned subsea discharges of BOP and hydraulic control fluids. Conservation management plans / threat abatement plans Several conservation management plans have been considered in the development of this EP (refer Appendix A). Emissions and discharges are listed as threatening processes; however, none of the recovery plans or conservation advices has specific actions relating to discharges of BOP control/hydraulic fluid discharges in remote offshore waters. ALARP summary Although the level of environmental risk is assessed as Low, a detailed ALARP evaluation was undertaken to determine what additional control measures could be implemented to reduce the level of impacts and risks. No additional controls, beyond those identified during the detailed ALARP assessment can reasonably be implemented to further reduce the risk of impact. Acceptability summary Based on the above assessment, the proposed controls are expected to effectively reduce the risk of impacts to acceptable levels because: • the activity demonstrates compliance with legislative requirements/industry standards • the activity takes into account stakeholder feedback • the activity is managed in a manner that is consistent with the intent of conservation management documents • the activity does not compromise the relevant principles of ESD • the predicted level of impact does not exceed the defined acceptable level in that the environmental risk has been assessed as "low", the consequence does not exceed "C – significant" and the risk has been reduced to ALARP.		
Environmental performance outcomes	Environmental performance standards	Measurement criteria
Limit planned discharges from drilling activities so that impacts to receptors will be localised.	Records of subsea discharges will be monitored and maintained.	Daily drilling report

7.2 Waste management

Table 7-10: Impact and evaluation – inappropriate waste handling and disposal

<table>
<tr><th colspan="2">Identify hazards and threats</th></tr>
<tr><td colspan="2">The MODUs and vessels associated with the activity will generate a variety of non-hazardous and hazardous wastes, which will not be intentionally discharged to the marine environment. Unsecured or incorrectly stored waste may be windblown or displaced into the ocean where it has the potential to negatively affect marine ecosystems. Wastes can cause contamination of the ocean resulting in changes to water quality e.g. through the leaching of chemicals from wastes, which can cause changes to ecosystem productivity and diversity. Additionally, certain types of waste can cause injury to marine fauna through entanglement or may affect the health of marine species that ingest waste materials.</td></tr>
<tr><th>Potential consequence</th><th>Severity</th></tr>
<tr><td>The particular values and sensitivities with the potential to be impacted by improper waste management are:
• EPBC-listed species
• planktonic communities.

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

A change to water quality has the potential to impact planktonic communities found at the sea surface. Impacts associated with the accidental loss of hazardous waste materials to the ocean as a result of leaching from waste would be localised and limited to the immediate area. These are further likely to be reduced due to the dispersive open ocean offshore environment. While plankton abundance in close proximity to the accidental loss location, or leaching waste items may be reduced, this is expected to be of insignificant ecological consequence (Insignificant F).

Marine fauna can become entangled in waste plastics, which can also be ingested when mistaken as prey (Ryan et al. 1988), potentially leading to injury or death. For example, due to indiscriminate foraging behaviour, marine turtles have been known to mistake plastic for jellyfish (Mrosovsky et al. 2009). Seabirds foraging on planktonic organisms, generally at, or near, the surface of the water column may eat floating plastic (DEE 2018). Other items (e.g. discarded rope) have also been found to entangle fauna, such as birds and marine mammals. The accidental loss of waste to the ocean may result in injury or even death to individual transient EPBC listed species, but this is not expected to result in a threat to population viability of a protected species (Insignificant F).</td><td>Insignificant (F)</td></tr>
<tr><th colspan="2">Identify existing design and safeguards/controls measures</th></tr>
<tr><td colspan="2">• Spill containment and recovery equipment
• MODUs and vessels will manage waste in accordance with MARPOL Annex V, specifically maintain and implement a garbage management plan.</td></tr>
</table>

Propose additional safeguards/control measures (ALARP Evaluation)			
Hierarchy of control	Control measure	Used?	Justification
Elimination	None identified	N/A	N/A
Substitution	None identified	N/A	N/A
Engineering	None identified	N/A	N/A
Procedures & administration	Premobilisation HSE inspection of MODU/vessel and waste contractors	Yes	HSE inspection conducted pre-mobilisation and ongoing during the activity will confirm correct storage, labelling and handling of wastes including presence of netting to prevent windblown waste
	Use of licensed onshore waste facility or contractor to receive / dispose of waste.	Yes	The use of licensed onshore waste receiving facilities/contractors provides assurances that wastes will be correctly handled and disposed of once unloaded from vessels.
	Reporting of equipment or materials lost to sea	Yes	Any equipment or materials and waste lost to the marine environment will be reported and records maintained in the garbage management plan.

Identify the likelihood		
During previous INPEX drilling activities with MODUs and associated vessels, the accidental release/loss of waste or equipment overboard has occurred on several occasions often through incorrect storage and handling. Therefore, impacts to EPBC-listed species and planktonic communities from the unplanned release of waste to the ocean are considered Possible (3). However, this is considered to be ecologically insignificant given the absence of any known BIAs that overlap the well locations and the dispersive open ocean environment.		
Residual risk summary		
Based on a consequence of Insignificant (F) and a worst-case likelihood of Possible (3) the residual risk is Low (8).		
Consequence	Likelihood	Residual risk
Insignificant (F)	Possible (3)	Low (8)

Assess residual risk acceptability
Legislative requirements The existing preventative and mitigation measures outlined to prevent accidental release of hazardous and non-hazardous wastes are consistent with, and typical of, good industry practice. Procedures for managing waste (i.e. handling, storage, transfer and disposal) will be outlined in the vessel/MODU garbage management plan, in accordance with MARPOL Annex V requirements. Stakeholder consultation No stakeholder concerns have been raised regarding potential impacts and risks from improper waste handling and disposal. Conservation management plans / threat abatement plans Several conservation management plans have been considered in the development of this EP (refer Appendix A). Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris was listed in August 2003 as a key threatening process under the EPBC Act as detailed in the 'Threat abatement plan for impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans' (DEE 2018). The entanglement and ingestion of marine debris is also identified as a threat in the 'Recovery Plan for Marine Turtles in Australia" (DEE 2017a). Specific actions which contribute to the long-term prevention of marine debris (Objective 1 of the 'Threat abatement plan for marine debris on vertebrate marine life' (DEE 2018)) have been adopted including compliance with applicable legislation in relation to the improvement of waste management practices, such as MARPOL Annex V. ALARP summary Although the level of environmental risk is assessed as Low, a detailed ALARP evaluation was undertaken to determine what additional control measures could be implemented to reduce the level of impacts and risks. No additional controls, beyond those identified during the detailed ALARP assessment can reasonably be implemented to further reduce the risk of impact. Acceptability summary Based on the above assessment, the proposed controls are expected to effectively reduce the risk of impacts to acceptable levels because: • the activity demonstrates compliance with legislative requirements/industry standards • the activity takes into account stakeholder feedback • the activity is managed in a manner that is consistent with the intent of conservation management documents • the activity does not compromise the relevant principles of ESD • the predicted level of impact does not exceed the defined acceptable level in that the environmental risk has been assessed as "low", the consequence does not exceed "C – significant" and the risk has been reduced to ALARP.

Environmental performance outcomes	Environmental performance standards	Measurement criteria
No unplanned loss of equipment, materials or wastes to the marine environment during the petroleum activity.	Loss of equipment or materials lost to sea will be reported.	Incident report of equipment or material lost overboard.
	Spill kits will be available on board the MODUs and vessels.	Inspection records confirm spill kits are available and stocked.
	Garbage management plans will be maintained and implemented on MODUs and vessels in accordance with Marine Order 95; Annex V of MARPOL (garbage), and will specifically include: • procedures for collecting, storing, processing and disposing of all waste types (including segregation and labelling) • the use of waste storage and transfer equipment • the use of food waste macerators/comminuters • garbage record keeping requirements, including discharges, and disposals of waste in a Garbage Record Book • communication of waste management practices and awareness materials for crew.	HSE inspection records confirm garbage management plans are implemented on MODUs and vessels. Incident report of waste lost overboard.
	Onshore transfer/disposal of MODU/vessel waste will be completed using a licensed waste facility or contractor.	Garbage Record Book demonstrates onshore transfer/disposal of facility/vessel waste via a licensed waste facility or contractor.

7.3 Noise and vibration

Table 7-11: Impact and risk evaluation – underwater noise

Identify hazards and threats	
Marine fauna may be exposed to several sources of noise emissions during the activity, as summarised below: • Operation of the MODU (including power generation and drilling) has the potential to expose sound sensitive marine fauna to localised changes in underwater noise levels. Machinery positioned on the deck is above the waterline and therefore the overall noise levels will be low. The level of underwater noise associated with MODUs while not drilling are reported to decrease rapidly with distance from the MODU. In a study by McCauley (1998), it is reported that during non-drilling operations sound levels of 117 dB re 1μPa were recorded at a distance of 125 m from the wellhead and were audible over a distance of 1-2 km. This noise was reported to be associated with the discharging of fluids and the operation of pumping systems and mechanical plant, etc. While actively drilling, sound levels of 115 dB re 1μPa were recorded at a distance of 405 m from the wellhead (McCauley 1998). Other studies have reported measured sound levels of 136 dB re 1 μPa at 100 m distance from drilling activities (Nedwell & Edwards 2004) and Greene (1986) reported 117 dB re 1 μPa at 185 m and 110 dB re 1μPa at 926 m. The noise generated during drilling activities was primarily associated with the use of the drill string. • The pre-drill surveys will use underwater acoustic techniques including MBES, side-scan sonar and sub-bottom profiling (Section 3.2). The surveys will be conducted from a dedicated geophysical survey vessel and have the potential to expose sound sensitive marine fauna to localised changes in underwater noise levels. The different survey devices shall emit various levels of sound at a range of frequencies. MBES and side-scan sonar transmit at high frequencies (approximately 120–410 kHz) and produce a highly focused beam of sound towards the seabed, due to this there is very limited horizontal sound propagation, and it is expected to rapidly attenuate. Indicative ranges of sound outputs at source are 163-190 dB re 1 μPa at 1 m and 137-200 dB re 1 μPa at 1 m, for MBES and side-scan sonar respectively. Sub-bottom profiling systems operate at low frequency (1-16 kHz) directing beans of sound towards the seabed and therefore horizontal sound propagation is again limited. Sound outputs at source may range from 142-200 dB re 1 μPa at 1 m. • Operating vessels (pre-drill survey and support vessels) have the potential to expose sound sensitive marine fauna to localised changes in underwater noise levels. Vessel engines and dynamic positioning thrusters are capable of generating sound at levels between 108 and 182 dB re 1 μPa at 1 m at dominant frequencies between 50 Hz and 7 kHz (Simmonds et al. 2004; McCauley 1998). • As part of reservoir evaluation, a VSP will be undertaken at each well in the permit areas (Section 3.3.5), which will generate high-intensity, impulsive sound that will propagate into the water column with the potential to expose sound sensitive marine fauna to localised changes in underwater noise levels. Sound levels generated during the VSP will be 232 dB re 1 μPa@1 m with a frequency range of 5–125 Hz. Each VSP will be of short duration (approximately 18 hours).	
Potential consequence	**Severity**
The particular values and sensitivities with the potential to be impacted by underwater noise emissions are:	Insignificant (F)

• EPBC-listed species (cetaceans, turtles and whale sharks) • fish (demersal fish community KEF and commercial species). The generation of underwater sound from the pre-drill survey and drilling activities in WA-285-P and WA-343-P has the potential to impact EPBC-listed marine fauna, specifically marine mammals and turtles. Sudden exposure to very high sound levels or exposure for prolonged periods can result in a permanent threshold shift (PTS) or temporary threshold shift (TTS) in hearing. Noise impact thresholds proposed by the U.S. National Oceanic and Atmospheric Administration and National Marine Fisheries Service (NMFS 2018) for cetaceans, suggest that, for the types of cetacean with the potential to occur in the permit areas, PTS could occur as a result of peak sound pressure levels of 219 – 230 dB re 1 µPa or prolonged exposure to sound exposure levels of 198 – 199 dB re 1 µPa2·s. TTS could occur at peak sound pressure levels of 213 - 224 dB re 1 µPa or prolonged exposure to sound exposure levels of 168 - 170 dB re 1 µPa2·s (NMFS 2018). Popper et al. (2014) propose conservatively protective sound pressure thresholds of 207 - 213 dB re 1 µPa for potential injury to various types of fish and for marine turtles. With the exception of the VSP, no sources of noise associated with the activity are expected to have the potential to result in PTS or TTS. However, a range of behavioural changes can occur in cetaceans in response to sound pressure levels as low as 120 dB re 1 µPa (Southall et al. 2007). This may include minor responses, such as a momentary pause in vocalisation or reorientation of an animal to the source of the sound, or avoidance responses (Southal et al. 2007). For cetaceans, NMFS (2019) propose a behavioural response threshold of 160 dB re 1 µPa for impulsive sound sources and 120 dB re 1 µPa for continuous sound sources (NMFS 2019). Marine turtles are not reported to use sound for communication; however, it is proposed that they may use sound for navigation, avoiding predators and finding prey (Dow Piniak 2012). For received sound pressure levels above 166 dB re 1 µPa, turtles have shown some increased swimming activity and above 175 dB re 1 µPa can become more agitated (McCauley et al. 2000). The 166 dB re 1 µPa level is used as the threshold level for a behavioural disturbance response by turtles (NSF 2011). A limited number of commercially significant fish stocks may be present in WA-285-P and WA-343-P that may be exposed to underwater noise emissions (Table 4-6). Given the deep waters, commercially significant fish stocks in the permit areas are primarily limited to highly mobile pelagic species such as tuna and billfish. The water depths and absence of suitable habitats mean WA-285-P and WA-343-P are not considered to offer spawning or aggregation habitat for commercially targeted demersal species which occur in the shallower waters on the continental shelf (typically less than 200 m water depth) (Section 4.11.3). Deep water scampi (*Metanephrops australiensis*), targeted by the North West Slope Trawl Fishery, may occur on the continental slope in the water depths where WA-285-P and WA-343-P are located. Scampi may be fished on the slope in water depths deeper than 200 m but are most commonly found at depths of 420 - 500 m (AFMA 2022g; Harte & Curtotti 2018). Timing of scampi spawning is uncertain, but studies of similar species suggest that spawning occurs in September-October (AFMA 2022g). *Pre-drill survey noise*	

MBES and side-scan sonar are high-frequency, low-energy geophysical survey instruments, which are understood to be significantly less intrusive than high-energy seismic survey instruments. As described in Section 3.2.1, sound source levels produced by these different instruments range from 137–200 dB re 1 µPa at 1 m. The high frequency pulses of sound are produced in a highly directional and narrow beams, which rapidly attenuate outside of the beam (Zykov 2013). The high operating frequencies of MBES and side-scan instruments place the dominant sound frequencies above the auditory range of most marine fauna species, including cetaceans, turtles and fish, although some instruments may be audible to mid-frequency and high-frequency cetaceans such as some dolphin species (MacGillivray et al*.* 2013; Zykov 2013). It is not expected that fauna would persist in close proximity to the instruments long enough for impacts to occur. Therefore, no impacts to these species' groups are expected and hearing impairment impacts to marine fauna from MBES and side-scan sonar have not been previously reported. Therefore, the consequence is considered to be Insignificant (F). Sub-bottom profilers produce directional beams of sound towards the seabed and therefore sound propagation tends to be downwards in the water column with limited horizontal propagation. The sub-bottom profiling system used for the pre-drill surveys will operate at low frequency (1-16 kHz) with sound output at source ranging from 142 - 200 dB re 1 µPa at 1 m. Underwater noise modelling of a range of sub-bottom profiling systems reported that sound levels may be audible over several kilometres (Zykov 2013). On this basis, behavioural responses to the sub-bottom profiler may occur in marine fauna limited to within a few kilometres of the survey vessel depending on the hearing range of the receptors. Based on the distances to the closest cetacean aggregation areas/migration corridors (humpback whale calving BIA approximately 100 km south-east from WA-285-P and 175 km east from WA-343-P at the closest points; and the blue whale migration BIA approximately 75 km to the west of WA-285-P and approximately 40 km west of WA-343-P at the closest points), and the short duration of the survey (approximately 10 days), any impacts from the pre-drill site survey are considered to be Insignificant (F). The sound levels generated during the pre-drill site survey will not be audible to any blue whales foraging at Scott Reef approximately 100 km and 130 km from WA-285-P and WA-343-P respectively. Therefore, they are not expected to be impacted or displaced from the foraging grounds (DAWE 2021). As WA-343-P is located approximately 68 km north of Browse Island, sound emissions from the pre-drill site survey will not disturb green turtles present in the 20 km internesting buffer. WA-285-P slightly overlaps the outer boundary of the Browse Island 20 km internesting buffer, with Browse Island itself located 19 km from WA-285-P at its closest point. However, the proposed location of the well in WA-285-P is in the south-west of the permit area, approximately 40 km from Browse Island. Popper et al. (2014) reported that turtles are highly likely to exhibit a behavioural response if they encounter the source within 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 source. Based on the sound source levels of the survey equipment and the NFS behavioural response threshold of 166 dB re 1 µPa (NFS 2011), any turtles present during the site survey and in proximity to the source may be disturbed and actively swim away. During internesting periods (November to March) studies have shown that green turtles tend to stay relatively close to their nesting beach, approximately 7 km as reported by Pendoley (2005) and generally within 10 km (Waayers et al. 2011). Therefore, any impacts are expected to be temporary with inconsequential behavioural responses (Insignficant F).	

A BIA for whale shark foraging is located approximately 5 km from WA-285-P and approximately 10 km from WA-343-P at its closest point; however, whale sharks are transient and there are no aggregation sites in proximity to the permit areas. Based on the levels of whale shark abundance observed in numerous studies (as described in Section 4.9.4), the likelihood of whale shark presence within this BIA is considered very low, with no specific seasonal pattern of migration. Sharks and rays (elasmobranchs) are considered to be less sensitive to sound pressure than bony finfish (McCauley 1994). Studies show that elasmobranchs may detect low frequency sound from 50-500 Hz (Myberg 2001; Hawkins & Popper 2012). As elasmobranchs lack a swim bladder it is thought that they have a relatively poor sensitivity to sound pressure and are mainly capable of detecting the particle motion component of sound (Casper et al. 2012). Given the expected low abundance of whale sharks in the BIA and the short duration of the survey (approximately 10 days) any impacts from the pre-drill site survey are considered to be Insignificant (F). *MODU and drilling noise* Based on the expected noise emissions associated with the MODU and drilling activities any sound emissions that are typically attributed to behavioral changes are expected to be limited to within a few hundred metres of the MODU, based on recorded drilling sound levels by McCauley (1998), Nedwell & Edwards (2004) and Greene (1986). Underwater noise modelling undertaken for the nearby Ichthys Project (INPEX 2010) to consider noise emissions (albeit for tanker offloading operations rather than drilling activities, reported that low-frequency noise generated would abate to 120 dB re 1 µPa within 8 km of the source location and the area receiving 130–140 dB re 1 µPa was very small, i.e. less than 1 km in radius. Therefore, drilling noise combined with associated vessel and MODU engines and thrusters may result in sound that is detectable above ambient noise levels over several kilometres from the MODU, although behavioural avoidance responses are more likely to occur within 1-2 km. As described above for pre-drill site survey, there are no known marine fauna BIAs or aggregation areas that would result in sedentary behaviour in WA-285-P and WA-343-P (as described in Section 4.9.4) that are expected to be affected by increased noise levels, and EPBC-listed species with the potential to be exposed are considered to be transient in nature with the ability to avoid the source in the open ocean of the permit areas. The outer extent of the green turtle internesting buffer at Browse Island slightly overlaps the far north eastern boundary of WA-285-P. However, the proposed location of the well in WA-285-P is in the south-west of the permit area, approximately 40 km from Browse Island. In the unlikely event that behavioural changes did occur such as reorientation of an animal to the source of the sound, or avoidance responses (Southall et al. 2007), they are expected to be localised and temporary (Insignificant F). Gradual exposure to continuous noise sources, such as the MODU, are generally regarded as being less harmful and less likely to startle or stress marine fauna than rapid-onset impulsive noise sources (Hamernik et al. 1993; Hamernik et al. 2003; Southall et al. 2007). Concurrent drilling operations may occur during the activity either with MODUs operating in both WA-285-P and WA-343-P and also the continued Ichthys drilling operations in the nearby in WA-50-L. However, the distance between any concurrently operating MODUs would be in the range of tens of km. As stated, MODU engines and thrusters may produce sound above ambient levels over several kilometres from the MODU, with behavioural avoidance responses possible within 1-2 km. Based on the distance between operating MODUs, any MODU and drilling noise is not expected to be detectable by receptors. *Vessel noise*	

Based on the expected noise emissions associated with the operation of vessels during the activity in WA-285-P and WA-343-P, any noise emissions (ranging from 108 to 182 dB re 1 µPa at 1 m) are not expected to result in PTS or TTS impacts to marine fauna. Although not directly relevant to vessel engine noise, modelling for the Ichthys Project (INPEX 2010) indicated that low frequency noise generated from tanker offloading operations would abate to 120 dB re 1 µPa within 8 km of the source location with the area receiving 130–140 dB re 1 µPa predicted to be less than 1 km in radius. The sound levels produced by smaller support vessels is expected to be less than the levels modelled for offloading tankers, but the sound may be audible to marine fauna over several kilometres, with the likelihood of behavioural impacts increasing in close proximity to the vessels. Gradual exposure to continuous noise sources, such as vessel engines, are generally regarded as being less harmful and less likely to startle or stress marine fauna than rapid-onset impulsive noise sources (Hamernik et al. 1993; Hamernik et al. 2003; Southall et al. 2007). As such, exposure that would result in significant alteration of behaviour is not expected and as such any impacts are considered to be Insignificant (F). *<u>VSP noise</u>* The VSP will emit high-intensity, impulsive sounds albeit on a temporary basis (approximately 18 hours) on one occasion in each permit area. Based upon the sound levels generated during the VSP (232 dB re 1 µPa@1 m) there is the potential for noise impacts to occur (PTS and TTS) in close proximity to the VSP source, with sound levels likely to be above ambient noise levels over several kilometres. Discharging the VSP source at full power may result in PTS for any cetaceans within a few metres of the source and TTS within a few tens of metres of the source. These ranges are comparable to ranges modelled for VSP by Matthews (2012) and reported in Salgado Kent et al. (2016). Prolonged exposure to multiple pulses of the VSP source could result in TTS within a few hundred metres of the source, but such exposures would occur after many minutes or hours and marine fauna are likely to move to avoid such sound exposures before TTS effects occur. In the unlikely event that TTS did occur to marine fauna, 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 the VSP in WA-285-P and WA-343-P, 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. Given other marine fauna have less sensitive hearing than cetaceans, the range of distances for which noise impacts may occur for other EPBC-listed species is expected to be less. 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 NSF (2011) behavioural response threshold of 166 dB re 1 µPa, turtles may actively swim to avoid the VSP within 1–2 km. Potential significant behavioural impacts in fish arising from exposure to seismic pulses is likely to be limited to within tens to hundreds of metres, or within thousands of metres for the most sensitive fish species (Popper et al. 2014).	

On this basis, it is possible that physical and behavioural impacts may occur from the VSP undertaken in the permit areas. Note, if concurrent drilling operations were to occur during the activity, no concurrent VSP operations would be undertaken. Potential behavioural responses for various groups of sound sensitive marine fauna are expected, at a worst case, to be limited to several kilometres from the source for the duration of the VSP. Marine fauna are transient and able to move away from noise sources and based on the distances to the nearest BIAs described above and in Section 4.9.4, any impacts are considered to be Insignificant (F) given the short duration and temporary/localised nature of any impacts with no displacement from foraging areas or other critical habitats. The impact of sound on crustacean species similar to scampi, such as rock lobster, crabs and prawns has been studied with respect to commercial scale seismic surveys, which are significantly louder than VSP sources. Many studies (e.g. Christian et al. 2003; Payne et al. 2008) found no acute or chronic mortality or stress impacts. Research undertaken by Day et al. (2016) on rock lobsters in Australian waters also found no mortality impacts and no impacts to the eggs or hatched larvae of berried females exposed to seismic sound at very close range. Some sub-lethal stress and pathological impacts were observed in these studies although this occurred while the lobsters were captive in cages and subject to repeat exposures within close proximity to an airgun. Therefore, the effect of VSP on scampi is not expected to result in any mortality or impacts to their eggs or larvae. It is likely that scampi will move to avoid the immediate proximity of the well site during the VSP, although in all probability are likely to have moved away from the well site prior to this as a result of drilling vibration and settlement of drill cuttings. The impacts will be highly localised (e.g. hundreds of metres) and limited to the duration of VSP activities (approximately 18 hours on one occasion per permit area). Therefore, the effects of sound to scampi will be negligible and are considered to be Insignificant (F). Pelagic fish species such as tuna and billfish may also be present in WA-285-P and WA-343-P but these species are highly mobile and belong to a group of fish with limited sensitivity to sound (Popper et al. 2014; Hawkins & Popper 2016; Carroll et al. 2017). Fish may avoid waters immediately surrounding VSP activities but no impacts to these stocks are expected. Therefore, disturbance to commercially important fish species may occur; however, given the absence of any spawning or aggregation habitat within the permit areas, any impact would be localised to individuals and would not result in any detrimental impacts in stock levels, and as such any impacts are considered to be Insignificant (F).	
Identify existing design and safeguards/controls measures	
• Implementation of EPBC Regulations 2000 – Part 8 Division 8.1. • Implement EPBC Act Policy Statement 2.1 - *Interaction between offshore seismic exploration and whales* during VSP operations. • Relevant personnel will receive an induction/training to inform them of the requirements of EPBC Regulations 2000 – Part 8, Division 8.1 (Regulation 8.05) in accordance with Table 9-3 (INPEX Australia Support Vessels Marine Fauna Awareness Training) • No concurrent VSP operations to be undertaken.	
Propose additional safeguards/control measures (ALARP Evaluation)	

Hierarchy of control	Control measure	Used?	Justification
Elimination	Eliminate the use of MODU and vessels	No	The use of MODU/vessels to undertake the activity cannot be eliminated.
	Do not undertake VSP	No	VSP is required to obtain information on the reservoirs. The number of VSPs has been limited to one per well.
	Do not undertake site survey	No	The pre-drill site survey is required to enable the completion of the MODU anchoring study for safety and stability purposes.
Substitution	Undertake WA-285-P pre-drill site survey outside of internesting period at Browse Island November to March	No	The duration of the site survey is approximately 10 days. Given the proposed location of the well in WA-285-P is to the south-west of the permit area, the site survey will not be in proximity to or overlap the BIA. Therefore, it is not considered necessary to avoid conducting the site survey between November to March given the distance from the BIA and short duration.
	Undertake WA-285-P VSP outside of internesting period at Browse Island November to March	No	The duration of the VSP is approximately 18 hours. As described for the pre-drill site survey, the well in WA-285-P is to the south-west of the permit area and does not overlap the BIA. Therefore, altering the timing of the VSP (outside of the November to March period) is not considered necessary given the distance from the BIA and the short duration.
Engineering	None identified	N/A	N/A
Procedures & administration	Implement EPBC Regulations 2000 - Part 8 Division 8.1 (Regulation 8.07 - aircraft) specifically maintaining separation distances for helicopters.	No	As described in Section 4.9.4, no BIAs for cetaceans overlap the permit areas. Given the distances to the nearest cetacean critical habitats and that helicopter approaches to the MODUs will not result in injury or hearing impairment implementing this control does not provide any significant environmental benefit.
Identify the likelihood			

With the above-described controls in place the likelihood of impacts to marine fauna and fish species from noise emissions generated from the MODU, vessels and drilling operations in the permit areas are considered Unlikely (4). Transient marine fauna individuals (particularly green turtles at Browse Island) may be present in the internesting buffer that slightly overlaps WA-285-P. However, the location of the well, in the south-west of WA-285-P, approximately 40 km from Browse Island does not overlap the BIA. Nevertheless, increased sound source levels and expected propagation distances associated with the pre-drill site survey and VSP noise emissions, impacts to marine fauna and fish species are considered Possible (3); however, this would be limited to individuals and the timeframes associated with these operations are considered to be of short duration. It is also expected that marine fauna would not persist in close proximity to the sound source long enough for impacts to occur.		
Residual risk summary		
Based on a consequence of Insignificant (F) and a worst-case likelihood of Possible (3) the residual risk is Low (8).		
Consequence	Likelihood	Residual risk
Insignificant (F)	Possible (3)	Low (8)
Assess residual risk acceptability		
Legislative requirements As required by law the EPBC Regulations 2000 – Part 8, Division 8.1 will be implemented during the activity. During VSP operations the EPBC Act Policy Statement 2.1 will also be implemented including the presence of a marine mammal observer (MMO) on board (Part B: additional management procedures). Stakeholder consultation No stakeholder concerns have been raised regarding potential impacts and risks from underwater noise. Conservation management plans / threat abatement plans Several conservation management plans have been considered in the development of this EP (Appendix A). Anthropogenic noise from seismic surveys (e.g. VSP) has been identified as a threat to pygmy blue whales in the Conservation Management Plan for the Blue Whale 2015-2025 (DoE 2015; DAWE 2021). Noise interference has also been identified as a threat to marine turtles (DEE 2017a). The above listed controls to be adopted during the activity are in alignment with the actions identified in the various conservation management documents. ALARP summary		

Although the level of environmental risk is assessed as Low, a detailed ALARP evaluation was undertaken to determine what additional control measures could be implemented to reduce the level of impacts and risks. No additional controls, beyond those identified during the detailed ALARP assessment can reasonably be implemented to further reduce the risk of impact.

Acceptability summary

Based on the above assessment, the proposed controls are expected to effectively reduce the risk of impacts to acceptable levels because:

- the activity demonstrates compliance with legislative requirements/industry standards
- the activity takes into account stakeholder feedback
- the activity is managed in a manner that is consistent with the intent of conservation management documents
- the activity does not compromise the relevant principles of ESD
- the predicted level of impact does not exceed the defined acceptable level in that the environmental risk has been assessed as "low", the consequence does not exceed "C – significant" and the risk has been reduced to ALARP.

Environmental performance outcomes	Environmental performance standards	Measurement criteria
Undertake site survey and drilling activities in a manner that prevents injury to marine fauna resulting from sound emissions.	Vessel contractors comply with relevant requirements of the EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans, within the 500m exclusion zone including: • Support vessels will not travel faster than 6 knots within 300 m of a cetacean or turtle (caution zone) and minimise noise. • Support vessels will not approach closer than 50 m to a dolphin or turtle and/or 100 m for a whale (with the exception of bow riding).	Records of breaches of vessel - cetacean interaction requirements outlined in the EBPC Regulations 2000 reported.
	INPEX will verify VSP operations are conducted in accordance with EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales which includes: • Implement 30-minute pre-start observations to the extent of the observation zone (as defined in Policy Statement 2.1), only start if no whales are sighted within 3 km.	Records of pre-start observations prior to time of commencement; and soft-start time of commencement and durations. Records of sound source on standby or VSP shutdown if whales are observed. Completed MMO records during VSP operations.

	• Implement soft-start procedures, including a gradual ramp up of acoustic source to full power over 20 minutes only if no whales are sighted within the shutdown zone during the pre-start observations. • While the VSP is operating, both during soft-start and operations: visual observations of the observation zone are maintained; if whales are sighted – acoustic source placed on standby; if whales are sighted in the shut-down zone (within 1 km of source)– the acoustic source will be shut down. • A marine mammal observer (MMO) will be on board during VSP operations.	
	No concurrent VSP operations will be undertaken during the drilling campaign.	VSP records.

7.4 Biodiversity and conservation protection

7.4.1 Introduction of invasive marine species

Table 7-12: Impact and evaluation – introduction of IMS

Identify hazards and threats	
IMS are non-indigenous marine plants or animals that have been introduced into a region beyond their natural range and have the ability to survive, reproduce and establish founder populations. IMS are widely recognised as one of the most significant threats to marine ecosystems worldwide. Shallow coastal marine environments in particular, are thought to be amongst the most heavily invaded ecosystems, which largely reflects the accidental transport of IMS by international shipping to marinas and ports where the preferred artificial hard structures are commonly found. The introduction and establishment of IMS into the marine environment may result in impacts to benthic communities and associated receptors dependent on these including fishing, due to changes to the structure of benthic habitats and native marine organisms through predation and/or competition for resources, leading to a change in ecological function. Once IMS establish, spread and become abundant in coastal waters some species can have major ecological, economic, human health and social/cultural consequences (Carlton 1996, 2001; Pimental et al. 2000; Hewitt et al. 2011). There are several pathways for the introduction and spread of IMS of concern associated with the petroleum activity in WA-285-P and WA-343-P including the mobilisation of vessels and MODUs from international and domestic waters, domestic conveyances associated with support vessels during planned operations and domestic conveyances during unplanned events, such as vessels seeking shelter in the lee of offshore islands during adverse sea conditions or cyclone events. If unmanaged, these may act as a pathway through the discharge of high-risk ballast water containing IMS and/or IMS present on submerged vessel hulls in the vicinity of sensitive, unaffected environments (with no previously reported presence of IMS).	
Potential consequence	**Severity**
The particular values and sensitivities with the potential to be impacted by the introduction of IMS are: • benthic communities – associated with KEFs, benthic primary producer habitat (BPPH) and shallow water coastal environments and marine parks, the closest of which is Browse Island (located approximately 19 km south-east of WA-285-P and 68 km south of WA-343-P at the closest points) other offshore islands and shoals with sensitive benthic habitats, where vessels may seek shelter during adverse sea conditions or cyclone events have the potential to be affected. • commercial, traditional and recreational fishing/aquaculture.	Significant (C)

The introduction and subsequent establishment of IMS could result in changes to the structure of benthic communities leading to a change in ecological function due to predation of native marine organisms and/or competition for resources. Once IMS establish, spread and become abundant in coastal waters some species can have major ecological, economic, human health and social/cultural consequences (Carlton 1996, 2001; Pimental et al. 2000; Hewitt et al. 2011). Benthic communities, shallow water coastal environments in WA marine parks and reserves (the closest of which is Browse Island) and fisheries (commercial (including aquaculture)/ traditional/recreational) all have the potential to be impacted by IMS. Shallow water, coastal marine environments are susceptible to the establishment of invasive populations, with most IMS associated with artificial substrates in disturbed shallow water environments such as ports and harbours (e.g. Glasby et al. 2007; Dafforn et al. 2009a, 2009b). Aside from ports and harbours, other shallow water, pristine environments also at risk include offshore island and shoals such as those found in the PEZ in WA marine parks and reserves as presented in Section 4.4. Many of these marine parks and reserves contain sensitive benthic habitats with a potential to be impacted by invasive populations. In order for an IMS to pose a biosecurity risk once present at a recipient location, viable IMS propagules and/or individuals must be able to transfer from the colonised area (e.g. a vessel hull), survive in the surrounding environment, find a suitable habitat, and establish a self-sustaining population. MODU and vessel operations are a mechanism for such transfer of IMS propagules either through the uptake and discharge of high-risk ballast water containing IMS and/or via the presence of IMS within biofouling communities on hulls or submerged equipment. IMS propagules may also be transferred via natural dispersion. Natural dispersal mechanisms could involve a mobile life-history stage (such as actively swimming adults or larval stages) with sufficient swimming capacity and/or larval durations to directly reach suitable habitats in coastal waters. Natural dispersal from offshore locations for IMS with shorter pelagic dispersal capabilities to coastal areas is also theoretically possible via intermediate steps (stepping stone dispersal), where intermediate populations establish in suitable habitats closer inshore, and subsequent generations then spread towards coastal regions. With consideration of the habitat preferences of IMS (shallow water environments), the closest shallow water habitat to the either permit area is Browse Island. However, it is neither disturbed nor contains artificial structures that IMS are reported to prefer. Support vessels transiting between the permit areas and Broome port have the potential to act as vectors for the transfer of IMS propagules to sensitive benthic habitats in the PEZ and this may result in medium term impacts to benthic communities with a consequence rating of Significant (C).	

The transfer of IMS propagules via anthropogenic dispersal mechanisms and/or stepping-stone dispersal from MODUs or vessels colonised with IMS, has the potential to affect distant commercial, traditional and recreational fishing including aquaculture. Of particular significance is aquaculture located in shallow coastal areas of WA waters which are potentially susceptible to IMS. The successful introduction of IMS in these areas may impact aquaculture resulting in a loss of revenue. Other fishing activities that may be impacted include traditional Aboriginal fishing known to occur at several IPAs located along the Kimberley coastline (Section 4.11.3) and recreational fishing that is known to occur around Broome, Wyndham and Darwin (Section 4.11.3). This may result in regional community disruption with a significant impact on economic or recreational values with a consequence rating of Significant (C). In the event an IMS is translocated into WA-285-P and/or WA-343-P, then transfers and subsequently establishes a self-sustaining population, values and sensitivities with the potential to be exposed include regionally important areas of high diversity, such as shoals, banks and coral reefs. It is considered that the establishment of an IMS in WA/NT waters has the potential to result in a medium to large scale event with a medium-term impact on the environment, also potentially resulting in regional community disruption with significant impact on economic or recreational values with a consequence rating of Significant (C).	

Identify existing design and safeguards/controls measures

- Vessels have an antifouling coating applied that is in accordance with the prescriptions of the International Convention on the Control of Harmful Anti-fouling systems on ships, 2001, and the *Protection of the Sea (Harmful Antifouling Systems) Act 2006* (Cwlth).
- MODU and vessels will have an approved ballast water management plan and valid ballast water management certificate, unless an exemption applies or is obtained.
- MODUs and vessels operating within Australian seas will manage ballast water discharge using one of the following approved methods of management (DAWE 2020):
    - an approved ballast water management system
    - ballast water exchange conducted in an acceptable area *
    - use of low risk ballast water (e.g. fresh potable water, water taken up on the high seas, water taken up and discharged within the same place)
    - retention of high-risk ballast water on board the vessel
    - discharge to an approved ballast water reception facility.

* Acceptable area is as defined in the Biosecurity (Ballast Water and Sediment) Determination 2019. For high-risk ballast water an acceptable area for ballast water exchange is defined as (DAWE 2020):

- Vessels servicing an offshore facility/MODU: at least 500 m from the facility, and no closer than 12 nm from the nearest land

- All other vessel movements: at least 12 nm from the nearest land and in water at least 50 m deep; not within 12 nm of the Great Barrier Reef or Ningaloo Reef ballast water exchange exclusion areas. • All MODUs and vessels that use ballast water will comply with the Australian Ballast Water Requirements Version 8 (DAWE 2020) enforceable under the *Biosecurity Act 2015*. • Complete a biofouling risk assessment (including immersible equipment) for vessels mobilised domestically, and implement mitigation measures commensurate to the risk, as appropriate to ensure the mobilisation of the vessel poses a low risk of introducing IMS in accordance with Figure 9-5. • Vessel masters will be advised to reduce time spent near high value sensitive areas such as offshore island and shoals and no ballast water to be exchanged in order to limit the potential spread of IMS.			
Propose additional safeguards/control measures (ALARP Evaluation)			
Hierarchy of control	Control measure	Used?	Justification
Elimination	Eliminate vessel use to avoid the spread of IMS	No	Vessels are the only form of transport that can supply and support the MODU that is practicable and cost efficient.
Substitution	Only use a local MODU already operating in Australian waters.	No	Although using only local vessels is possible for the activity, using only a local MODU would result in delays when sourcing an appropriate available MODU. The potential cost and time needed to source a capable MODU locally is disproportionate to the minor environmental gain potentially achieved. Additional to this, there are known locations within Australia which harbour IMS (Section 4.10) and could potentially act as a source for the further spread of IMS within Australian regions. Therefore, substituting to the use of a locally available MODU will not provide an environmental benefit.
Engineering	MODU has an anti-fouling coating to all submerged areas.	No	Some MODUs currently on the market may have anti-fouling coatings applied to all submerged areas and others may only have it applied to intakes and seachests.

			Anti-fouling coatings vary in their efficacy and utilise a range of technologies to limit the ability of biofouling to attach to the surface. Some anti-fouling coatings include biocidal layers, while others rely upon creating surfaces that reduce the likelihood of organisms to freely attach. Despite the differences in types of anti-fouling coatings and the subsequent variations in performance and efficacy, there is always an inherent risk that niche areas below the water line may harbor biofouling communities and IMS, even when antifoul coatings are present. MODU availability must align with the schedule and other commercial considerations therefore, to limit MODU selection to only those that have anti-fouling coatings may add some value, but it will not eliminate the risk completely. Therefore, INPEX will engage an independent third-party to undertake a biofouling risk assessment for the MODU (described in procedural controls row below) and will implement any controls required as the outcome of the biofouling risk assessment rather than rely on a MODU being available that has an anti-fouling coating that may not necessarily be an effective control.
Procedures & administration	Complete a biofouling risk assessment (including immersible equipment) for vessels/MODU mobilised from international waters, and implement mitigation measures commensurate to the risk, as appropriate to ensure the mobilisation of the vessel poses a low risk of introducing IMS.	Yes	The completion of a biofouling risk assessment and the implementation of associated biofouling reduction and management measures reduce the likelihood of IMS translocation and subsequent potential for transfer and establishment. This approach is in accordance with the National Biofouling Management Guidelines for the Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee 2018) A biofouling risk assessment is a desktop-based evaluation to determine the likelihood, and hence theoretical risk of a vessel acting as a vector for the transfer of IMS. It does not attempt to identify whether or not a vessel is actually carrying a pest species, but rather ranks vessels on a relative scale of High, Uncertain or Low/Acceptable risk, to identify which vessels may require further detailed investigation and/or management actions to reduce potential risk.

			The assessment, undertaken by an independent third-party IMS expert on behalf of INPEX, relies on the provision of accurate information from the vessel operator, which may include, but is not limited to, the following: • vessel specifications: vessel name, type, size and Flag State, etc. • movements: port of origin, voyage history, destination, transport method, evidence of recent dry-docking and/or inspection, etc. • anti-fouling coating: type (i.e. biocidal/non-biocidal), age, service life, application area, record of Antifouling Systems Certificate, etc. • inspection/cleaning: inspection and cleaning history including any relevant independent biofouling inspection reports, etc. • seawater systems: marine growth prevention systems present and functioning, maintenance records, evidence of chemically or manually cleaned seawater systems including last treatment date and chemicals used etc. • duration of stay: at overseas or interstate locations, and duration in WA coastal waters etc. Outcomes of the biofouling risk assessment may identify the need to implement mitigation measures such as limitations of time spent in coastal waters/or alongside and managing interactions with supply vessels, through to inspection and cleaning of hulls and submerged areas.
	MODU/vessels will have biofouling management plans and record book.	Yes	A biofouling management plan provides operational guidance for the planning and actions required to manage vessel biofouling, in addition to outlining measures for the control and management of vessel biofouling in accordance with the IMO Guidelines for the Control and Management of Ship' Biofouling to Minimize the Transfer of Invasive Aquatic Species (2012 Edition).
Identify the likelihood			

The likelihood of an IMS becoming successfully established at a recipient location depends on a range of factors including physical characteristics of the environment falling within the tolerance ranges of the IMS (i.e. salinity, temperature, nutrient availability, etc.), and the biological characteristics of the species and the natural environment (i.e. reproductive properties, presence of appropriate prey species, predation pressure, etc.). This potential is known to be dependent on a range of factors including propagule pressure, density of the colonised population, and a range of biotic interactions and abiotic factors specific to the local marine environment.

For an IMS to establish a self-sustaining reproductive population in a recipient region, it must successfully pass through a series of stages along an invasion pathway, which include a range of selective filters. Selective filters affect the total number of organisms that can survive and successfully transition to the next stage of the invasion pathway. Offshore selective filters in the invasion pathway are likely to be more significant than for coastal environments, given there is little availability of artificial surfaces or suitable settlement habitats for propagules, and greater dilution of propagule plumes. As a result, in offshore oceanic environments propagule plumes from infrastructure colonised by IMS are likely to be highly dispersed with low densities of propagules present in the water column. In turn, if propagules are able to survive the extended periods necessary for them to be transferred to coastal waters, this is still likely to result in low densities of propagules encountering suitable habitat in shallow coastal environments. As a result, propagule pressure will be low and therefore establishment potential constrained. It is now widely accepted that ‘propagule pressure’ (or the number of individuals introduced), is a primary determinant of establishment success for introduced populations (Lockwood et al. 2005, Simberloff 2009). Propagule pressure is also important for the post-establishment success of IMS populations. As propagule pressure increases, it becomes more likely that the founder population will survive or has sufficient genetic variation to adapt to local conditions and establish a self-sustaining population (Lejeusne et al. 2014; Roman & Darling 2007) thereby becoming ‘introduced’. Many propagules may be released but never survive to join local populations.

Marine pests known to be present in WA and NT waters (including the ports of Broome, Dampier and Darwin) and are described in Section 4.10 and 4.11.5.

MODUs and vessels that may be mobilised from international waters or domestically are not considered to provide a likely source for the introduction and establishment of IMS. This is due to a number of factors including the lack of man-made infrastructure e.g. jetties/wharves in the deep waters of the permit areas where the activity will occur, and the controls and procedures in place to manage ballast water exchange and biofouling risks. As such, there is a low potential for biofouling to occur and act as a potential inoculum for the establishment and subsequent spread of IMS. Adherence to the Australian ballast water management requirements including the use of an approved ballast water management method also reduces the potential for the spread of IMS (Remote 6).

During drilling, support vessels will use Broome Port as the main supply base however they may also use Darwin or Dampier ports. The presence of jetties and wharves in ports, provides substrate for IMS, meaning that the ports could act as a source of IMS inoculum. However, resupply is typically undertaken within a relatively short timeframe (approximately 48 hours) therefore the potential for vessels to become colonised by biofouling communities is reduced. Guidance from WA DPIRD (Vessel Check Biofouling Risk Assessment Tool) acknowledges that the attachment of biofouling may occur in as short a time frame as 24 hours; however, as a ‘rule of thumb’, 7 days is considered to provide a pragmatic balance between logistical factors versus the risk of a vessel being contaminated with an IMS. With the described controls in place, the potential spread of IMS via support vessels during the activity is considered to be Remote (6).

Vessel masters will select appropriate transit routes between the WA/NT mainland and the permit areas based on sea state conditions. During adverse sea conditions or cyclone events, due to safety reasons, vessels may seek shelter in protected areas. Typically, this would be on the leeward side of offshore islands or shoals, with vessels remaining on DP in water depths of >100 m. Many offshore islands and shoals contain sensitive, pristine benthic habitats with respect to IMS. Therefore, access to these habitats by vessels is not permitted under normal circumstances. However, sheltering during cyclone events for safety reasons, may result in these habitats being exposed to vessels that have been alongside known sources of IMS (e.g. mainland ports). Water depths where vessels would seek shelter will be approximately 100 to 150 m, as this affords the vessel the greatest protection from oncoming swells. Such deep water, sheltering locations are unlikely to provide optimal conditions for the recruitment of IMS based on a lack of hard substrate (either natural or artificial). Additionally, an advantage of sheltering on the leeward side of an island/shoal is that based on the prevailing current, the vessel will likely be downwind and therefore potential IMS propagules released from any biofouling assemblages on vessel hulls (ballast water exchange is not planned during these times) would be released downstream of the islands/shoals. Therefore, any propagules will be carried in the current away from sensitive benthic habitats. During sheltering events, considered infrequent, the vessel controls in place for planned operations are considered to be sufficient to manage potential risks. Typically, during adverse sea conditions or cyclonic events, vessels may spend approximately 12 to 48 hours in sheltered locations and therefore it is considered to be of relatively short duration and an infrequent activity. With described controls in place, the potential for colonisation of vessels is not considered to be likely and hence the potential for spread of IMS of concern via domestic conveyances during unplanned operations is considered to be Remote (6).		
Residual risk summary		
Based on a consequence of Significant (C) and a worst-case likelihood of Remote (6) the residual risk is Moderate (8).		
Consequence	Likelihood	Residual risk
Significant (C)	Remote (6)	Moderate (8)
Assess residual risk acceptability		
Legislative requirements MODU and vessel ballast water will be managed in accordance with the intent of the Australian Ballast Water Requirements Version 8 (DAWE 2020) and the *Biosecurity Act 2015*. Biofouling will be managed through vessel and equipment risk assessments and mitigation measures, in accordance with the National Biofouling Management Guidelines for the Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee 2018). All vessels that use ballast water are required to meet the Regulation D2 discharge standard of the International Convention for the Control and Management of Ships' Ballast Water and Sediments (the Convention) if they were constructed after 2017 or at their next renewal survey after September 2019. All ships must meet the D2 standard by 8th September 2024 and this will lead to an ongoing reduction in potential risk from ballast water discharges over the life of this EP. The control measures described are consistent with NOPSEMA's Information Paper: Reducing marine pest biosecurity risks through good practice and biofouling management, IP1899 (NOPSEMA 2020b).		

Stakeholder consultation

No stakeholder concerns have been raised regarding potential impacts and risks from IMS.

Conservation management plans / threat abatement plans

Several conservation management plans have been considered in the development of this EP (refer Appendix A). IMS have been identified as a threat in many conservation management plans, with actions focusing on the prevention of their introduction. The control measures described are consistent with the actions described in the conservation management documentation.

ALARP summary

The level of environmental risk is assessed as Moderate, therefore a detailed ALARP evaluation was undertaken to determine what additional control measures could be implemented to reduce the level of impacts and risks. No additional controls, beyond those identified during the detailed ALARP assessment can reasonably be implemented to further reduce the risk of impact.

Acceptability summary

Based on the above assessment, the proposed controls are expected to effectively reduce the risk of impacts to acceptable levels because:

- the activity demonstrates compliance with legislative requirements/industry standards
- the activity takes into account stakeholder feedback
- the activity is managed in a manner that is consistent with the intent of conservation management documents
- the activity does not compromise the relevant principles of ESD
- the predicted level of impact does not exceed the defined acceptable level in that the environmental risk has been assessed as “moderate”, the consequence does not exceed “C – significant” and the risk has been reduced to ALARP.

Environmental performance outcomes	Environmental performance standards	Measurement criteria
No establishment of IMS of concern in the Commonwealth Marine Area or coastal waters via ballast water or biofouling attributable to the petroleum activity.	Support vessels (of appropriate class) will have an antifouling coating applied in accordance with the prescriptions of the International Convention on the Control of Harmful Anti-fouling Systems on Ships (2001) and the *Protection of the Sea (Harmful Antifouling Systems) Act 2006* (Cwlth).	Support vessels (of appropriate class) have a current International Anti-fouling Systems certificate or a Declaration on Anti-fouling Systems.

	MODUs and vessels operating within Australian seas will manage ballast water discharge using one of the following approved methods of management (DAWE 2020) including: • an approved ballast water management system • exchange of ballast water exchange conducted in an acceptable area • use of low risk ballast water (e.g. fresh potable water, water taken up on the high seas, water taken up and discharged within the same place) • retention of high-risk ballast water on board the vessel • discharge to an approved ballast water reception facility.	MODUs/vessels premobilisation inspection and annual verification audit reports confirm through ballast water records that an approved ballast water management option has been used.
	MODUs/vessels that use ballast water will comply with the Australian Ballast Water Requirements Version 8 (DAWE 2020)	Records confirm MODUs/vessels meet Australian Ballast Water Requirements Version 8.
	All MODUs/vessels will have: • Approved MODUs/vessel-specific ballast water management plan maintained, or record of DAWE issued exemption (if not automatic exemption) on board. • Valid ballast water management certificate or record of DAWE issued exemption (if not an automatic exemption) on board.	All MODUs/vessels will have: • an approved ballast water management plan, unless an exemption applies or is obtained • a valid ballast water management certificate, unless an exemption applies or is obtained.

	A biofouling risk assessment will be completed by an independent IMS expert for MODUs and all support vessels, including immersible equipment, prior to mobilisation from international waters. Where required, mitigation measures commensurate to the risk will be implemented to ensure the vessel mobilisation poses a low risk of introducing IMS.	MODUs/vessel-specific biofouling risk assessment and any records of mitigation measures implemented confirming the MODU/vessel presents a low risk.
	Domestic biofouling risk assessment for MODU/vessels mobilised from other regions in Australia, and implement mitigation measures commensurate to the risk, as appropriate to ensure the mobilisation of the vessel poses a low risk of introducing IMS in accordance with Figure 9-5.	Domestic biofouling risk assessment.
	MODU and all support vessels will have a biofouling management plan to include elements of performance described in the IMO Guidelines for the Control and Management of Ship Biofouling to Minimize the Transfer of Invasive Aquatic Species (2012 Edition).	Biofouling management records are available in the biofouling record book.
	Vessel masters notified to reduce time spent near high value areas such as offshore islands and shoals and no ballast water exchange to be undertaken to limit the potential spread of IMS.	Records of adverse weather planning communications including environmental assessment of vessel movements.

7.4.2 Interaction with marine fauna

Table 7-13: Impact and risk evaluation – Physical presence of vessels and interaction with marine fauna (vessel strike)

Identify hazards and threats	
The physical presence and use of vessels in the permit areas has the potential to result in collision (vessel strike) with marine fauna which may result in death or injury to individuals. Increased vessel traffic may result in increased turtle/vessel interactions and disruption to internesting or foraging behaviours.	
Potential consequence	**Severity**
The particular values and sensitivities with the potential to be impacted by vessel strike are: • EPBC-listed species. Vessels undertaking the pre-drill site survey and vessels supporting the exploration drilling activities in WA-285-P and WA-343-P have the potential to interact with EPBC-listed species; specifically, marine mammals, whale sharks and turtles. This may result in injury or death of marine fauna from a vessel strike. Collisions between vessels and cetaceans occur more frequently where high vessel traffic and cetacean habitat overlap (Dolman & Williams Grey 2006). Vessel speed has been demonstrated as a key factor in collisions with marine fauna such as cetaceans and turtles, and it is reported that there is a higher likelihood of injury or mortality from vessel strikes on marine mammals when vessel speeds are greater than 14 knots (Laist et al. 2001; Vanderlaan & Taggart 2007). The potential for vessel strike applies to all marine mammals, whale sharks and turtle species; however, humpback whales are considered to have a higher potential likelihood due to their extended surface time. The potential for collision during the petroleum activity is reduced as the permit areas are located hundreds of kilometres offshore, away from critical habitats such as humpback BIA areas (migration and calving) as shown in Figure 4-4 (located approximately 100 km south-east from WA-285-P and 175 km east from WA-343-P at its closest point). The reaction of whales to approaching ships is reported to be quite variable. Dolman and Williams Grey (2006) indicate that some cetacean species, such as humpback whales, can detect and change course to avoid a vessel.	Minor (E)

The blue whale has a foraging BIA at Scott Reef and a migratory corridor approximately 75 km to the north-west of WA-285-P and approximately 40 km west of WA-343-P (Figure 4-4). The blue whale is subject to a Conservation Management Plan (Appendix A). The Conservation Management Plan identifies that, since 2006, there have been two records of likely ship strikes of blue whales in Australia. In 2009 and 2010, there were blue whale strandings in Victoria, near the Bonney Upwelling with suspected ship strike injuries visible. Where blue whales are feeding at or near the surface, they are more susceptible to vessel strike. However, the open ocean environment allows for whales to invoke avoidance behaviour in threatening situations. The Blue Whale Conservation Management Plan highlights that minimising vessel collision is one of the top four priorities and requires assessment of vessel strike on blue whales, assures that incidents are reported in the National Ship Strike Database, and that control measures proposed will align with these priorities. Whale sharks do not breach the surface as cetaceans do; however, they are known to spend considerable time close to the surface increasing their vulnerability to vessel strike (DEE 2017c). Whale sharks reportedly spend 40% of their time in the upper 15 m of the water column which leaves them vulnerable to collision with smaller vessels as well as larger commercial vessels that have drafts that extend greater than 20 m below the surface (Wilson et al. 2006, Gleiss et al. 2013). The foraging area for whale sharks (BIA) is located approximately 5 km from WA-285-P and approximately 10 km from WA-343-P at its closest point. Whale sharks are also subject to a Conservation Advice (Appendix A), which notes that the threat to the recovery of the species includes strikes from vessels. While the Conservation Advice does not specify any particular measures for whale shark strike reporting, a control measure requiring compliance with the Whale Shark Wildlife Management Program no. 57 (DPaW 2013b) addresses avoidance of whale sharks and, as such, is considered to align with the Conservation Advice for whale sharks. Turtles transiting the region are also at risk from vessel strike when they periodically return to the surface to breathe and rest. Only a small portion of their time is spent at the surface, with routine dive times lasting anywhere between 15 and 20 minutes nearly every hour. The presence of vessels has the potential to alter the behaviour of individual turtles. Some turtles have been shown to be visually attracted to vessels, while others show strong avoidance behaviour (Milton et al. 2003). Within the PEZ, several marine turtle BIAs are known to occur (Figure 4-6), and WA-285-P slightly overlaps the outer boundary of the Browse Island 20 km internesting buffer, with Browse Island itself located 19 km from WA-285-P at its closest point. However, the location of the well within WA-285-P and hence the majority of vessel traffic will be in the south-west of the permit area, approximately 40 km from Browse Island. Following publication of the Recovery Plan for Marine Turtles in Australia (DEE 2017a), habitats critical for the survival of the genetically distinct, 'Scott Reef – Browse Island' green turtle population has been identified. The internesting buffer at Browse Island provides critical habitat for green turtles between November and March each year. During internesting periods studies have shown that green turtles tend to stay relatively close to their nesting beach, approximately 7 km as reported by Pendoley (2005) and generally within 10 km (Waayers et al. 2011). Therefore, any impacts are expected to be localised and of minor consequence at the population level for these mobile and broad-ranging species.	

<table>
<tr><td colspan="3">Given the expansive open ocean environment of the permit areas, the potential for the displacement of cetaceans by vessel activities is considered to be low. Additionally, there are no recognised feeding or breeding grounds for cetaceans within the permit areas. While there is potential for a small number of individual marine fauna (particularly green turtles present in the internesting buffer at Browse Island) to be impacted by vessels associated with the activity, any potential vessel strike to marine fauna is likely to be limited to isolated incidents. As reported by the DEE (2017a), although the outcome can be fatal for individual turtles, vessel strike (as a standalone threat) has not been shown to cause stock level declines. In the event of the death of an individual whale or turtle, it would not be expected to have a significant effect at the population level (Minor E).

With reference to the Recovery Plan for Marine Turtles in Australia (DEE 2017a) based on the long-life span and highly dispersed life history requirements of marine turtles it is acknowledged that they may be subject to multiple threats acting simultaneously across their entire life cycle, such as increases in background light and noise levels. In considering cumulative impacts of threats on small or vulnerable stocks of marine turtles, it is likely that vessel strike may act as contributor to a stock level decline.</td><td></td></tr>
<tr><td colspan="4">Identify existing design and safeguards/controls measures</td></tr>
<tr><td colspan="4">• Implementation of EPBC Regulations 2000 – Part 8 Division 8.1 (Regulation 8.05)
• Vessel speed restrictions and separation distances maintained for whale sharks
• Vessel crew will receive an induction/training to inform them of the requirements of EPBC Regulations 2000 – Part 8, Division 8.1 (Regulation 8.05) in accordance with Table 9-3 (INPEX Australia Support Vessels Marine Fauna Awareness Training).</td></tr>
<tr><td colspan="4">Propose additional safeguards/control measures (ALARP Evaluation)</td></tr>
<tr><td>Hierarchy of control</td><td>Control measure</td><td>Used?</td><td>Justification</td></tr>
<tr><td rowspan="2">Elimination</td><td>Eliminate the use of vessels</td><td>No</td><td>Vessels are the only form of transport that can undertake the pre-drill site survey and provide the required level of supply and support to the MODU, that is practicable and cost efficient.</td></tr>
<tr><td>Reduce the frequency of supply vessel visits to MODUs</td><td>No</td><td>Reducing the number of vessel supply trips would decrease the potential for vessel interactions with marine fauna; however, the frequency of re-supply by support vessels is already optimised to be as low as practicable and cannot be further reduced.</td></tr>
</table>

	Prevention of vessels entering internesting area during November to March to avoid disturbance to nesting green turtles at Browse Island	No	The introduction of an exclusion zone within the Browse Island internesting BIA buffer (20 km) is not considered to be warranted given support vessels transiting between the MODU in WA-285-P or WA-343-P and Darwin/Broome/Dampier typically remain 12 nm (approximately 22 km) from Browse Island. However, exact vessel routes will be influenced by sea state conditions and under adverse sea conditions (e.g. cyclone sheltering) vessels may enter the BIA but would remain on DP in water depths of >100 m. Given the short duration (12-48 hours) of any sheltering events and that research has indicated that internesting green turtles generally stay within 10 km of their nesting beaches, the need for a total exclusion zone (during nesting season) from the 20 km buffer is not considered necessary.
Substitution	Use smaller vessels for resupply of the MODU	No	Using smaller vessels, travelling at slower speeds may decrease the potential to harm or fatally injure marine fauna in the event that a vessel strike occurred; however, smaller vessels would require more frequent journeys or may have space and weight limitations for equipment required on the MODU.
Engineering	None identified	N/A	N/A
Procedures & administration	Vessel speed restrictions or separation distances maintained for turtles	No	It is reported that turtles generally stay close to their nesting beaches during the internesting period. At WA-343-P the closest habitat is at Browse Island, located 68 km away, green turtles are not expected to be present in WA-343-P. WA-285-P slightly overlaps the outer boundary of the 20 km interesting buffer at Browse Island, with Browse Island located 19 km from WA-285-P at its closest point. However, within WA-285-P the well will be located in the south-west portion of the permit area approximately 40 km from Browse Island. Turtles reportedly spend a small portion of their time at the surface, this makes turtle observations by crew from the bridge of a vessel very difficult given that turtles are considerable smaller than whales or whale sharks. On this basis, reducing vessel speeds and maintaining separation distances is not considered to be an effective control and will not be implemented.

	Dedicated MMO on vessels	No	The use of dedicated MMOs onboard vessels may improve the ability to identify marine fauna at risk of collision. However, this is not considered to be practicable given POB limits on vessels and through implementation of the environmental awareness program for crew (Table 9-2) is not considered to provide additional environmental benefit for the increase in cost associated with implementing this control. The whale shark foraging BIA is located approximately 5 km from WA-285-P and approximately 10 km from WA-343-P at its closest point. However, based on the levels of whale shark abundance observed in numerous studies (as described in Section 4.9.4), the likelihood of whale shark presence within this BIA is considered very low, with no specific seasonal pattern of migration.
Identify the likelihood			
Collisions with large vessels often go unnoticed and/or unreported (Cates et al. 2017). A preliminary examination of vessel collision reports between 1840 and 2015 was undertaken by Peel et al. in 2016, referenced in the National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Fauna (DEE 2017c). Peel et al. (2016) identified 109 records of ship strike in Australian waters predominantly involving humpback whales (47%). The records showed that the majority of events were in Queensland, with 10 events recorded in WA waters between 1995 and 2015. This suggests that despite the growing presence of oil & gas activities on the NWS/Timor Sea, and the steady increase (9% per year) in humpback whale numbers (Bejder et al. 2016), whale populations have not been affected by collisions with oil & gas related vessels. An internesting BIA for green turtles at Browse island (20 km buffer, DEE 2017a) has identified habitat critical for survival between November and March each year, however internesting turtles are likely to stay within 10 km of their nesting beach. Nevertheless, support vessel routes will not encroach on the 20 km buffer unless in adverse sea conditions, as they shall remain beyond the 12 nm territorial sea limit (12 nm equates to approximately 22 km). During weather events i.e. sheltering during cyclone events, support vessel may seek shelter in lee of Browse Island for safety reasons. The duration of such activities is expected to be limited to 12-48 hours and therefore the likelihood of interactions with marine turtles is further reduced. The controls described above are commensurate with the level of risk and the likelihood of a vessel strike causing injury or death to EPBC-listed species is considered to be Highly Unlikely (5). There have been no incidents of vessel strike reported during the nearby INPEX Ichthys operational activities in WA-50-L to date. If concurrent drilling operations were to occur during the activity, including the ongoing Ichthys drilling campaign in nearby WA-50-L, an increase in vessel traffic could be expected. However, given the distance (tens of km) between any concurrently operating MODUs and the controls in place, impacts to EPBC-listed species are not expected.			
Residual risk summary			

Based on a consequence of Minor (E) and a likelihood of Highly Unlikely (5) the residual risk is Low (9).		
Consequence	Likelihood	Residual risk
Minor (E)	Highly Unlikely (5)	Low (9)

Assess residual risk acceptability

Legislative requirements

EPBC Regulations 2000 – Part 8, Division 8.1 (Regulation 8.05) will be implemented with regards to vessel speeds and separation distances.

Stakeholder consultation

No stakeholder concerns have been raised regarding potential impacts and risks from the physical presence of the MODU and support vessels and potential for vessel strike associated with the petroleum activity.

Conservation management plans / threat abatement plans

Several conservation management plans have been considered in the development of this EP (Appendix A). Actions identified in the Blue Whale Conservation Management Plan and conservation advice documents for whale sharks regarding vessel strike incident reporting will be implemented and controls in this EP are in alignment with the intent of the National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Fauna (DEE 2017c).

ALARP summary

Although the level of environmental risk is assessed as Low, a detailed ALARP evaluation was undertaken to determine what additional control measures could be implemented to reduce the level of impacts and risks. No additional controls, beyond those identified during the detailed ALARP assessment can reasonably be implemented to further reduce the risk of impact.

Acceptability summary

Based on the above assessment, the proposed controls are expected to effectively reduce the risk of impacts to acceptable levels because:

- the activity demonstrates compliance with legislative requirements/industry standards
- the activity takes into account stakeholder feedback
- the activity is managed in a manner that is consistent with the intent of conservation management documents
- the activity does not compromise the relevant principles of ESD

• the predicted level of impact does not exceed the defined acceptable level in that the environmental risk has been assessed as "low", the consequence does not exceed "C – significant" and the risk has been reduced to ALARP.		
Environmental performance outcomes	Environmental performance standards	Measurement criteria
No injury/ mortality of cetaceans, whale sharks or turtles resulting from interactions with vessels undertaking the petroleum activity.	Interactions between vessels and cetaceans will be consistent with EPBC Regulations 2000 – Part 8, Division 8.1 (Regulation 8.05) *Interacting with cetaceans*: • Support vessels will not travel faster than 6 knots within 300 m of a cetacean (caution zone) and minimise noise. • Support vessels will not approach closer than 50 m to a dolphin and/or 100 m for a whale (with the exception of bow riding). • If a cetacean shows signs of being disturbed, support vessels will immediately withdraw from the caution zone at a constant speed of less than 6 knots.	Records of event reports if vessel strike occurs.
	Interactions between support vessels and whale sharks will be consistent with the Whale Shark Wildlife Management Program no. 57 (DPaW 2013b); specifically, support vessels will not travel faster than 8 knots within 250 m of a whale shark (exclusive contact zone) and not approach closer than 30 m of a whale shark.	Records of breaches of whale shark code of conduct are documented.

7.5 Seabed disturbance

Table 7-14: Impact and risk evaluation – Seabed disturbance

Identify hazards and threats	
To validate and ground truth the geophysical pre-drill survey data, approximately 25 samples of seabed sediments may be collected within the permit areas during the pre-drill site surveys (Section 3.2.1). Each sample comprises of approximately 0.13 m^3 of sediment collected using a specialised grab sampler. In the event that a CANDuctor is used to replace the conventionally drilled conductor hole sections (Section 3.3.1), the installation (suction pile method) may result in the localised disturbance of the seabed at the well locations. The area potentially disturbed could be approximately 30 m^2 at each well location. As described in Section 3.4, a moored MODU may be secured to the seabed through a series of anchors and anchor chains. No vessels will anchor during the activity. For a typical moored semi-submersible MODU, given the expected anchor and anchor chain dimensions (Section 3.4.1) approximately 1,000 m^2 (0.001 km^2) of benthic habitat in each permit area may be disturbed. On completion of the drilling and wireline evaluation activities, the wells will be permanently plugged and abandoned. As described in Section 3.3.2 *Well Abandonment*, the conductor and casing will be cut below the sea floor (mudline) and the wellhead removed from each permit area. This process also has the potential to disturb benthic communities at the well location, albeit in an already disturbed area due to discharged drill cuttings (top-hole section) and excess cement returns at the well location. The physical footprint of the drilling activities will be limited to the well locations and MODU mooring system in WA-285-P and WA-343-P. A disturbance to benthic communities has the potential to result in reduced ecosystem productivity or diversity. In addition to physical disturbance, the drilling activities may also result in the localised generation of silt plumes that could affect surrounding benthic communities.	
Potential consequence	**Severity**
The particular values and sensitivities with the potential to be impacted by seabed disturbance are: • benthic communities • fish (demersal fish community KEF and commercial species). Physical disturbance of the seabed may cause temporary disturbance to benthic habitats and loss of associated infauna and epifauna. As described in Section 4.8.3, seabed habitat surveys have been undertaken in the nearby Ichthys Field, and at Echuca and Heywood Shoals located approximately 80 km and 95 km from WA-285-P respectively and located approximately 75 km and 60 km from WA-343-P respectively (Figure 4-2).	Insignificant (F)

The results of the surveys observed that seabed topography was relatively flat and featureless (INPEX 2010) with no obstructions or features on the seafloor, such as boulders, reef pinnacles or outcropping hard layers (Fugro Survey Pty Ltd. 2005; RPS 2007). The observed habitat generally supported a diverse infauna dominated by polychaetes and crustaceans typical of the broader region and this was reflected in survey results which indicated that the epibenthic fauna was diverse but sparsely distributed (RPS 2008). Benthic habitats within WA-285-P and WA-343-P are expected to comprise of soft substrate, typical of deep continental shelf seabed habitats which are widely distributed in deeper parts of the Browse Basin (RPS 2007), and commonly found throughout the NWMR (Baker et al. 2008). From the extrapolation of the nearby survey data, the seabed in WA-285-P and WA-343-P are expected to have heavily rippled sediments suggestive of strong near seabed currents and a lack of seabed features. In general, deep-sea infaunal assemblages are poorly studied on the NWS but are likely to be widely distributed in the region (INPEX 2010) including WA-285-P and WA-343-P. Impacts from grab sampling are expected to be limited due to the small size of area affected by sampling. Well abandonment activities may also disturb benthic communities at the well locations during the cutting and recovery of the conductor/casing at the mudline; however as described in Table 7-7 and Table 7-8, the discharge of drill cuttings and excess cement adjacent to the well will have already previously disturbed this area and given the short-term duration of the activity (approximately 95 days in WA-285-P and 150 days in WA-343-P) it is not expected to delay the recolonisation and recovery of benthic habitats in the permit areas. In the event that a CANDuctor system is used some seabed disturbance would be exected during installation. However, it would eliminate the requirement to drill the conductor hole section and avoid the need for cementation of the conductor string. This in turn would reduce the volume of drill cuttings and cement discharges to seabed and would therefore potentially reduce impacts to benthic habitats and communities. The total disturbance footprint from the petroleum activity is expected to be approximately 0.001 km^2 within in each permit area. In the context of WA-285-P and WA-343-P, which cover an area of approximately 490 km^2 and 530 km^2 respectively, this represents a very small area of disturbance (<0.000002% and <0.0000019%). The activity may result in the mortality of sessile fauna within this footprint and potentially the mortality of benthic infauna associated with the habitat; however, it is considered that potentially impacted benthic habitats and associated biota are well represented in the region. Therefore, any temporary disturbance and losses will represent a very small fraction of the widespread available habitat. Following removal of the MODU anchors, CANDuctor system (if used), and completion of the activity, the soft sediments will be left disturbed; however, based on the short-term duration (approximately 95 days in WA-285-P and 150 days in WA-343-P) upon retrieval of the anchors/CANDuctor system, benthic habitats would remain viable and are expected to recolonise through the recruitment of new colonists from planktonic larvae and adjacent undisturbed areas.	

Displacement of sediments during anchor and mooring deployment/retrieval may result in temporary, localised plumes of suspended sediment and subsequent deposition of sediment resulting in smothering of marine benthic habitat and benthic communities in the immediate vicinity. Parts of the ancient coastline KEF, particularly where it exists as a rocky escarpment, are thought to provide biologically important habitats in areas otherwise dominated by soft sediments (DSEWPaC 2012a). It is considered that the hard substrate of the escarpment is likely to support a range of sponges, corals, crinoids, molluscs, echinoderms and other benthic invertebrates (DSEWPaC 2012a). The ancient coastline KEF is located, approximately 10 km south of WA-285-P and approximately 30 km south of WA-343-P at its closest point. Therefore, benthic communities associated with the KEF are not expected to be impacted 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. This is also expected to be the case for Echuca and Heywood Shoals located over 60 km from either permit area at the closest points. The potential consequence on benthic communities is a localised impact from physical disturbance within the footprint of the anchors/chains/CANDuctor which is expected to be limited given the predicted sparse cover of benthic communities and expected recovery through recolonization. Therefore, it is assessed to be of inconsequential ecological significance (Insignificant F). The demersal fish community KEF overlaps both permit areas and a limited number of commercially significant fish stocks, considered as key indicator species, may be present in the waters of WA-285-P and WA-343-P (Table 4-6). Although they may be present, given the deep waters and absence of suitable habitats, the permit area areas not considered to offer spawning or aggregation habitat (Section 4.11.3). Disturbance to seabed habitats from the petroleum activity is therefore not expected to affect fish spawning habitats (Insignificant F).	

Identify existing design and safeguards/controls measures
• No planned anchoring of vessels.

Propose additional safeguards/control measures (ALARP Evaluation)			
Hierarchy of control	Control measure	Used?	Justification
Elimination	No anchoring by MODU	No	All MODUs require some form of contact to remain stable on the seabed at the well location. Given the water depth in the permit areas, the use of a jack-up rig is not possible and therefore a semi-submersible MODU will be used. If available, a DP MODU may be selected; however due to the drilling schedule availability cannot be guaranteed, in which case a moored semi-submersible MODU will be used and hence this has been assessed.

<table>
<tr><td>Substitution</td><td>None identified</td><td>N/A</td><td colspan="2">N/A</td></tr>
<tr><td>Engineering</td><td>None identified</td><td>N/A</td><td colspan="2">N/A</td></tr>
<tr><td>Procedures & administration</td><td>Rig move and positioning plan</td><td>Yes</td><td colspan="2">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 boundaries of WA-285-P and WA-343-P.</td></tr>
<tr><td colspan="5">Identify the likelihood</td></tr>
<tr><td colspan="5">Given the controls in place, the likelihood of impacting benthic communities located at the anchor/chain locations in WA-285-P and WA-343-P, is considered to be Possible (3). Any temporary impacts are considered to be ecologically insignificant to the wider diversity and productivity of benthic communities in the region, including the ancient coastline KEF, based on the relatively small area potentially impacted i.e. total disturbance footprint relative to the widespread available habitat and expected recovery.</td></tr>
<tr><td colspan="5">Residual risk summary</td></tr>
<tr><td colspan="5">Based on a consequence of Insignificant (F) and a likelihood of Possible (3) the residual risk is Low (8).</td></tr>
<tr><td colspan="2">Consequence</td><td colspan="2">Likelihood</td><td>Residual risk</td></tr>
<tr><td colspan="2">Insignificant (F)</td><td colspan="2">Possible (3)</td><td>Low (8)</td></tr>
<tr><td colspan="5">Assess residual risk acceptability</td></tr>
<tr><td colspan="5">Legislative requirements

There are no specific environmental guidelines/legislation regarding the environmental management of anchoring/moorings with respect to impacts on benthic communities. The rig moves and positioning plans will be developed in accordance with industry guidelines and standards namely the Mooring Code API RP 2SK and the APPEA MODU Mooring in Australian Tropical Waters Guidelines. In accordance with s572 of the OPGGS Act (removal of property), titleholders are required to remove all structures, equipment and other property from the title area, therefore any property associated with the plugged and abandoned exploration wells in WA-285-P and WA-343-P will be removed by INPEX.

Stakeholder consultation

No stakeholder concerns have been raised regarding potential impacts and risks from seabed disturbance caused by the petroleum activity.</td></tr>
</table>

Conservation management plans / threat abatement plans Several conservation management plans have been considered in the development of this EP (Appendix A). The recovery plan for sawfish and river sharks specifies habitat degradation and modification as a principle threat and details actions to reduce impacts on critical sawfish and river shark habitats. There are no critical habitats for sawfish or river sharks within the permit areas and therefore no specific actions relating to seabed disturbance from anchoring/mooring activities apply. ALARP summary Although the level of environmental risk is assessed as Low, a detailed ALARP evaluation was undertaken to determine what additional control measures could be implemented to reduce the level of impacts and risks. No additional controls, beyond those identified during the detailed ALARP assessment can reasonably be implemented to further reduce the risk of impact. Acceptability summary Based on the above assessment, the proposed controls are expected to effectively reduce the risk of impacts to acceptable levels because: • the activity demonstrates compliance with legislative requirements/industry standards • the activity takes into account stakeholder feedback • the activity is managed in a manner that is consistent with the intent of conservation management documents • the activity does not compromise the relevant principles of ESD • the predicted level of impact does not exceed the defined acceptable level in that the environmental risk has been assessed as "low", the consequence does not exceed "C – significant" and the risk has been reduced to ALARP.

Environmental performance outcomes	Environmental performance standards	Measurement criteria
Seabed disturbance is limited to planned well locations.	No planned anchoring of vessels associated with the activity.	Incident report
	INPEX will verify that the contractor prepares and implements a Rig Move and Positioning Plan prior to the MODU arriving in WA-285-P and WA-343-P. The plan shall include: Details of the configuration of the anchors necessary to keep the MODU securely on location and provides anchor-mooring analyses and procedures for anchor mobilisation and retrieval activities. This includes:	Documentation confirming implementation of the Rig Move and Positioning Plan and any issues with anchor deployment, use and recovery that could increase seabed footprint of disturbance.

	• planning and verification of well and MODU anchoring locations (including for relief wells) so that well and anchors are all located within the boundaries of each permit area. • definition of procedures for anchor deployment and recovery. • anchors will be carried to the deployment location and deployed or retrieved directly using AHSV to minimise drag.	

7.6 Social and cultural heritage protection

7.6.1 Physical presence - disruption to other marine users

Table 7-15: Impact and risk evaluation – Physical presence of MODU and vessels resulting in disruption to marine users

<table>
<tr><th colspan="2">Identify hazards and threats</th></tr>
<tr><td colspan="2">The physical presence of the MODUs and vessels in WA-285-P and WA-343-P has the potential to cause disruption to other marine users, including shipping operators and fisheries through the reduction of space available to conduct shipping and fisheries activities in the permit areas. Support vessels do not have an associated 500 m PSZ; however, MODUs are required to maintain a PSZ under the OPGGS Act. The PSZ will remain in place for the duration of the drilling activity while the MODU is at each well location estimated to be 95 days in WA-285-P and 150 days in WA-343-P. The potential, albeit temporary, interference with and/or exclusion of other users, within the PSZ may result in a loss of revenue for commercial users including fisheries.</td></tr>
<tr><th>Potential consequence</th><th>Severity</th></tr>
<tr><td>The particular values and sensitivities with the potential to be impacted by physical presence of the MODU/vessels are:
• shipping
• commercial, traditional and recreational fisheries.

Other marine users in the vicinity of WA-285-P and WA-343-P may be impacted by MODU and vessel presence (including the presence of PSZ exclusion) because of the loss of navigable space available to conduct their activities. The implications of such disruptions include changes to sailing routes and journey times, or reduced ability to fish in an area. The worst-case consequence from a loss of access to an area could result in economic losses and/or potential reduction in employment levels.</td><td>Insignificant (F)</td></tr>
</table>

A review of AMSA's vessel traffic data for the Browse Basin confirmed the absence of any major shipping lanes within the permit areas (Figure 4-9). A large proportion of the high-density vessel traffic in and around the permit areas is related to supply vessels supporting the offshore developments (INPEX Ichthys facility and Shell Prelude FLNG facility) that routinely transit between the offshore production facilities and the ports of Darwin and Broome on the Australian mainland. Therefore, in some areas of WA-285-P heavy vessel traffic may occur. As these operational facilities are situated further away from WA-343-P, approximately 60 km south (Ichthys) and 50 km south-west (Prelude), support vessel transit routes do not intersect WA-343-P. Despite the absence of any shipping lanes or petroleum supply transit routes, vessel traffic will still occur in WA-343-P, and in some areas of the permit vessel traffic is still considered to be heavy. Therefore, any vessels passing through either permit area may temporarily suffer a minor loss of navigable space when the PSZs are in place during the drilling activities. Individual vessels may have to slightly alter their sailing routes to avoid the MODUs potentially leading to longer journey times. However given the relatively small size of the PSZs in relation to the permit areas, any disruption to the shipping industry is expected to cause a minor, temporary impact and not result in any economic losses. Therefore, the consequence is considered to be insignificant (F). Several Commonwealth and state managed fisheries overlap WA-285-P, WA-343-P and the PEZ (Section 4.11.3). Fisheries whose fishing grounds overlap the permit areas and therefore may potentially have access limitations during the 95-day and 150-day drilling activities are highlighted in bold in Table 4-7 and Table 4-8. In many instances, although the area of the fishery overlaps the permit area, no fishing effort actually occurs due to water depth, water temperature and lack of suitable habitat. Of the fisheries overlapping WA-285-P and WA-343-P, the North West Slope Trawl Fishery is the only active fishery; however, it reportedly fishes at low levels, with only negligible trawl fishing occurring in the nearby Ichthys Field (AFMA 2022a). Based on the low level of identified commercial fishing activity and the relatively small spatial area occupied by the PSZs, in comparison to the entire extent of the fishing grounds available to commercial operators, and the relatively short-term duration of the activity (95 and 150 days), the potential loss of navigable space in which a fishing operator could conduct their activities is considered to be insignificant (F). If concurrent drilling operations were to occur, the presence of MODUs (and associated PSZs) and vessels operating in the permit areas is not expected to significantly affect the availability of navigable waters in relation to the area covered by the fishing grounds. Therefore, no cumulative impacts are expected. WA-285-P and WA-343-P are both situated within the memorandum of understanding (MoU) box for Indonesian traditional fishing (DSEWPaC 2012a) as shown on Figure 4-2. Therefore, Indonesian fishing vessels may be present in the permit areas when transiting between fishing grounds at Scott Reef and Browse Island. This would potentially only apply to WA-285-P, as Scott Reef and Browse Island are located approximately 150 km and 68 km from WA-343-P. Therefore, any interference and disruption are not expected, and impacts are expected to be insignificant (F). Recreational fishing may also operate off the WA coast during certain times of the year. There is no evidence that recreational fishing that occurs within WA-285-P and WA-343-P most likely due to the distance from land, lack of features of interest and deep waters. Therefore, the potential for loss of access to the recreational fishing industry as a result of MODU/vessel physical presence is considered to be of Insignificant consequence (F).	
Identify existing design and safeguards/controls measures	

• Ongoing stakeholder consultation with relevant stakeholders as per Section 9.8.3 and Table 9-7 • MODU and vessels fitted with lights, signals, an automatic identification system (AIS) transponders and navigation equipment as required by the *Navigation Act 2012* and associated Marine Orders (consistent with COLREGS requirements).			
Propose additional safeguards/control measures (ALARP Evaluation)			
Hierarchy of control	Control measure	Used?	Justification
Elimination	Eliminate the use of MODU/vessels	No	The use of MODU/vessels to undertake the activity cannot be eliminated.
Substitution	Reduce the size of the PSZ	No	The implementation of the PSZ promotes the safety of other sea users and the integrity of MODUs. In accordance with the OPGGS Act, PSZs are required and cannot be reduced in size.
	Alter timing to avoid peak fishing periods	No	The area that stakeholders are excluded from is of limited size (500 m radius PSZ) when compared to the area available to other marine users. In conjunction with low fishing activity in the area, as confirmed through stakeholder consultation, altering the timing of the activity is not deemed necessary or considered an effective control.
Engineering	None identified	N/A	N/A
Procedures & administration	None identified	N/A	N/A
Identify the likelihood			
The MODU and vessels associated with the drilling activities in WA-285-P and WA-343-P will have an insignificant impact by reducing the navigable space available to shipping and fishing operators. The likelihood of loss of access/space in the open ocean resulting in an economic loss or reduction in employment levels is considered to be Highly Unlikely (5). During stakeholder engagement for the EP, shipping operators were not considered as relevant stakeholders to be consulted, as the petroleum activity is outside of any shipping routes/channels. Relevant stakeholders, including fisheries, were consulted throughout the development of this EP. Commercial fisheries will continue to be informed and updated on operational activities being undertaken by INPEX. On this basis, with the controls in place, impacts to economic values from loss of revenue for fisheries due to lack of access to fishing grounds with potential reduction in employment levels is considered Highly Unlikely (5).			

Residual risk summary		
Based on a consequence of Insignificant (F) and a likelihood of Highly Unlikely (5) the residual risk is Low (10).		
Consequence	Likelihood	Residual risk
Insignificant (F)	Highly Unlikely (5)	Low (10)
Assess residual risk acceptability		

Legislative requirements

While a MODU is on location, a PSZ with a 500 m radius will be maintained around it to control activities and reduce the risk of marine collisions, as required under the OPGGS Act. The OPGGS Act requires that activities do not cause interference to other users more than is reasonably necessary for carrying out rights conferred by the Act. MSI notifications will be issued for the drilling period via AMSA, while the AHO will issue a Notice to Mariners. The MODU and vessels will be equipped with navigation equipment as required by the *Navigation Act 2012*.

Stakeholder consultation

No stakeholder concerns have been raised regarding potential impacts and risks from the physical presence of the MODU and PSZ in the permit areas. During stakeholder consultation AMSA requested that all relevant notifications be adopted as controls in this EP and therefore, these requirements have been adopted. AMSA also identified that lighting of vessels should be consistent with the requirements of the COLREGS. All vessels are required to comply with the *Navigation Act 2012*, and associated Marine Orders, which are consistent with the COLREGS requirements.

Conservation management plans / threat abatement plans

Several conservation management plans have been considered in the development of this EP (Appendix A). None of the recovery plans or conservation advice documents are relevant to the physical presence of MODUs/vessels disrupting shipping or fishing operators.

ALARP summary

Although the level of environmental risk is assessed as Low, a detailed ALARP evaluation was undertaken to determine what additional control measures could be implemented to reduce the level of impacts and risks. No additional controls, beyond those identified during the detailed ALARP assessment can reasonably be implemented to further reduce the risk of impact.

Acceptability summary

Based on the above assessment, the proposed controls are expected to effectively reduce the risk of impacts to acceptable levels because:

- the activity demonstrates compliance with legislative requirements/industry standards
- the activity takes into account stakeholder feedback

- the activity is managed in a manner that is consistent with the intent of conservation management documents
- the activity does not compromise the relevant principles of ESD
- the predicted level of impact does not exceed the defined acceptable level in that the environmental risk has been assessed as "low", the consequence does not exceed "C – significant" and the risk has been reduced to ALARP.

Environmental performance outcomes	Environmental performance standards	Measurement criteria
Interference with other marine users is limited to the extent necessary for the reasonable exercise of the right conferred by the petroleum title.	Vessels will be fitted with lights, signals, AIS transponders and navigation and communications equipment, as required by the *Navigation Act 2012*.	Records confirm that required navigation equipment is fitted to vessels to ensure compliance with the *Navigation Act 2012*.

7.7 Loss of containment

The activity will require the handling, use and storage of chemicals and hydrocarbon materials which may include, but are not limited to:

- diesel
- hydraulic oil
- BOP/hydraulic control fluids
- grease
- drilling fluids.

Undertaking the activity introduces the potential for loss of containment events. These events may be classified as Level 1, Level 2 or Level 3 incidents, in accordance with the INPEX Browse Regional OPEP described in Table 8-10 of this EP.

INPEX defines an emergency condition as:

"an unplanned or uncontrolled situation that harms or has the potential to harm people, the environment, assets, Company reputation or Company sustainability and which cannot, through the implementation of Company standard operating procedures, be contained or controlled."

An evaluation of the environmental impacts and risks associated with emergency conditions is included in Section 8 of this EP.

A summary of potential loss of containment events (and emergency conditions) associated with this EP is presented in Table 7-16. Incident levels are indicative only and classifications have been assigned for the purposes of enabling the risk evaluation to be undertaken. In the event of a spill, the incident level will be classified as described in the INPEX Browse Regional OPEP (Table 8-10).

Table 7-16: Representative loss of containment events and emergency conditions identified for the activity

Scenario		Basis of volume calculation	Type	Indicative incident level	Section addressed
Source	Threat				
Management of chemicals and hydrocarbons products on board	Inappropriate use /handling/ spills Failure of hydraulic hoses on equipment Drop out of hydrocarbons while flaring due to non-combustion	Failure of tote tank estimated to be in the order of 1 m^3 Failure of hydraulic hoses estimated to be in the order of < 1 m^3 Drop out volumes estimated to be in the order of < 1 m^3	Various	1	Accidental release – Table 7-17
Cargo transfers	Dropped objects	5.5 m^3 – based on the volume of a tote tank which, if lost during cargo transfer,	Various	1	Accidental release – Table 7-17

Scenario		**Basis of volume calculation**	**Type**	**Indicative incident level**	**Section addressed**
Source	**Threat**				
		has the potential to result in a full loss of contents			
SBM transfers	Spill during transfer	10 m³ – based on hose failure during transfer 70 m³ - loss of riser contents	Various	1	Accidental release – Table 7-17
Hydrocarbon transfers	Spill during bunkering	10 m³ – based on hose failure during transfer	Group II – diesel	1	Accidental release – Table 7-17
Helicopter refuelling	Spill during refuelling on board the MODU	4.4 m³ – based on volume stored on board the MODU	Group I (i.e. aviation fuel)	1	Accidental release – Table 7-17
Emergency conditions (refer to Section 8)					
Loss of well containment	Integrity failure	Brewster reservoir: 255,475 m³ – based on 3,193 m³ per day for an 80-day blowout Plover reservoir: 99,705 m³ - based on 867 m³ per day for a 115-day blowout.	Group I – condensate	3	Loss of well containment – Section 8.2
Vessels	Collision	250 m³ – based on capacity of largest single fuel tank (AMSA 2015a)	Group II – diesel	2	Vessel collision – Section 8.3

7.7.1 Accidental release

Table 7-17: Impact and evaluation – loss of containment: accidental release

Identify hazards and threats	
Several potential loss of containment events were identified (Table 7-16), including minor spills on board (<1 m^3); drop out of hydrocarbons during flaring (< 1 m^3); loss of tote tank during cargo transfer (5.5 m^3); failure of hydraulic hoses (<1 m^3); loss of SBM during transfer or from riser (10 – 70 m^3) and loss of hydrocarbon fuels during bunkering of vessels and helicopters (4.4 - 10 m^3). Specific predictive modelling was not undertaken for the potential loss of containment events. This was based on the expected low volumes and that any predicted impacts are likely to be localised to the point of release. Given the properties of the chemicals involved (predominantly Group I and Group II hydrocarbons), which tend to be more volatile and less persistent in the environment any spills will rapidly disperse at the sea surface. An accidental release overboard resulting in a spill that reaches the marine environment has the potential to result in localised changes to water quality, resulting in impacts to marine fauna and planktonic communities at the sea surface, but no impact on deeper water communities or benthic habitats would be expected.	
Potential consequence	**Severity**
The particular values and sensitivities with the potential to be impacted by a loss of containment/accidental release are: • EPBC-listed species • planktonic communities. Potential accidental releases overboard from loss of containment events may result in the exposure of marine fauna and plankton near the sea surface, to a range of chemicals and Group I and Group II hydrocarbons. Foreseeable loss of chemicals to the marine environment would be of small volumes (<1–5 m^3), and impacts would generally be of low consequence (Insignificant F). Therefore, the focus of this assessment is based on the larger spill volumes associated with loss of SBM and diesel during transfers/bunkering. Given the anticipated volumes (worst case 10 m^3 of diesel or 70 m^3 SBM), potential exposure is expected to be localised to the point of discharge in the permit areas and in some instances a portion of the spilled volume is expected to be at least partially captured within the MODU drainage system, therefore further reducing the potential spill volume. The 70 m^3 release from loss of the riser, would likely occur at the seabed. Upon release to the marine environment hydrocarbons will disperse through natural physical oceanic processes, such as currents, tides and waves, and photochemical and biological degradation. Therefore, any surface expression is expected to weather and dissipate in a relatively short time with limited potential for exposure to surfacing marine fauna or plankton at the sea surface.	Insignificant (F)

As air-breathers, marine mammals, if they surface, are vulnerable to exposure to hydrocarbon spill impacts through the inhalation of evaporated volatiles. Effects include toxic effects, such as damage to lungs and airways, and eye and skin lesions from exposure to oil (WA DoT 2018). Vapours, if inhaled, have the potential to damage the mucous membranes of the airways and the eyes. Inhaled volatile hydrocarbons are transferred rapidly to the bloodstream and may accumulate in tissues, such as in the brain and liver, resulting in neurological disorders and liver damage (Gubbay & Earll 2000). Blue whales and humpback whales (baleen whales), that may filter feed near the surface, would be more likely to ingest oil than gulp-feeders, or toothed-whales and dolphins. Spilled hydrocarbons may also foul the baleen fibres of baleen whales, thereby impairing food-gathering efficiency, or resulting in the ingestion of hydrocarbons, or prey that has been contaminated with hydrocarbons (Geraci & St. Aubin 1988). There are no known marine fauna BIAs or aggregation areas that would result in sedentary behaviour in WA-285-P and WA-343-P. The outer extent of the green turtle internesting buffer at Browse Island overlaps the far north eastern boundary of WA-285-P (Figure 4-6); however, the well location, and hence location of any discharges, is in the south-west of the permit area approximately 40 km from Browse Island. Additionally, a whale shark foraging BIA is located approximately 5 km from WA-285-P and approximately 10 km from WA-343-P at its closest point (Figure 4-7). However, based on the levels of whale shark abundance observed in numerous studies (as described in Section 4.9.4), the likelihood of whale shark presence within this BIA is considered very low, with no specific seasonal pattern of migration. Given the low volumes, limited duration of exposure due to expected weathering and dispersion in an open ocean environment, the level of consequence is expected to present a local scale event of inconsequential ecological significance (Insignificant F). As a consequence of their presence close to the water surface, plankton may be exposed to any entrained/dissolved components of any hydrocarbons spilled at the sea surface, particularly in high energy seas where the vertical mixing of oil through the water column would be enhanced. The effects of oil on plankton have been well studied in controlled laboratory and field situations. The different life stages of a species often show widely different tolerances and reactions to oil pollution. Usually, eggs, larval and juvenile stages will be more susceptible than adults (Harrison 1999). Post-spill studies on plankton populations are few, but those that have been conducted, typically show either no effects or temporary minor effects (Kunhold 1978). Given the high temporal and spatial variability in plankton communities, and the small size of the area impacted by an accidental release, the potential consequence in regard to planktonic communities is considered to be Insignificant (F).	
Identify existing design and safeguards/controls measures	
• All vessels >400 GT will have a SOPEP (or SMPEP) in accordance with Marine Order 91 • Spill kits will be available on-board MODUs and vessels • Personnel will receive an induction/training to inform them of deck spill response requirements in accordance with Table 9-3 • INPEX chemical, assessment and approval procedure for selection of chemicals in accordance with Section 9.6.1 and Table 9-5 • INPEX lifting standard and cargo transfer procedures.	

Propose additional safeguards/control measures (ALARP Evaluation)			
Hierarchy of control	Control measure	Used?	Justification
Elimination	Eliminate the use of chemicals and hydrocarbons on board.	No	Chemicals and hydrocarbons are required for safe and efficient operations and cannot be eliminated. In the case of diesel, it is required as fuel and cannot be eliminated.
	No bunkering or SBM transfers.	No	Bunkering of fuel and SBM from supply vessels to MODUs is required during the activity as space limitations/tank capacities mean that supplies need to be replenished.
	No cargo transfers.	No	Cargo transfers cannot be eliminated, as this is the only practicable option for supplying MODUs in offshore locations.
Substitution	None identified	N/A	N/A
Engineering	Prevent onboard spills through appropriate storage of hydrocarbons and chemicals including their associated waste constituents.	Yes	Through bunding of storage areas and good housekeeping practices, the storage and management of hydrocarbon and chemical products and associated wastes can reduce the potential risk of a loss of containment event occurring.
Procedures & administration	Implement hydrocarbon/SBM transfer procedures that specify keeping of hose registers, and operational requirements (e.g. minimum lighting conditions, communications, visual monitoring, dry break/break away couplings installed and used, use and maintenance of certified hoses and a permit-to-work system).	Yes	The transfer of fuel and SBM will occur in accordance with strict conditions for preventing spills to the marine environment. Offshore transfers of fuel and SBM will be conducted in accordance with the MODU contractor's transfer procedures.
	Hydraulic equipment on board MODU and vessels will be subject to routine servicing and inspection to ensure it is fit for purpose.	Yes	Routine servicing and inspection of hydraulic equipment will ensure it is fit for purpose and minimise the potential for leaks and spills to deck as a result of corrosion, and wear and tear of hydraulic hoses.

	DST procedure (well test package) implemented for flaring operations.	Yes	This procedure includes a continuous 24/7 flare watch to observe and monitor flaring operations and reduce potential for hydrocarbon drop out during flaring. Function testing of continuous ignition system and pilot system is also covered by the procedure.
Identify the likelihood			
Routine vessel controls, such as bunding, and the ready availability of spill recovery equipment reduce the likelihood of any spills reaching the environment. Routine servicing of hydraulic equipment onboard reduces the likelihood of spills during the activity. In the event of an overboard spill from a MODU/vessel or an unplanned release, based on the low volumes and expected weathering of spilled chemicals, in conjunction with the controls in place the likelihood of a loss of containment event causing harm to the identified receptors is considered to be Unlikely (4).			
Residual risk summary			
Based on a consequence of Insignificant (F) and a likelihood of Unlikely (4) the residual risk is Low (9).			

Consequence	Likelihood	Residual risk
Insignificant (F)	Unlikely (4)	Low (9)

Assess residual risk acceptability
Legislative requirements The activities and proposed management measures are compliant with industry standards and relevant Australian legislation, specifically concerning prevention pollution, including Marine Order 91: Marine Pollution Prevention - Oil. Stakeholder consultation No stakeholder concerns have been raised regarding potential impacts and risks from accidental release/loss of containment. Spill response activities and notifications to relevant stakeholders have been identified and included in INPEX spill response processes. Conservation management plans / threat abatement plans Several conservation management plans (Appendix A) 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 conservation management plans.

ALARP summary

Although the level of environmental risk is assessed as Low, a detailed ALARP evaluation was undertaken to determine what additional control measures could be implemented to reduce the level of impacts and risks. No additional controls, beyond those identified during the detailed ALARP assessment can reasonably be implemented to further reduce the risk of impact.

Acceptability summary

Based on the above assessment, the proposed controls are expected to effectively reduce the risk of impacts to acceptable levels because:

- the activity demonstrates compliance with legislative requirements/industry standards
- the activity takes into account stakeholder feedback
- the activity is managed in a manner that is consistent with the intent of conservation management documents
- the activity does not compromise the relevant principles of ESD
- the predicted level of impact does not exceed the defined acceptable level in that the environmental risk has been assessed as "low", the consequence does not exceed "C – significant" and the risk has been reduced to ALARP.

Environmental performance outcomes	Environmental performance standards	Measurement criteria
No loss of containment of hydrocarbons or chemicals to the marine environment.	Premobilisation HSE inspections confirm that MODU and vessels >400 GT have SOPEP (or SMPEP) compliant with Marine Order 91.	Premobilisation HSE inspection documentation.
	Spill kits will be available on board the MODUs and vessels.	Inspection records confirm spill kits are available and stocked.
	INPEX lifting standard and cargo transfer processes are implemented.	Training records of personnel involved in lifting and cargo transfer activities.
	Bunding around stored bulk wet chemicals or hazardous liquid waste storage areas in accordance with Australian standards.	Bunding and drainage verified by containment specialist.

	INPEX will verify the contractor implements MODU and vessel bunkering procedures for hydrocarbon and SBM transfers that will include as a minimum: • completion of permit to work (PTWs) for all diesel and SBM transfers. • dry break couplings/weak link breakaway couplings and flotation collars are installed on hydrocarbon bulk transfer hoses to prevent entanglement and enable early leak detection. • hydrocarbon bulk transfer hoses are certified and rated for hydrocarbons and pressure tested and maintained in a hose register. • bunkering is undertaken during daylight hours, if permit to work in place and weather is good (e.g. suitable sea conditions). Night-time bunkering will not be undertaken on a routine basis. This will only be undertaken in fully lit conditions and in favourable sea states. • preventive maintenance of hydraulic equipment to ensure its integrity.	Documentation that hydrocarbon and SBM bunkering procedures approved and are implemented, e.g. undertaken during daylight hours and in appropriate sea state, etc. Hose register. Completed and approved PTW records for all diesel and SBM transfers. Documentation of maintenance recorded in the preventive maintenance system.
	DST procedure (well test package) implemented including: • Continuous (24/7) flare watch during flaring operations • Function testing of continuous ignition system and pilot system.	Pre-flow checklist

8 EMERGENCY CONDITIONS

An evaluation of potential spill sources and worst-case spill scenarios (WCSS) identified several potential emergency conditions related to the activity (Table 7-16). The emergency conditions are summarised in Table 8-1.

Table 8-1: Potential emergency conditions

Scenario		**Hydrocarbon type**	**Release location**
Source	Threat		
Loss of well containment: Brewster and Plover reservoirs	Integrity failure	Group I – condensate	Subsea
Vessels	Collision	Group II – diesel	Surface

8.1 PEZ and EMBA based on oil spill modelling

As described in Section 4, the PEZ has been derived to inform the outer boundary of potential exposure for oil spill planning and scientific monitoring purposes using low thresholds described in NOPSEMA bulletin #1 (NOPSEMA 2019). The low thresholds used may not be ecologically significant as hydrocarbon exposure has the potential to result in both acute and chronic impacts to marine flora and fauna, depending on the sensitivity of organisms exposed and the concentration of exposure.

A summary of the range of concentrations of different hydrocarbon exposure thresholds adopted to conservatively identify the PEZ and EMBA (area where potential environmental impact may occur) is described in Table 8-2. These thresholds include surface, entrained, dissolved and shoreline accumulation thresholds to account for the different partitioning and fate of oils released in different scenarios as outlined in Table 8-1.

Table 8-2: Hydrocarbon exposure thresholds

Threshold		**Description**
Surface hydrocarbon exposure	PEZ 1 g/m^2	To define the outer extent of potential exposure, a low surface exposure threshold of 1 g/m^2 has been used to provide an indication of the furthest extent at which a visible sheen may be observed on the sea surface. It is considered too low for ecological impact assessment purposes and is used to inform oil spill scientific monitoring purposes (water quality) as per NOPSEMA (2019). The low exposure threshold also provides an indication of socioeconomic receptors, such as oil and gas industry, tourism and fishing activities that may be affected by safety concerns associated with a light/visible surface expression.

Threshold		Description
	EMBA 10 g/m^2	The surface oil threshold of 10 g/m^2 to assess environmental impacts is based on research by French-McCay (2009) who has reviewed the minimum oil thickness (0.01 mm) required to impact on thermoregulation of marine species, predominantly seabirds and furred mammals (furred mammals are not present within the EMBA of this EP). Seabirds are particularly vulnerable to oil spills because their feathers easily become coated, and they feed in the upper water column. Other tropical marine megafauna species are unlikely to suffer from comparable physical oil coating because they have smooth skin. Applying the threshold for the scenarios outlined for this EP therefore, represents a conservative measure to define the EMBA. This threshold has been applied to various industry oil spill impact assessments by French-McCay (2002; 2003) and is recommended in the AMSA guidelines (AMSA 2015b).
Entrained hydrocarbon exposure	PEZ 10 ppb	The low exposure threshold of 10 ppb has been used to inform the outer extent of potential exposure to entrained hydrocarbons in the water column. It is considered too low for ecological impact assessment and is used to inform oil spill scientific monitoring purposes (water quality) as per NOPSEMA (2019).
	EMBA 100 ppb	The biological impact of entrained oil cannot be determined directly using available ecotoxicity; however, it can be derived from tests using either water soluble fraction (WSF) of oil or oil-in-water dispersions (OWD). OWD are prepared by highly turbulent shaking of oil in water, which are allowed to separate before use, so that the test organisms are exposed to the dissolved fractions, as well as any very fine entrained oil droplets that remain in suspension. However, results are conservative because entrained droplets are less biologically available to organisms through tissue absorption than the dissolved fraction (Tsvetnenko 1998). To provide an estimate of the magnitude of toxicity effects from oil exposure to marine biota across a wide taxonomic range, a review was undertaken of global ecotoxicology data for numerous species (115 for fish, 129 for crustaceans, and 34 for other invertebrates) by French-McCay (2002). These were based on both WSF and OWD tests. Under low turbulence conditions, the total PAH LC_{50} for species of average sensitivity ranges from about 300–1,000 ppb. Under higher turbulence, such as a subsea release, the total PAH LC_{50} decreased to about 64 ppb (French-McCay, 2002). Comparatively, the lowest no observed effect concentration level for unweathered Browse condensate from the north-west region was found to be 20 ppm, based on a fish imbalance and tiger prawn toxicity test (Woodside 2014).

Threshold		Description
		In addition to potential toxicity impacts, entrained oil droplets (although less bioavailable) may present smothering impacts to submerged receptors. Physical and chemical effects of the entrained oil droplets have been demonstrated through direct contact with receptors through physical coating of gills and body surfaces, and accidental ingestion (NRC 2005). To be conservative, a 100 ppb entrained threshold is proposed to account for any ecological impacts (toxicity and smothering) in the EMBA.
Dissolved hydrocarbon exposure	PEZ -	As dissolved hydrocarbons are the soluble component of entrained hydrocarbons, the conservative low exposure threshold used for entrained hydrocarbons at 10 ppb encompasses the dissolved component to identify the furthest extent of potential exposure used for oil spill planning and scientific monitoring purposes (water quality) as per NOPSEMA (2019).
	EMBA 50 ppb	The 99% species protection threshold of 50 ppb for PAH (ANZG 2018) has been selected to indicate the zones where acute exposure could potentially occur over shorter durations, following a spill.
Shoreline accumulation	PEZ 10 g/m^2	Certain industries, such as tourism may be affected by visible sheen on sandy beaches, therefore a shoreline accumulation of 10 g/m^2 has been included for information purposes to inform the PEZ, that may indicate potential socioeconomic impact as per NOPSEMA (2019) guidance. However, it is considered too low for ecological impact assessment purposes.
	EMBA 100 g/m^2 (where threshold for surface or entrained/ dissolved hydrocarbon exposure at that shoreline is also exceeded).	A shoreline accumulation threshold of 100 g/m^2 is recommended from the review by French-McCay (2009) based on exposure to birds and smothering of invertebrates in intertidal habitats. This threshold is also proposed to be an acceptable minimum thickness that does not inhibit recovery and is best remediated by natural coastal processes (AMSA 2015b).

As described in Section 4, the spatial extent of the PEZ, used as the basis for the EPBC Act Protected Matters database search (Appendix A), was determined using stochastic spill modelling by applying the low thresholds. The EMBA, used as the basis for the impact and risk evaluation presented in this section of the EP, was determined by applying the defined impact exposure thresholds detailed in Table 8-2.

The stochastic spill modelling results from the three worst-case spill scenarios included a loss of well containment from both Brewster (WA-285-P) and Plover (WA-343-P) reservoirs, and a vessel collision scenario. All modelling outputs from all seasons (summer, winter and transitional) and under different hydrodynamic conditions (e.g. currents, winds, tides, etc.) were overlaid and the furthest extents were used to define the outer boundaries of the PEZ and EMBA as presented in Figure 8-1.

Overlaying of multiple stochastic spill modelling results provides a highly conservative representation of the PEZ and EMBA from all potential loss of containment events to ensure that the EPBC Protected Matters database searches identify all potential receptors. As such, the actual area that may be affected from any single spill event would be considerably smaller than that represented by the PEZ and EMBA. Example model outputs from individual spill events are available in the INPEX *Browse Regional OPEP Basis of Design and Field Capability Assessment Report* (refer to Table 8-10).

Deterministic modelling is a single spill simulation using one set of wind and weather conditions over time. Deterministic modelling runs are often paired with stochastic modelling to place the large stochastic footprint into perspective. Specific deterministic analysis or the use of a selection of worst case individual stochastic run(s) (selected from the stochastic analysis) are utilised as the basis for developing the response plans and field capability/equipment needs for a realistic spill response as described in the INPEX *Browse Regional OPEP*.

Figure 8-1: Combined PEZ and EMBA for all credible spill scenarios

8.2 Loss of well containment

A worst-case loss of well containment leading to a Group I hydrocarbon loss (gas and condensate) could occur due to integrity failure resulting from any of the following:

- MODU loss of stability
- failure of primary and secondary well controls
- loss of well integrity.

The worst-case loss of containment scenarios in this EP assumes the wellbore is free from all restrictions, there are no restrictions at the wellhead and the hole section is fully drilled. To establish the worst credible discharge rates from a well blowout, a transient simulation model (OLGA model) for each reservoir was used to determine the gas discharge rates before calculating the condensate discharge rates using condensate:gas ratios. The highest gas and condensate discharge rates and seabed gas temperatures were used in the model simulations in order to obtain credible worst-case results. A range of possible permeability sensitivities were also considered in order to derive a range of credible worst-case results. Reservoir inflow was subsequently calculated based upon pressure, temperature, thickness, porosity, permeability and productivity data.

8.2.1 Location

The Brewster loss of well containment scenario was modelled from a release location within WA-285-P, approximately 40 km north-west of Browse Island and with a modelled release depth of 235 m (RPS 2021).

The Plover loss of well containment scenario was modelled from a release location within WA-343-P, approximately 80 km north of Browse Island and with a modelled release depth of 347 m (RPS 2022).

8.2.2 Volume and duration

The volume of Brewster condensate used in the modelling was 255,475 m^3, based on an uncontrolled blowout with no restrictions within the well bore. The duration of the hydrocarbon release was 80 days (based on the time to complete a relief well / well-kill operation). The overall duration of the modelled simulations was 108 days, to account for the fate of hydrocarbons after the well has been contained (RPS 2021).

The volume of Plover condensate used in the modelling was 99,705 m^3, based on an uncontrolled blowout with no restrictions within the well bore. The duration of the hydrocarbon release was 115 days (based on the time to complete a relief well / well-kill operation). The overall duration of the modelled simulations was 129 days, to account for the fate of hydrocarbons after the well has been contained (RPS 2022). A well-kill for a Plover reservoir well blowout may be longer than that for a Brewster well, due to deeper reservoir depth and associated deeper relief well drilling requirements. However, because of differences in reservoir properties, the overall Plover release volume represents approximately 40% of the volume of a Brewster reservoir scenario.

8.2.3 Hydrocarbon properties

Hydrocarbon properties associated with the Group I Brewster and Plover condensate used for the modelling studies (RPS 2021; RPS 2022) are presented in Table 8-3.

Table 8-3: Group I condensate properties

Hydrocarbon type	Density at 15 ˚C (g/cm^3)	Viscosity – centipoise (cP)	Characteristic	Volatile (%)	Semi-volatile (%)	Low volatility (%)	Residual (%)
			Boiling point (˚C)	<180	180–265	265–380	>380
Brewster condensate	0.7640	1.200 @ 20ºC	% of total	64.3	17.6	12.1	6.0
Plover condensate	0.8074	1.400 @ 25ºC		47.0	29.0	20.0	4.0

8.2.4 Modelling results

A comparison of the Brewster and Plover spill modelling results is presented in Table 8-4. The Brewster modelling results can be considered as the WCSS with respect to a number of parameters including extent of floating oil at the sea surface, minimum time to shoreline contact, length of shoreline exposed, worst-case volume of oil on shoreline and worst-case concentrations/depths of entrained oil and dissolved aromatic hydrocarbons. On this basis, further discussion throughout this section of the EP is focussed on the Brewster modelling results presented in Table 8-5, Figure 8-2 and Figure 8-3.

The results of the OILMAP Deep simulation predicted that the subsea release will generate a cone of rising gas that will entrain the oil droplets and ambient sea water up to the water surface. The mixed plume is initially forecast to jet towards the water surface with a vertical velocity of around 8.9 m/s, gradually slowing and increasing in plume diameter as more ambient water is entrained. The diameter of the central cone of rising water and oil at the point of surfacing is predicted to be approximately 30.5 m. The results suggest that beyond the immediate vicinity of the blowout most of the released hydrocarbons will be present in the upper layers of the water column, with the potential for oil to form floating slicks under sufficiently calm local wind conditions.

Based on the discharge characteristics, the properties of the hydrocarbon and its expected weathering behaviour, floating oil will be susceptible to entrainment into the wave-mixed layer under typical wind conditions. Evaporation rates will be significant, given the high proportion of volatile and semi-volatile compounds in the oil (81.9%). The low-volatility fraction of the oil (12.1%) will take longer durations, of the order of days, to evaporate, and the residual fraction of 6% is expected to persist in the environment until slower degradation process occur.

Table 8-4: Comparison of Brewster and Plover spill modelling results

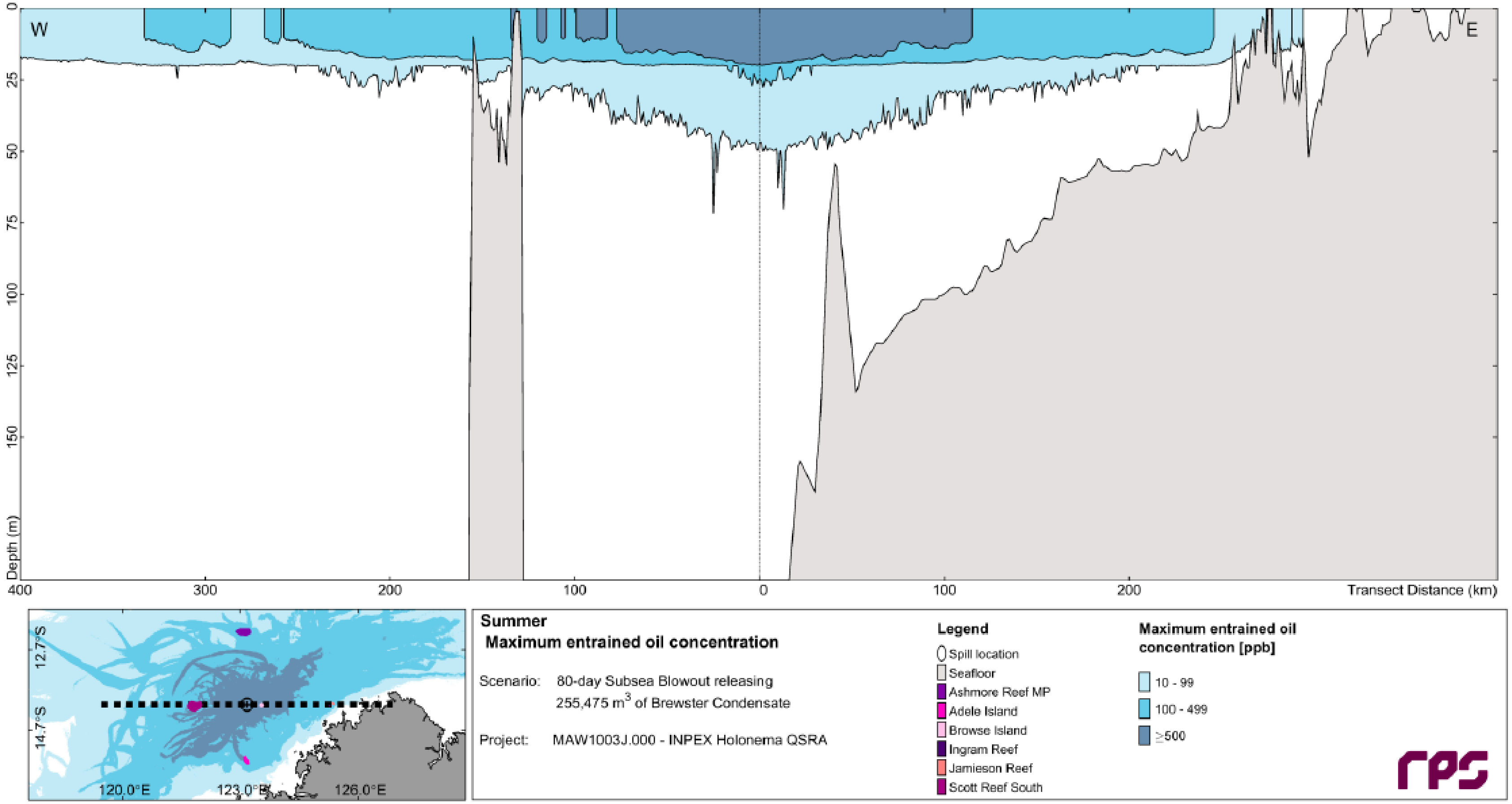
Result	Brewster (RPS 2021)	Plover (RPS 2022)
Maximum lineal distance (km) floating oil >1g/m^2	883	287
Maximum lineal distance (km) floating oil >10g/m^2	263	91
Minimum time (days) to shoreline oil accumulation >10 g/m^2	3 (67 hours)	5 (116 hours)
Minimum time (days) to shoreline oil accumulation >100 g/m^2	3 (68 hours)	5 (123 hours)
Longest length (km) or number of segments of shoreline oiled >10 g/m^2	158	137
Longest length (km) or number of segments of shoreline oiled >100 g/m^2	27	13
Worst-case volume (m^3) of oil on shoreline >100 g/m^2 at any time	433	61
Worst-case concentration of entrained oil (ppb)	16,082	10,273
Maximum distance (km) of entrained oil >100 ppb	897	960
Maximum depth (m) of entrained oil >100 ppb	30	30
Worst-case concentration of dissolved aromatic hydrocarbons (ppb)	8,958	619
Maximum distance (km) of dissolved aromatic hydrocarbons >50 ppb	450	150
Maximum depth (m) of dissolved aromatic hydrocarbons >50 ppb	130	60

Table 8-5: Brewster spill modelling results summary (RPS 2021)

Hydrocarbon exposure	Summary of results
Surface	Concentrations of hydrocarbons at the sea surface, greater than the impact threshold of 10 g/m^2 are predicted to occur at distances of up to 263 km from the source.

Hydrocarbon exposure	Summary of results
Entrained/ dissolved	Entrained oil concentrations, greater than the impact threshold of 100 ppb were predicted to extend up to a maximum of 897 km from the source. Worst-case instantaneous entrained oil concentrations predicted were 16,082 ppb in the vicinity of the release location and 2,851 ppb at Browse Island. Other representative shallow receptors received the following worst-case entrained oil concentrations: Ashmore Reef (482 ppb), Cartier Island (313 ppb), Kimberley MP (1,802 ppb) Adele Island (654 ppb), Heywood shoal (840 ppb), Echuca shoal (52 ppb), Seringapatam Reef (662 ppb), Sandy Islet (447 ppb) and Scott Reef (655 ppb). Cross-sectional transects in the vicinity of the release site indicated that entrained oil concentrations at or greater than the 100 ppb threshold are not predicted to reach depths greater than approximately 30 m (Figure 8-2). Dissolved aromatic hydrocarbons, greater than the impact threshold of 50 ppb were predicted to extend up to approximately 450 km from the source. Worst-case dissolved aromatic hydrocarbon concentrations were calculated as 8,958 ppb in the vicinity of the release location and 3,376 ppb at Browse Island. Other representative shallow receptors received the following worst-case dissolved aromatic hydrocarbon concentrations: Ashmore Reef (439 ppb), Cartier Island (382 ppb), Kimberley MP (1,492 ppb) Adele Island (84 ppb), Heywood shoal (1,477 ppb), Echuca shoal (953 ppb), Seringapatam Reef (952 ppb), Sandy Islet (1,088 ppb) and Scott Reef (1,088 ppb). Cross-sectional transects in the vicinity of the release site indicated that dissolved aromatic hydrocarbon concentrations at or greater than the 50 ppb threshold are not predicted to reach depths greater than approximately 130 m (Figure 8-3).
Shoreline	Predicted highest potential volumes on shorelines, in the worst-case replicate included Browse Island (433 m^3), Ashmore Reef (207 m^3), shorelines in the North Kimberley MP (198 m^3), Cassini Island (106 m^3), Sandy Islet (62 m^3), Cartier Island MP (55 m^3) and the Bonaparte Archipelago (30 m^3). Highest potential concentrations of oil on shore, through accumulation, were calculated as 19,262 g/m^2 (Browse Island), 3,636 g/m^2 (Sandy Islet), 3,195 g/m^2 (Cassini Island), 3,195 g/m^2 (North Kimberley MP), 3,182 g/m^2 (Ashmore Reef), 2,150 g/m^2 (Cartier Island) and 887 g/m^2 (Bonaparte Archipelago). In the worst-case replicate, the shortest elapsed time before exposure could occur at any shoreline was predicted as 68 hours for Browse Island. With other times to contact ranging from 221 hours (9 days) at Sandy Islet, 254 hours (11 days) at Cartier Island, 305 hours (13 days) at Ashmore Reef up to 1,409 hours (59 days) at the Bonaparte Archipelago.

a)


W
E
Depth (m)
0
25
50
75
100
125
150
400
300
200
100
0
100
200
Transect Distance (km)
12.7°S
14.7°S
120.0°E
123.0°E
126.0°E
Summer
Maximum entrained oil concentration
Scenario: 80-day Subsea Blowout releasing 255,475 m3 of Brewster Condensate
Project: MAW1003J.000 - INPEX Holonema QSRA
Legend
Spill location
Seafloor
Ashmore Reef MP
Adele Island
Browse Island
Ingram Reef
Jamieson Reef
Scott Reef South
Maximum entrained oil concentration [ppb]
10 - 99
100 - 499
≥500

b)

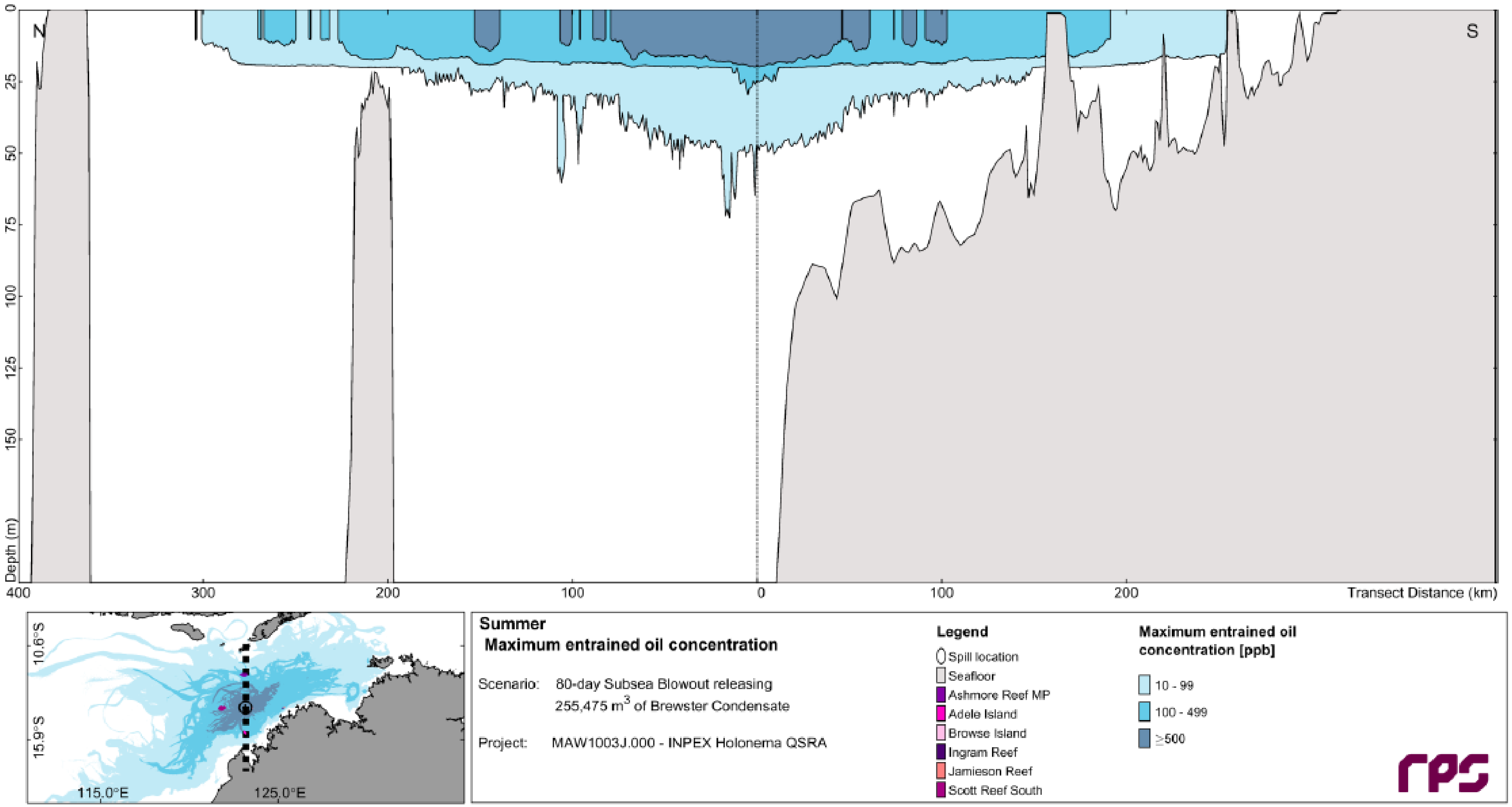
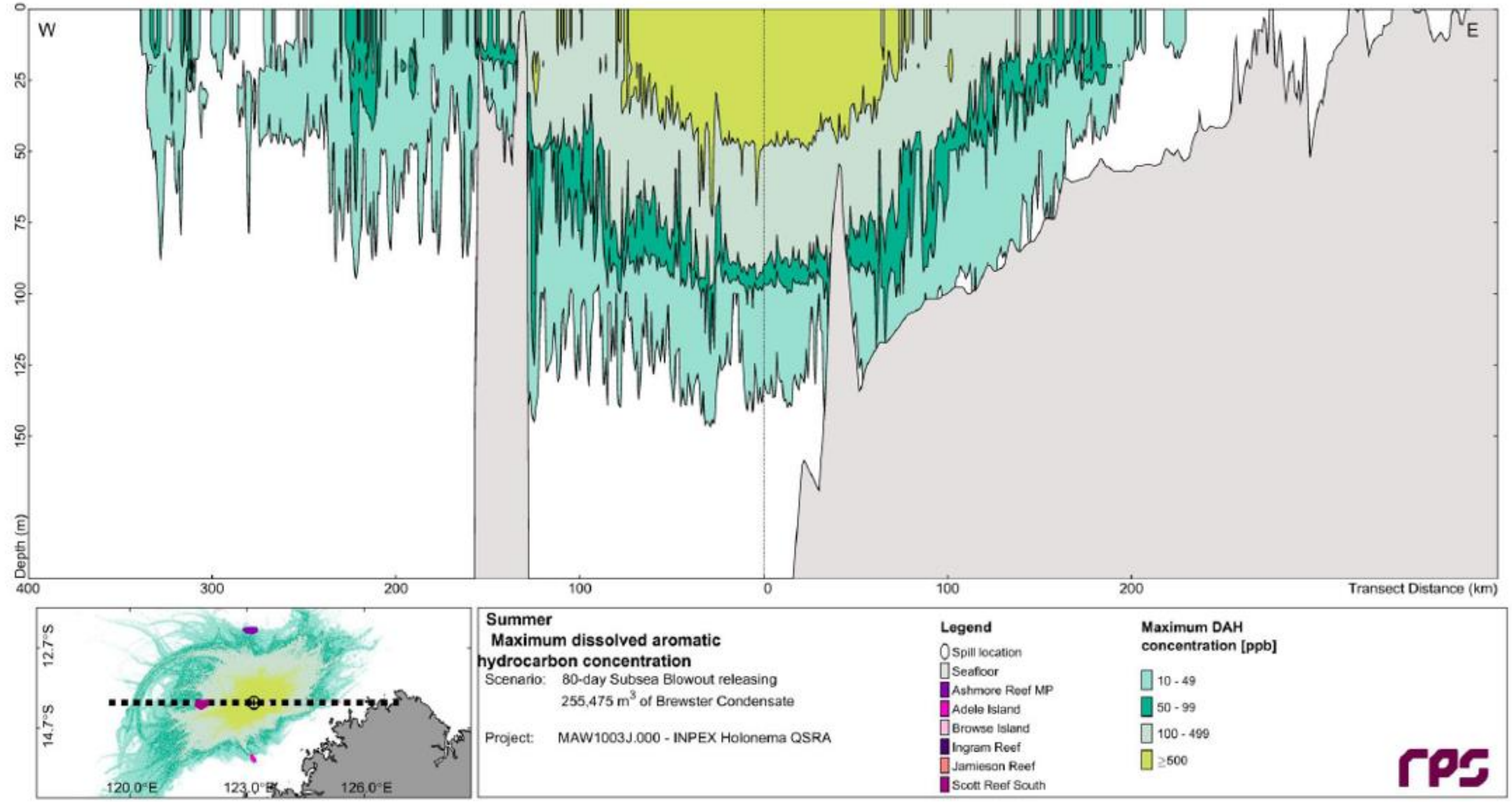


Figure 8-2: Cross-section transect of entrained hydrocarbons from a Brewster condensate blowout a) east-west (summer) b) north-south (summer)

a)


W
E
Depth (m)
0
25
50
75
100
125
150
400
300
200
100
0
100
200
Transect Distance (km)
12.7°S
14.7°S
120.0°E
123.0°E
126.0°E
Summer
Maximum dissolved aromatic hydrocarbon concentration
Scenario: 80-day Subsea Blowout releasing 255,475 m³ of Brewster Condensate
Project: MAW1003J.000 - INPEX Holonema QSRA
Legend
Spill location
Seafloor
Ashmore Reef MP
Adele Island
Browse Island
Ingram Reef
Jamieson Reef
Scott Reef South
Maximum DAH concentration [ppb]
10 - 49
50 - 99
100 - 499
≥500

b)

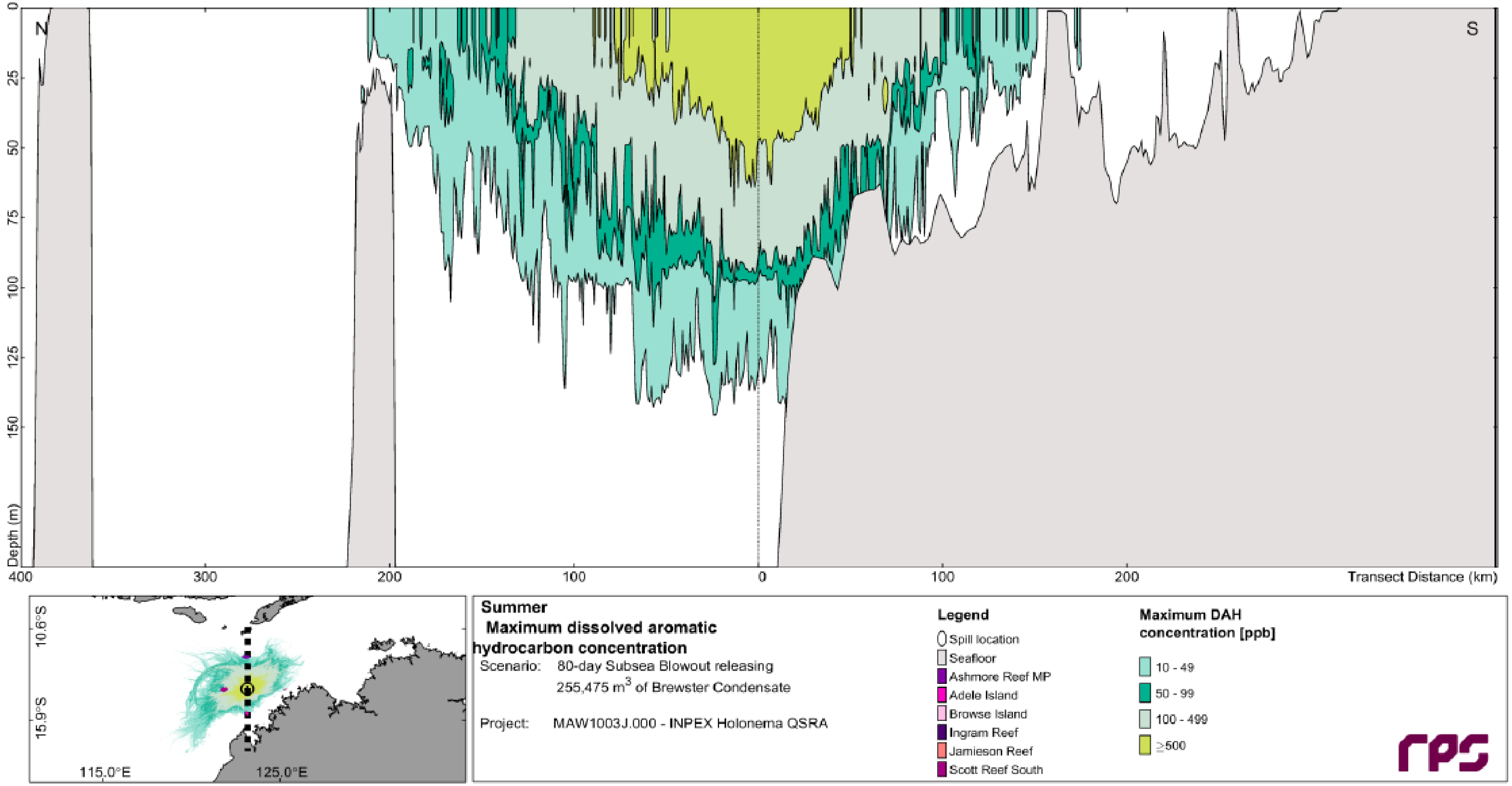


Figure 8-3: Cross-section transect of dissolved aromatic hydrocarbons from a Brewster condensate blowout a) east-west (summer) b) north-south (summer)

8.2.5 Impact and risk evaluation

Table 8-6: Impact and evaluation – Loss of well containment

<table>
<tr><th colspan="2">Identify hazards and threats</th></tr>
<tr><td colspan="2">A subsea release of Group I hydrocarbons from an exploration well, has the potential to result in changes to water quality through surface, entrained/dissolved, and shoreline hydrocarbon exposure. The thresholds for impacts associated with surface, entrained/dissolved, and shoreline hydrocarbon exposures are described in Table 8-2. The results of the predictive oil spill modelling for the loss of well containment scenarios are presented in Table 8-4,

Table 8-5, Figure 8-1, Figure 8-2 and Figure 8-3.</td></tr>
<tr><th>Potential consequence – surface hydrocarbons</th><th>Severity</th></tr>
<tr><td>The particular values and sensitivities with the potential to be exposed to surface hydrocarbon may include:
• commercial, traditional and recreational fisheries including aquaculture (within approximately 883 km from the release location based on the visible sheen threshold)
• EPBC-listed species (within approximately 263 km from the release location based on 10 g/m^2 impact threshold).
• planktonic communities (within approximately 263 km from the release location based on 10 g/m^2 impact threshold).

Based on the properties of condensate (Group I) any slick forming at the sea surface following a subsea release will undergo rapid evaporation of volatile components during light wind conditions and rapid entrainment during increased wind conditions (RPS 2021). This will reduce the duration of any surface expression and potential for impacts to marine fauna at the sea surface.

The values and sensitivities associated with aquaculture, commercial, traditional and recreational fisheries (seafood quality and employment) could be impacted by a visible sheen on the sea surface. Although the visible sheen is predicted to possibly extend up to 883 km from the release location it would not be a continuous surface expression. Exclusion zones may impede access to fishing areas for a short-to-medium term, and nets and lines could become oiled (ITOPF 2011). There is no evidence of any recreational fishing that occurs within the permit areas because of the distances from land, lack of features of interest and deep waters. Recreational day-fishing is concentrated around the population centres of Broome, Derby and Wyndham, as well as other readily accessible coastal population settlements which are generally at the edge of, or outside of the PEZ, and therefore unlikely to be impacted by this type of spill.</td><td>Moderate (D)</td></tr>
</table>

Commercial fisheries that transect the PEZ predominantly operate in the shallower waters of the PEZ, with generally low levels of fishing activity reported (refer to Section 4.11.3). Traditional fishing, particularly at Browse Island, Scott Reef and along the Kimberley coast at various IPAs including on intertidal reef platforms, could also be affected by impacts to fish and benthic habitats from entrained oil, discussed below. Based on the expected rapid weathering of condensate at the sea surface by evaporation, photo-oxidation and biodegradation and high potential for entrainment due to wave and wind action, any surface exposure is expected to be limited to a relatively short duration (RPS 2021). Therefore, the socioeconomic impacts on commercial, recreational and traditional fishing and aquaculture are expected to be short to medium term, and the consequence is considered to be Minor (E). There are no known marine fauna BIAs or aggregation areas that would result in sedentary behaviour in WA-285-P or WA-343-P. However, there are several marine fauna BIAs in areas predicted to be exposed to surface expressions above the 10 g/m^2 exposure threshold (within 263 km of the release location). These include a 20 km internesting buffer at Browse Island for green turtles, blue whale migration located approximately 75 km west of WA-285-P and 40 km west of WA-343-P, blue whale foraging at Scott Reef and the humpback whale migration corridor located 100 km south-east from WA-285-P. A range of other marine fauna may also be present within this area albeit on a transient basis. As air-breathers, marine mammals, if they surface, are vulnerable to exposure to hydrocarbon spill impacts through the inhalation of evaporated volatiles. Effects include toxic effects, such as damage to lungs and airways, and eye and skin lesions from exposure to oil (WA DoT 2018). Vapours, if inhaled, have the potential to damage the mucous membranes of the airways and the eyes. Inhaled volatile hydrocarbons are transferred rapidly to the bloodstream and may accumulate in tissues, such as in the brain and liver, resulting in neurological disorders and liver damage (Gubbay & Earll 2000). Blue whales and humpback whales (baleen whales), that may filter feed near the surface, would be more likely to ingest oil than gulp-feeders, or toothed-whales and dolphins. Spilled hydrocarbons may also foul the baleen fibres of baleen whales, thereby impairing food-gathering efficiency, or resulting in the ingestion of hydrocarbons, or prey that has been contaminated with hydrocarbons (Geraci & St. Aubin 1988). The outer extent of the green turtle internesting buffer at Browse Island overlaps the far north eastern boundary of WA-285-P (Figure 4-6) with the proposed well location in the south-west of the permit area approximately 40 km from Browse Island. Turtles can be exposed to hydrocarbons if they surface within the spill, resulting in direct contact with the skin, eyes, and other membranes, as well as the inhalation of vapours or ingestion (Milton et al. 2003). Floating oil is considered to have more of an effect on reptiles than entrained/dissolved oil because reptiles hold their breath underwater and are unlikely to directly ingest dissolved oil (WA DoT 2018). Other aspects of turtle behaviour, including a lack of avoidance behaviour, indiscriminate feeding in convergence zones, and large, pre-dive inhalations, make them vulnerable (Milton et al. 2003; WA DoT 2018). In addition, hatchlings spend more time on the surface than older turtles, thus increasing the potential for contact with oil slicks (Milton et al. 2003). A whale shark foraging BIA is located approximately 5 km from WA-285-P and approximately 10 km from WA-343-P at its closest point (Figure 4-7). Based on the levels of whale shark abundance observed in numerous studies (as described in Section 4.9.4), the likelihood of whale shark presence within this BIA is considered very low, with no specific seasonal pattern of migration.	

The permit areas are located within the EAA Flyway. The migration of marine avifauna through the EAA Flyway generally occurs at two times of year, northward between March and May and southward between August and November (Bamford et al. 2008; DEE 2017b). There are no BIAs for marine avifauna that overlap WA-285-P or WA-343-P. Marine avifauna foraging BIAs associated with Ashmore Reef and Cartier Island provide the closest foraging habitat to either permit area with the outer boundary of the BIA located approximately 10 km north of WA-343-P at its closest point. The EMBA overlaps three Ramsar sites (Ashmore Reef, Eighty Mile Beach and Roebuck Bay) and several nationally important wetland sites. Additionally, the PEZ includes other Ramsar sites and nationally important wetlands (refer to Section 4.6), and there are a large number of BIAs for marine avifauna species present within the region (Figure 4-8). Marine avifauna have the potential to directly interact with hydrocarbons on the sea surface during normal foraging activities. Direct contact with surface hydrocarbons may result in dehydration, drowning and starvation and is likely to foul feathers, which may result in hypothermia (Matcott et al. 2019). Birds resting at the sea surface and surface-plunging birds are considered particularly vulnerable to surface hydrocarbons. Impacts may include damage to external tissues, including skin and eyes, and internal tissue irritation in lungs and stomachs (WA DoT 2018). Toxic effects may also result where hydrocarbons are ingested, as birds attempt to preen their feathers (Jenssen 1994; Matcott et al. 2019). Based on the predicted limited extent of the surface hydrocarbons (approximately 263 km where concentrations are > 10 g/m^2), the rapid evaporation of volatile components and expected weathering resulting in reduced levels of toxicity, any impacts to transient EPBC-listed species are expected to be on a local to medium scale, with short to medium term impacts with no threat to the overall population of a protected species (Moderate D). As a consequence of their presence close to the water surface, plankton may potentially be exposed to hydrocarbons on the sea surface. However, the majority of impacts would be toxicity related, associated with entrained/dissolved hydrocarbons exposure. This is particularly the case in high energy seas where the vertical mixing of oil through the water column would be enhanced. Therefore, the impact evaluation for planktonic communities is provided in the entrained/dissolved hydrocarbons subsection below.	
Potential consequence – entrained/dissolved hydrocarbons	Severity
A subsea release of condensate due to an exploration well blowout in WA-285-P or WA-343-P could result in entrained hydrocarbons (>100 ppb) potentially extending up to 960 km from the release location at depths of up to 30 m below sea level. Concentrations of dissolved aromatic hydrocarbons >50 ppb may also extend over a wide area (approximately 450 km) at depths of up to 130 m below sea level. The values and sensitivities with the potential to be affected by entrained and dissolved aromatic hydrocarbon exposure include: • commercial, traditional and recreational fisheries including aquaculture • KEFs and associated biodiversity (fish communities, BIA - whale shark foraging) • benthic primary producer habitats / benthic habitats (corals, seagrasses and mangroves) • planktonic communities • EPBC-listed species (BIAs - marine mammals, turtles and avifauna).	Significant (C)

The values and sensitivities associated with commercial, traditional and recreational fisheries including aquaculture (seafood quality and employment) could be impacted due to entrained/dissolved oil. The impact to fish communities from exposure to entrained and dissolved hydrocarbons above threshold values, is primarily associated with toxicity resulting in impacts to seafood quality. Chronic impacts to juvenile fish and larvae may occur if exposed to entrained/dissolved hydrocarbon plumes potentially resulting in lethal or sub-lethal effects or impairment of cellular functions (WA DoT 2018). Juvenile fish and larvae may experience increased toxicity upon such exposure to plumes, because of the sensitivity of these life stages, with the worst impacts predicted to occur in smaller species (WA DoT 2018). Adult fish exposed to entrained hydrocarbons are likely to metabolise the hydrocarbons and excrete the derivatives, with studies showing that fish have the ability to metabolise petroleum hydrocarbons. These accumulated hydrocarbons are then released from tissues when fish are returned to hydrocarbon free seawater (Reiersen & Fugelli 1987). Following a subsea release from a well blowout, the plume of gas/condensate will rise through the water column and become entrained in the upper layers of the water column (top 30 m) (Figure 8-2). Soluble aromatics components will dissolve as the plume rises through the water column, with concentrations >50 ppb predicted in the top 130 m (Figure 8-3). Therefore, pelagic fish, and site attached fish on coral reefs, such as Heywood Shoal, Echuca Shoal, Ashmore Reef, Cartier Island and Browse Island, have the potential to be exposed to entrained/dissolved hydrocarbons above the 100 ppb and 50 ppb impact thresholds. Whereas demersal fish communities (such as the continental slope demersal fish community KEF which intersects both WA-285-P and WA-343-P) and fish associated with other KEFs or deeper benthic habitats are less likely to be exposed above impact thresholds in deeper waters. A whale shark foraging BIA is located approximately 5 km from WA-285-P and approximately 10 km from WA-343-P at its closest point. Whale sharks reportedly spend 40% of their time in the upper 15 m of the water column and are therefore likely to be exposed to entrained and dissolved hydrocarbons. Potential effects to whale sharks include damage to the liver and lining of the stomach and intestines, as well as toxic effects on embryos (Lee 2011). As whale sharks are filter feeders they are expected to be highly vulnerable to entrained/dissolved hydrocarbons (Campagna et al. 2011). The consequence of entrained/dissolved hydrocarbons on fisheries (commercial, recreational and traditional including aquaculture), fish and shark populations is considered to be Significant (C).	

Benthic communities in the EMBA, including benthic primary producers, such as coral reefs, seagrass and mangroves, and deeper water filter-feeding communities could be exposed to entrained oil above impact thresholds (down to 30 m depth) and dissolved aromatic hydrocarbons (down to 130 m depth) which could result in a number of lethal or sub-lethal effects on these values and sensitivities. Shallow water communities are generally at greater risk of exposure than deep water communities (NRC 1985; WA DoT 2018). Exposure of shallow subtidal corals to entrained and dissolved hydrocarbons has the potential to result in lethal or sublethal toxic effects, resulting in acute impacts or death at moderate to high exposure thresholds (Loya & Rinkevich 1980; Shigenaka 2001; WA DoT 2018), including increased mucus production, decreased growth rates, changes in feeding behaviours and expulsion of zooxanthellae (Peters et al. 1981; Knap et al. 1985). Adult coral colonies, injured by oil, may also be more susceptible to colonisation and overgrowth by algae or to epidemic diseases (Jackson et al. 1989). A study by Nordborg et al. (2018) reported that the presence of ultraviolet radiation increases the hazard posed by dissolved hydrocarbons to tropical, shallow-water coral reefs due to phototoxicity. PAH phototoxicity occurs through the formation of radical oxygen species and/or transformation of PAHs into more toxic products. Therefore, co-exposure to ultraviolet radiation may considerably enhance negative impacts and the risks to coral larvae may be substantially underestimated in shallow-water tropical reef systems (Nordborg et al, 2018). Lethal and sublethal effects of entrained and dissolved oils have been reported for coral gametes at much lesser concentrations than predicted for adult colonies (Heyward et al. 1994; Harrison 1999; Epstein et al. 2000). Goodbody-Gringley et al. (2013) found that exposure of coral larvae to oil and dispersants negatively impacted coral settlement and survival, thereby affecting reef resilience. Browse Island (closest shallow water receptor) is predicted to receive a concentration of entrained hydrocarbons of 2,851 ppb and dissolved aromatic hydrocarbons at 3,376 ppb; concentrations were predicted to be higher at the immediate release locations within WA-285-P and WA-343-P (RPS 2021; RPS 2022). Due to the proximity of some deep-water filter feeding communities, such as the 125 m ancient coastline KEF, Echuca Shoal and Heywood Shoal, and the prolonged exposure above impact thresholds that may be received at these locations, the potential consequence for coral reefs is considered to be Significant (C). Entrained and dissolved hydrocarbons have the potential to affect seagrasses and macroalgae through toxicity impacts. The hydrophobic nature of hydrocarbon molecules allows them to concentrate in membranes of aquatic plants. Hence the thylakoid membrane (an integral component of the photosynthetic apparatus) is susceptible to oil accumulation, potentially resulting in reduced photosynthetic activity (Runcie & Riddle 2006). However, a layer of mucilage present on most species of seagrass prevents the penetration of toxic aromatic fractions (Burns et al. 1993). 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 & 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 & Rasheed (2011) that seagrass meadows were not significantly affected by an oil spill when compared to a non-impacted reference seagrass meadow. The majority of seagrass locations within the EMBA are distant from WA-285-P and WA-343-P, with the exception of Ashmore Reef (approximately 115 km north of WA-343-P). Therefore, the associated received concentrations of entrained and dissolved hydrocarbons will be lower; however, may still be above thresholds that could cause impact and the consequence is considered to be Minor (E) based on the expected rapid recovery.	

Mangrove communities within the EMBA, present along WA, NT and international coastlines are also susceptible to entrained/dissolved hydrocarbon exposure, with potential impacts, including defoliation and mortality. A study by Duke (2000), on the use of dispersant on surface spills, resulting in an increase in the entrainment of oil showed a positive benefit to mangroves. Therefore, impacts of entrained/dissolved hydrocarbons on mangroves is expected to be less than the impacts predicted from surface oiling (Burns et al. 1993; Duke et al. 2000). Mangrove communities are distant from the permit areas and so the associated received concentrations would be lower; however, potentially still above the threshold that could cause impacts. Therefore, the consequence is considered to be Moderate (D). Planktonic communities may be exposed to entrained/dissolved hydrocarbon plumes, especially in high energy seas where the vertical mixing of oil through the water column would be enhanced. The effects of oil on plankton have been well studied in controlled laboratory and field situations. The different life stages of a species often show widely different tolerances and reactions to oil pollution. Usually, eggs, larval and juvenile stages will be more susceptible than adults (Harrison 1999). Post spill studies on plankton populations are few, but those that have been conducted typically show either no effects, or temporary minor effects (Kunhold 1978). The lack of observed effects may be accounted for by the fact that many marine species produce very large numbers of eggs, and therefore larvae, to overcome natural losses (such as through predation by other animals; adverse hydrographical and climatic conditions; or failure to find a suitable habitat and adequate food). A possible exception to this would be if a shallow entrained/dissolved hydrocarbon plume were to intercept a mass, synchronous spawning event. Recently spawned gametes and larvae would be particularly vulnerable to oil spill effects, since they are generally positively buoyant and would also be exposed to surface spills. Hook & Osborn (2012) reported that typically, phytoplankton are not sensitive to the impacts of oil. Although phytoplankton are not sensitive to oil, they do accumulate it rapidly because of their small size and high surface area to volume ratio and can pass oil onto the animals that consume them (Wolfe et al. 1998a, 1998b). This is also applicable to zooplankton, that are reported to accumulate oil via the ingestion of phytoplankton. However, consumption of zooplankton by fish does not appear to be an efficient means of trophic transfer, perhaps because of the metabolism of oil constituents (Wolfe et al. 2001). Under most circumstances, impacts to plankton at the sea surface is expected to be localised, with short term impacts; however, if a shallow entrained/dissolved plume reached a coral spawning location, such as Browse Island or Scott Reef, during a spawning event, localised short to medium term impacts could occur. Therefore, the consequence is considered to be Moderate (D). Marine mammals, marine reptiles and marine avifauna could also be impacted through entrained and dissolved hydrocarbon exposure, primarily through ingestion during foraging activities (WA DoT 2018). The EMBA overlaps three Ramsar sites (Ashmore Reef, Eighty Mile Beach and Roebuck Bay) and several nationally important wetland sites (Section 4.6). Several other marine fauna BIAs are predicted to be exposed to entrained and dissolved hydrocarbons above exposure thresholds. These include the 20 km internesting buffer at Browse Island for green turtles, blue whale foraging at Scott Reef, blue whale migration corridor located approximately 75 km west of WA-285-P and 40 km west of WA-343-P and the humpback whale migration corridor located 100 km south-east from WA-285-P. A range of other marine fauna may also be present within this area albeit on a transient basis. Small proportions of populations of protected species could be impacted by exposure to entrained and dissolved hydrocarbons, therefore the consequence is considered to be Moderate (D).	
Potential consequence – shoreline hydrocarbons	Severity

As presented in Table 8-5, shoreline contact and accumulation of oil on shorelines was predicted at multiple locations within the EMBA at concentrations in excess of the 100 g/m^2 impact threshold. Indicative quantities of oil that could potentially accumulate on shorelines within the EMBA included but were not limited to: • Browse Island (433 m^3) • Ashmore Reef (207 m^3) • shorelines in the Kimberley MP (198 m^3) • Cassini Island (106 m^3) • Sandy Islet (62 m^3) • Cartier Island (55 m^3) • Bonaparte Archipelago (30 m^3). The minimum predicted time for shoreline contact was 68 hours (3 days) at Browse Island. In general, time to contact for other shorelines was in the order of 9 to 59 days. Given this time to reach shorelines, any surface release is expected to have weathered due to several physical and biological processes, such as evaporation of volatile/toxic components, photo-oxidation and biodegradation (Stout et al. 2016). Impacts to ecological receptors from exposure to weathered oil (waxy flakes and residues) are far less than those associated with exposure to fresh oils, which have higher levels of toxicity (Milton et al. 2003; Hoff & Michel 2014; Woodside 2014; Stout et al. 2016). Therefore, impacts from weathered oil are generally limited to smothering and coating associated with the waxy flakes and residues which generally have low levels of adhesion. Intertidal habitats and marine fauna known to use shorelines are most at risk from shoreline accumulations, due to smothering of intertidal habitats (such as emergent coral reefs) and coating of marine fauna (WA DoT 2018). Consequently, the particular values and sensitivities with the potential to be exposed to shoreline accumulated hydrocarbons are: • benthic primary producer habitats/shoreline habitats (intertidal only) • EPBC-listed species (BIAs - turtles and avifauna). Benthic primary producer habitats exposed at spring low tides are the most vulnerable to smothering. However, as spills disperse, intertidal communities are expected to recover (Dean et al. 1998). Direct contact of hydrocarbons to emergent corals can cause smothering, resulting in a decline in metabolic rate and may cause varying degrees of tissue decomposition and death. A range of impacts may also result from toxicity, including partial mortality of colonies, reduced growth rates, bleaching, and reduced photosynthesis (Negri & Heyward 2000; Shigenaka 2001). 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).	Moderate (D)

Three Ramsar sites (Ashmore Reef, Eighty Mile Beach and Roebuck Bay) and several nationally important wetlands are present within the EMBA (Section 4.6). These coastal sites generally include intertidal mudflats and mangroves that provide important foraging, resting and breeding habitats for migratory and shoreline bird species. As described for entrained and dissolved hydrocarbon exposure, mangrove communities within EMBA could potentially be exposed to shoreline oil accumulation above impact threshold concentrations, with potential impacts including defoliation and mortality (Burns et al. 1993; Duke et al. 2000). The recovery of mangroves from shoreline oil accumulation can be a slow process, due to the long-term persistence of oil trapped in anoxic sediments and subsequent release into the water column (Burns et al. 1993). The predicted times to contact for locations in the EMBA with mangrove communities is in the order of many days, therefore the shoreline accumulations are expected to be highly weathered and comprise of waxy flakes/residues. Lighter oils are reported to penetrate more deeply into mangrove forests than heavier and more weathered oils (Hoff & Michel 2014); therefore, it is considered that the weathered hydrocarbons will generally be less toxic in nature (Stout et al. 2016). Given the predicted times to contact and significant expected weathering of any hydrocarbons accumulating on shorelines, any impacts to benthic primary producer or intertidal habitats are expected to be localised and of short to medium term with a consequence of Moderate (D). Marine reptiles, including turtles and crocodiles that utilise shoreline habitats can be exposed to hydrocarbons externally, through direct contact; or internally, by ingesting oil, consuming prey containing oil, or inhaling volatile compounds (Milton et al. 2003). Shoreline hydrocarbons can impact turtles at nesting beaches when they come ashore, with exposure to skin and cavities, such as eyes, nostrils, and mouths. Eggs may also be exposed during incubation, potentially resulting in increased egg mortality and detrimental effects on hatchlings. Hatchlings may be particularly vulnerable to toxicity and smothering, as they emerge from the nests and make their way over the intertidal area to the water (Milton et al. 2003). There are a number of foraging, nesting and internesting BIAs for turtles within the EMBA that have the potential to be exposed to shoreline accumulations above the impact threshold concentration (100 g/m^2). Potential impacts may occur on nesting populations, which may affect species recruitment at a local population level particularly in relation to green turtles at Browse Island with a small, localised range of habitat (DEE 2017a). At locations with longer times for shoreline contact, there is a high potential for hydrocarbons to become more weathered. Weathered oil has been shown to have little impact on turtle egg survival, while fresh oil may have a significant impact (Milton et al. 2003). Given the modelling results (time to contact and predicted volumes on shorelines), there is the potential for local to medium scale impacts with medium term effects on nesting populations of turtles at individual nesting beaches/locations (Moderate D). Birds coated in hydrocarbons may suffer toxic effects where oil is ingested, either through birds' attempts to preen their feathers (Jenssen 1994; Matcott et al. 2019) or ingested as weathered waxy flakes/residues present on shorelines. However, waxy residues are generally considered to be of lower toxicity (Stout et al. 2016; Woodside 2014). Shorebirds foraging and feeding in intertidal zones are at potential risk of exposure to shoreline hydrocarbons, potentially causing acute effects to numerous marine avifauna BIAs, and species present at Ramsar/wetland sites as described above. It is also possible that birds exposed to surface hydrocarbons may be displaced (i.e. fly away) and use nearby shorelines to recover, thereby, potentially increasing their exposure to shoreline hydrocarbons. In the event of shoreline contact following a loss of containment event from an exploration well in WA-285-P or WA-343-P, there is the potential for short–to-medium term impacts on the environment while local populations recover. It is not expected that the overall population viability for any protected species would be threatened. Therefore, the potential consequence associated with shoreline hydrocarbon exposure for EPBC-listed species is considered to be Moderate (D).	

In summary, the potential extent of shoreline accumulation (> 100 g/m^2) may result in exposure to the identified values and sensitivities. There would likely also be cumulative impacts as a result of interactions between surface, entrained/dissolved and shoreline hydrocarbon impacts on the food web and through bioaccumulation up the food chain potentially impacting a small portion of a population of protected species. On this basis, the potential consequence associated with shoreline accumulation from a loss of well containment is considered to be Moderate (D).			
Identify existing design safeguards/controls			
• Conduct drilling in accordance with the OPGGS (Resource Management and Administration) Regulations 2011 and OPGGS (Safety) Regulations 2009 including a NOPSEMA accepted WOMP and MODU safety case.			
Propose additional safeguards/control measures (ALARP evaluation)			
Hierarchy of control	Control measure	Used?	Justification
Elimination	None identified.	N/A	N/A
Substitution	None identified.	N/A	N/A
Engineering	Maintain well integrity throughout the well's lifecycle to avoid the requirement to implement source control.	Yes	Controls to maintain well integrity throughout the well's lifecycle will be in place as documented in the NOPSEMA accepted WOMP. These will include but are not limited to: • adherence to the drilling management system including in particular the well integrity standard, well design standard and well operations standard • well design inputs such as hazardous gases, temperature and pore pressure and how these are used in well design • barrier design, installation and verification • drilling Technical Authorities • well integrity assurance activities • well design assurance activities • drilling fluid type and density selection and calculation of kick tolerance • cementing design, placement and verification

			• well abandonment design, execution and verification • risk management process including identification, analysis, evaluation, control, monitoring and review • management of change • use of performance standards in well construction including but not limited to well acceptance criteria • process safety management • the competency assurance process. Through implementation of such preventative controls, the potential for a release of hydrocarbon to the marine environment is reduced.
Procedures and administration	Well Control Bridging Document, well integrity standard and well operations standard.	Yes	The drilling Contractor's Well Control Bridging Document, INPEX Well Integrity Standard and INPEX Well Operations Standard covers all aspects of primary and secondary well control for drilling operations implemented to minimise the potential for a loss of well containment and reduce any impacts to the environment by preventing a spill.
	Trained and competent personnel.	Yes	Adherence to the INPEX Competency Assurance and Management Standard (0000-AN-STD-60011) to ensure all personnel on the MODU and vessels will be competent to undertake their assigned positions, including, all critical drilling personnel comply with minimum well control training and oil spill response competency requirements.
	Implement Browse Regional OPEP	Yes	The INPEX Browse Regional OPEP defines the processes that will be used to maintain oil spill preparedness and implement effective response measures, in the event of a spill. For this EP, an assessment of the well blowout WCSS against the Browse Regional OPEP Basis of Design has been conducted, as is required under BROPEP BOD/FCA, Figure 8-1 – management of change process. The well blowout WCSS from this EP have been compared against the Browse Regional OPEP BOD response planning thresholds, (BROPEP BOD/FCA Table 4-4). The WA-285-P well blowout modelling data presented in Table 8-4 of this EP is the same modelling data presented in the Browse Regional OPEP BOD/FCA report Table 4-4. The WA-343-P well blowout modelling results, as shown in Table 8-4 of this EP, are lower than the response planning thresholds, as presented in the BROPEP BOD/FCA Table 4-4.

			Therefore, the two well blowout WCSS assessed under this EP are equivalent, or less than the WCSS defined in the Browse Regional OPEP BOD. As such, no revision to the spill preparedness/response arrangements defined in the Browse Regional OPEP are required.
	Implement INPEX Source Control Capability & Arrangements	Yes	The INPEX Source Control Capability & Arrangements report provides a detailed source control capability analysis for the worst credible blowout scenario. It also provides an implementation strategy for source control arrangements and risk assessment, including management of change processes and compliance reporting requirements.
Identify the likelihood			
Likelihood	Given the design and mitigation controls that have been identified to minimise the potential for a loss of well containment the likelihood of the consequence occurring is considered Highly Unlikely (5). INPEX has conducted a drilling campaign risk assessment and maintains a risk register for current drilling operations, which determines the likelihood rating, and subsequently the residual risk, of a loss of well containment event against associated consequential factors including finance reputation, health and safety and environment. This process is verified by a quarterly risk review, which continues to assess any change to activities which may affect residual risk levels. Together these processes verify the likelihood level as 'High Unlikely' (5). A suite of control measures that typically exceed industry well control and barrier standards have been implemented by INPEX for the exploration drilling activities covered in this EP and include: • the development and implementation of a Well Control Bridging Document for alignment and agreement on the systems and approach to be used for well control in operations • INPEX well control audits of drilling contractor equipment, systems and personnel via subject matter experts • major and minor (major accident event) barrier health checks which are in-depth reviews of well control related barriers including related performance standards • independent third-party inspection of well control equipment, systems, maintenance and testing • detailed INPEX quality audits of drilling contractor maintenance system including well control equipment • enhanced conventional pit monitoring with multiple sensors per pit / solids control tanks • continuous fluid density in/out, gas in/out and temperature in/out monitoring available via mudlogging • connection flowback fingerprinting utilized as a standard practice		

	• real time data from mudlogging available to Driller as well as Operator and Drilling Contractor site-based supervisor offices • application of the INPEX Drilling Behaviours throughout the campaign which create an open culture of speaking up and reporting bad news, avoiding rushing of tasks, not getting comfortable and being visible and actively present. Previous application of these behaviors has created a strong culture of effective well monitoring and control • rigorous management of change (MoC) process that includes a technical authority that is independent of direct well operations. The INPEX risk matrix describes associated likelihood timeframes, frequencies and probabilities (in line with historical industry and regional events); however, the introduction of these additional control measures, considered by INPEX to further reduce the likelihood, has resulted in a likelihood rating of Highly Unlikely (5). If concurrent drilling operations were to occur during the activity, up to two MODUs could be potentially operating (one in each permit are). In this case the likelihood of two well blowouts is deemed to be non-credible and with the above controls in place the likelihood of the consequence occurring is Remote (6).		
Residual risk	Based on the worst-case consequence for all hydrocarbon exposure mechanisms (surface/entrained/dissolved/shoreline) Significant (C) and a likelihood of Highly Unlikely (5) the residual risk is ranked as Moderate (7).		
Residual risk summary			
Consequence		Likelihood	Residual risk
Significant (C)		Highly Unlikely (5)	Moderate (7)
Assess residual risk acceptability			
Legislative requirements All reasonable means to minimise the likelihood of a loss of well containment occurring have been taken during the design and planning process for the exploration wells. Relevant Australian standards, codes of practice and industry best practice has been adopted to ensure well integrity is maintained. All activities will be undertaken in accordance with the OPGGS (Resource Management and Administration) Regulations 2011 and OPGGS (Safety) Regulations 2009. The controls are typical for the proposed activities and are appropriate for the NWS region. **Stakeholder consultation** Stakeholders have been engaged throughout the development of the EP. Where relevant, the controls in place have been developed in consultation with relevant stakeholders (e.g. WA DoT, WA DBCA, AMSA and AMOSC). **Conservation management plans / threat abatement plans**			

Several conservation management plans (refer Appendix A) identify oil spills as a key threatening process, through both direct and acute impacts of oil, as well as indirect impacts through habitat degradation (which is a potential consequence of an oil spill). The prevention of a loss of well containment and reducing impacts to the marine environment through oil spill response preparedness and response (refer INPEX *Browse Regional OPEP*) demonstrates alignment with the various conservation management plans.

ALARP summary

Given the level of environmental risk is assessed as Moderate, a detailed ALARP evaluation was undertaken to determine what additional control measures could be implemented to reduce the level of impacts and risks. No additional controls, beyond those identified during the detailed ALARP assessment can reasonably be implemented to further reduce the risk of impact.

Acceptability summary

Based on the above assessment, the proposed controls are expected to effectively reduce the risk of impacts to acceptable levels because:

- the activity demonstrates compliance with legislative requirements/industry standards
- the activity takes into account stakeholder feedback
- the activity is managed in a manner that is consistent with the intent of conservation management documents
- the activity does not compromise the relevant principles of ESD
- the predicted level of impact does not exceed the defined acceptable level in that the environmental risk has been assessed as "moderate", the consequence does not exceed "C – significant" and the risk has been reduced to ALARP.

Environmental performance outcomes	Environmental performance standards	Measurement criteria
No incidents of loss of hydrocarbons to the marine environment as a result of a loss of well containment	INPEX and MODU contractor will conduct drilling activities in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011 and OPGGS (Safety) Regulations 2009 requirements, including: • a NOPSEMA accepted WOMP • a NOPSEMA accepted MODU safety case.	• WOMP acceptance letter received from NOPSEMA. • NOPSEMA acceptance of MODU safety case.

	INPEX will verify that the MODU contractor complies with the requirements of the approved Well Control Bridging Document which aligns requirements (and clarifies if conflicts exist, which standard takes precedence) between the INPEX Well Operations Standard (0000-AD-STD-60004) and Well Operations Manual (0000-AD-MAN-60002) which covers all aspects of primary and secondary well control for floating drilling operations, including: Well design/planning • Assessment of formation pressure and fracture gradient along the length of the well. • Shallow gas analysis and assessment has shown no potential for any shallow hazards. • Planned hydrostatic overbalance to stop ingress potential (i.e. inflow of formation fluids) into the well. • Kick tolerance – adequate design window to tolerate a kick of a certain volume and safe circulation out of the well. • Assessment of well control equipment requirements to ensure they are suitable and specific for well design, including subsea BOP stacks, well choke and kill systems. • Well-bore monitoring equipment – two independent systems for monitoring flow and volume from the well-bore shall be provided (by the drilling contractor and the mud logging contractor). BOP system • BOP installed in sections where there is potential for flow from the well. • BOP function and pressure tested prior to use and meets the requirements of the industry standard American Petroleum Institute (API) STD 53 Blowout Prevention Equipment Systems for Drilling Wells (4th edition, November 2012). The INPEX drilling supervisor or drilling engineer must approve BOP pressure tests in accordance with predetermined acceptance criteria.	Well design/planning • Proposed well design, and comparison with drilling contractor's equipment to ensure minimum requirements are met and align with the INPEX Well Operations Manual (0000-AD-MAN-60002). BOP system • BOP pressure and function testing prior to installation and at regular intervals for the duration of drilling campaign while installed. The INPEX drilling supervisor or drilling engineer must approve BOP pressure tests and report appropriately. • Inspection and maintenance records show BOP meets INPEX requirements (e.g. shear ram capability, industry standard etc.) and maintained in accordance with MODU preventive maintenance system. Mud logging • Documentation that mud logging unit provides kick detection. • Documentation demonstrates all issues identified, addressed or closed out. Summary of compliance with INPEX Well Integrity Standard (0000-AD-STD-60003) summarised in pre-start environmental audit and annual environmental audit report. Well abandonment • Compliance with INPEX Well Integrity Standard (0000-AD-STD-60003) and WOMP reported.

	• The drilling contractor shall have a maintenance/inspection program for BOP control equipment which will align with the drilling contractor's well control standard. The BOP will undergo weekly/fortnightly function and pressure testing. • BOP shall have a shear ram capable of shearing the drill pipe in use and sealing the well-bore. • Compliance with INPEX Well Integrity Standard (0000-AD-STD-60003) which requires two tested barriers to allow removal of the BOP. Mud logging The mud logging unit shall provide kick detection through the following: • continually manned (24 hrs) during all live, open hole well operation, with appropriate checks and calibration checks on key components • continuous recording of drilling operations, including mud flow out and pressure evaluation, with alarms in place to detect any significant changes. Well abandonment • INPEX will verify compliance with the WOMP which outlines the means by which the wells will be plugged and abandoned using a combination of verified barriers.	
	MODU and vessel personnel will demonstrate competence in accordance with the INPEX Competency Assurance and Management Standard (0000-AN-STD-60011).	Training records.
Refer to the INPEX *Browse Regional OPEP* for environmental performance outcomes, standards and measurement criteria related to mitigative controls.		
Refer to the INPEX *Source Control Capability & Arrangements report for* environmental performance outcomes, standards and measurement criteria related to source control.		

8.3 Vessel collision

8.3.1 Location

Only vessels using marine diesel will be used during the petroleum activity. Spill modelling (APASA 2015) was undertaken for an instantaneous Group II hydrocarbon surface release of marine diesel at a location approximately 15 km north-north-west of Browse Island. The release point provides indicative information only as an exact location for a vessel collision cannot be predicted and is considered to be representative for a vessel collision spill scenario at either WA-285-P or WA-343-P.

8.3.2 Volume and duration

AMSA guidance (AMSA 2015a) recommends that the maximum credible volume spill for a vessel collision scenario be based on the volume of the largest single fuel tank. A review of the expected tank sizes associated with the activity indicated the survey vessel largest tank size to be approximately 40 m^3, and the MODU support vessels to be approximately 225 m^3. Conservatively, the modelling of a 250 m^3 spill volume has been used (APASA 2015) with the spill modelled as an instantaneous release, with spill trajectory and fate tracked for 14 days.

8.3.3 Hydrocarbon properties

Hydrocarbon properties associated with the Group II diesel used for the modelling study are presented in Table 8-7.

Table 8-7: Group II diesel properties

Hydrocarbon type	**Density at 15 ˚C (g/cm³)**	**Viscosity – centipoise (cP) – at 40 ˚C**	**Characteristic**	**Volatile (%)**	**Semi-volatile (%)**	**Low volatility (%)**	**Residual (%)**
			Boiling point (˚C)	<180	180–265	265–380	>380
Diesel fuel oil	0.8291	4.0	% of total	6	34.6	54.4	5

8.3.4 Modelling results

Modelling results are summarised in Table 8-8 and include results taken for three modelled seasons throughout the year: October to February (wet); May to July (dry); and March to April/August to September (transitional). For each season, 100 modelled replicates were run and therefore the results summarised represent 300 possible spill scenarios.

Under weak wind conditions, which will not generate breaking waves, the oil is predicted to float on the water surface, where it will be subject to evaporation and degradation (photochemical and biological). After the loss of approximately 40% of the mass over the first 48 hours, evaporation will slow considerably to account for a further 10% over the first week. About 20% of the mass is likely to be lost through decay, leaving approximately 30% of the mass as residual oil on the water surface.

Under stronger wind conditions that would generate breaking surface waves, approximately 70% of the oil is predicted to entrain in less than a day, which is forecasted to greatly reduce the volume floating on the surface and inhibit the evaporation of the oil. Under stronger wind conditions, 80% of the oil is predicted to entrain in the first few hours and only 20% of the mass is predicted to evaporate, with no further evaporation occurring while oil remains entrained.

Table 8-8: Vessel collision spill modelling results (APASA 2015)

Hydrocarbon exposure	Surface release of 250 m^3 marine diesel
Surface	The maximum distance of floating hydrocarbon, at concentrations greater than 1 g/m^2 (visible sheen), travelled by a single spill trajectory (out of 300 simulations) was approximately 560 km from the release location during the transitional season. Distances travelled during dry and wet seasons were considerably less (140 km dry; 185 km wet). The maximum distance travelled by a single spill trajectory (out of 300 simulations) for floating hydrocarbons at concentrations >10 g/m^2 (environmental impact threshold) were predicted to be approximately 140 km again during the transitional season. Distances travelled during dry and wet seasons were considerably less (55 km dry; 85 km wet).
Entrained and dissolved	Entrained oil > 100 ppb is predicted to occur at distances up to approximately 245 km (dry), 335 km (wet) and 355 km (transitional) from the release location. The maximum entrained oil concentration was predicted as 3,896 ppb at the Ancient Coastline KEF, in the worst replicate (transitional). Other locations potentially exposed to entrained hydrocarbons include Browse island (2,207 ppb); Heywood Shoal (1,678 ppb); Echuca Shoal (1,576 ppb); Eugene McDermott Shoal (504 ppb); Vulcan Shoals (461 ppb); Scott Reef South (437 ppb); Barracouta Shoals (354 ppb); Woodbine Bank (222 ppb); Sahul Banks (273 ppb); and Cartier Island (205 ppb). These values represent worst single replicates from 300 modelled simulations. When averaged over all replicate simulations, the highest concentrations of entrained hydrocarbons were predicted at Ancient Coastline KEF (70 ppb), Browse Island (68 ppb) Echuca Shoal (35 ppb) and Heywood Shoal (24 ppb), all below the 100-ppb impact threshold. Exposure to dissolved hydrocarbons was predicted at several locations. The maximum exposure to dissolved hydrocarbons for the worst replicate simulation was Browse Island (54 ppb); Echuca Shoal (44 ppb) and Heywood Shoal (26 ppb). When averaged over all replicate simulations, exposure to dissolved hydrocarbons was predicted as <1 ppb for all locations except Browse Island (2 ppb) and all below the 50-ppb impact threshold.
Shoreline	The potential for oil to accumulate over time on shoreline receptors was limited to two locations for all replicate simulations, these were Browse Island (3,315 g/m^2 in wet and transitional seasons) and Cartier Island 356 g/m^2 in wet season). These concentrations are based on highest maximum accumulations from 300 replicate simulations (worst-case single simulation). Highest average, local accumulations across all replicate seasons were calculated for Browse Island as 127 g/m^2, exceeding the 100 g/m^2 impact threshold. The highest average, local accumulation at Cartier Island were 3.6 g/m^2) below the impact threshold.

	Minimum times for shoreline contact at Browse Island was 5 hours (by slicks >25 g/m^2 during transitional season) and 229 hours at Cartier Island (by slicks >1 g/m^2 during wet season). No contact was predicted at Cartier Island by slicks >10 g/m^2 or > 25 g/m^2 during all modelled seasons. Worst-case accumulated volumes of oil along shorelines at Browse Island were predicted to be 50.5 m^3 (transitional season) and 3.4 m^3 at Cartier Island (wet season).

8.3.5 Impact and risk evaluation

Table 8-9: Impact and evaluation – Vessel collision resulting in a Group II (diesel) spill

<table>
<tr><th colspan="2">Identify hazards and threats</th></tr>
<tr><td colspan="2">A surface release of Group II hydrocarbons has the potential to result in changes to water quality through exposure to hydrocarbons. The thresholds for impacts associated with surface, entrained/dissolved, and shoreline, hydrocarbon exposures are described in Table 8-2. The results of the predictive modelling for the vessel collision scenario are presented in Table 8-8.</td></tr>
<tr><th>Potential consequence – surface hydrocarbons</th><th>Severity</th></tr>
<tr><td>The values and sensitivities with the potential to be affected by surface hydrocarbon exposure from a surface release due to a vessel collision include:
• commercial, recreational and traditional fisheries including aquaculture (within 560 km from the release location based on 1 g/m^2 visible sheen threshold in worst-case)
• EPBC-listed species (within 140 km from the release location based on 10 g/m^2 impact threshold)
• planktonic communities (within 140 km from the release location based on 10 g/m^2 impact threshold).
As described in Table 8-6, commercial, recreational and traditional fisheries including aquaculture may be impacted by the presence of exclusion zones and the oiling of nets and lines. The potential extent of the visible sheen associated with the vessel collision scenario is significantly less than for a loss of well containment scenario. There are low levels of recreational and traditional fishing activities in the permit areas, and no aquaculture (refer to Section 4.11.3 and 4.11.4). Based on the low level of reported commercial fishing in the permit areas, any socioeconomic impacts are expected to be localised to within 560 km of the release location and temporary in nature given the expected evaporation and rapid dispersion of Group II hydrocarbons at the sea surface. Therefore, the consequence is considered to be Insignificant (F)

There are several marine fauna BIAs located in areas predicted to be exposed to surface expressions above the 10 g/m^2 exposure threshold (within 140 km of the release location). These include a 20 km internesting buffer at Browse Island for green turtles, blue whale foraging/migration located approximately 75 km west of WA-285-P and 40 km west of WA-343-P and the humpback whale migration corridor located 100 km south-east from WA-285-P. A range of other marine fauna may also be present within this area albeit on a transient basis. Impacts to EPBC-listed species are described in Table 8-6. Based on the predicted limited extent of the surface hydrocarbons (within 140 km where concentrations are >10 g/m^2, noting that the spill would not represent a continuous surface expression) and the rapid evaporation of volatile components and expected weathering resulting in reduced levels of toxicity, any impacts to EPBC-listed species are expected to be on a local scale, with short-term impacts on a small portion of the population of a protected species (Minor E).</td><td>Minor (E)</td></tr>
</table>

Plankton may potentially be exposed to hydrocarbons on the sea surface. However, the majority of impacts would be toxicity related, associated with entrained/dissolved hydrocarbons exposure. Therefore, the impact evaluation for plankton is provided in the subsection below.	
Potential consequence – entrained/dissolved hydrocarbons	**Severity**
The values and sensitivities with the potential to be affected by dissolved/entrained hydrocarbon exposures are: • commercial, traditional and recreational fisheries (within 355 km from the release location) • KEFs, fish communities and whale shark BIA (within 355 km from the release location) • planktonic communities (within 355 km from the release location) • benthic communities (within 355 km from the release location) • EPBC-listed species including marine mammals, turtles, marine avifauna BIAs (within 355 km from the release location). Fishing grounds that overlap the permit area may potentially be exposed to entrained/dissolved hydrocarbons above impact thresholds. The impact to fish communities from exposure to entrained and dissolved hydrocarbons above threshold values, is primarily associated with toxicity resulting in impacts to seafood quality as described in Table 8-6. The level of effort in fisheries overlapping the permit areas is reported to be low, however for other fishing activities it is unknown. A surface release of diesel is expected to entrain predominantly within the upper water column (APASA 2015); therefore, exposure is considered to be relatively limited within the water column. Traditional fishing at Browse Island and along the Kimberley and NT coastlines, including on intertidal reef platforms, could be affected by impacts to fish and benthic habitats from dissolved/entrained oil, discussed below. Pelagic fish, and site attached fish on coral reefs, such as Heywood Shoal, Echuca Shoal and Browse Island, have the potential to be exposed to entrained hydrocarbons above the impact threshold (>100 ppb). Only Browse Island was predicted to exceed the dissolved hydrocarbons impact threshold (>50 ppb). Whereas demersal fish communities (such as the continental slope demersal fish community KEF) and fish associated with other KEFs or deeper benthic habitats are less likely to be exposed above impact thresholds in deeper waters. Impacts to fish from entrained/dissolved hydrocarbon exposure are described in Table 8-6. Given the highly mobile nature of pelagic fish, they are not expected to remain within entrained/dissolved hydrocarbon plumes for extended periods, and limited acute impacts or risks associated with the exposure are expected. However, a whale shark foraging BIA is located approximately 5 km from WA-285-P and approximately 10 km from WA-343-P at its closest point. Whale sharks reportedly spend 40% of their time in the upper 15 m of the water column and are therefore likely to be exposed to entrained and dissolved hydrocarbons. Potential effects to whale sharks include damage to the liver and lining of the stomach and intestines, as well as toxic effects on embryos (Lee 2011). As whale sharks are filter feeders they are expected to be highly vulnerable to entrained/dissolved hydrocarbons (Campagna et al. 2011). In the event that a spill from a vessel collision occurred during whale shark foraging activities, there is the potential for a small proportion of the population to be affected; however, as there are no whale shark aggregations (such as the Ningaloo Reef aggregation) and reported low abundance, the overall population viability is not expected to be threatened.	Moderate (D)

Site attached fish, such as reef fish within the EMBA may be exposed above the hydrocarbon exposure thresholds for a more extended duration. Therefore, local to medium scale, with short to medium term impacts could occur to site attached fish and sharks. As such, the consequence of entrained/dissolved hydrocarbons on fisheries (commercial, recreational and traditional), KEFs, fish and shark populations is considered to be Moderate (D). The potential range of impacts of entrained/dissolved hydrocarbon exposure on planktonic communities is described in Table 8-6. In the event of a vessel collision resulting in a diesel spill, impacts on plankton are expected to be highly localised, with short-term impacts, due to the limited exposure (upper water column). However, if a shallow entrained/dissolved plume reached a coral-spawning location, such as Browse Island or Scott Reef, during a spawning event, localised short-to-medium term impacts could occur. Therefore, the consequence is considered to be Minor (E). Impacts to benthic communities from entrained and dissolved hydrocarbon exposure is described in Table 8-6. Browse Island (closest shallow water receptor) is predicted to receive a maximum concentration of 2,207 ppb entrained hydrocarbons and 54 ppb of dissolved aromatic hydrocarbons. Other deep-water filter feeding communities, such as the 125 m ancient coastline KEF, Echuca Shoal and Heywood Shoal are predicted to receive entrained hydrocarbon concentrations of 3,896 ppb, 1,576 ppb and 1,678 ppb respectively. Exposure to dissolved hydrocarbons was predicted to a lesser extent with concentrations of 70 ppb, 44 ppb and 26 ppb for 125 m ancient coastline KEF, Echuca Shoal and Heywood Shoal respectively. Therefore, the potential consequence for coral reefs is considered to be Moderate (D). EPBC-listed species including marine mammals, marine reptiles and marine avifauna could also be impacted through entrained and dissolved hydrocarbon exposure, primarily through ingestion during foraging activities as described in Table 8-6. The EMBA overlaps a large number of BIAs for a number of different marine fauna species (Section 4.9.4). Three Ramsar sites (Ashmore Reef, Eighty Mile Beach and Roebuck Bay) and several nationally important wetlands are also present within the EMBA (refer to Section 4.6), these sites provide important habitat for marine avifauna. Several other marine fauna BIAs are predicted to be exposed to entrained and dissolved hydrocarbons. These include the 20 km internesting buffer at Browse Island for green turtles, blue whale foraging/migration located approximately 75 km west of WA-285-P and 40 km west of WA-343-P and the humpback whale migration corridor located 100 km south-east from WA-285-P. A range of other marine fauna may also be present within this area albeit on a transient basis. Any entrained/dissolved plume would be spatially and temporally limited in extent and as such, impacts to EPBC-listed species are expected to be on a local scale, with short-term impacts on a small portion of the population of a protected species, with the consequence considered to be Minor (E). In summary, the potential extent of entrained/dissolved hydrocarbons with concentrations above impact thresholds may result in localised, short-term exposure to the identified values and sensitivities. There would likely also be cumulative impacts as a result of interactions between surface, entrained/dissolved and shoreline hydrocarbon impacts on the food web and through bioaccumulation up the food chain. On this basis, the potential consequence associated with entrained/dissolved plumes from the identified vessel collision scenarios is considered to be Moderate (D).	
Potential consequence – shoreline hydrocarbons	**Severity**

As summarised in Table 8-8, only Browse Island and Cartier Island were predicted to receive shoreline accumulations, and only Browse Island to exceed the 100 g/m^2 threshold (highest predicted concentration recorded as 127 g/m^2). Times to contact ranged from 5 hours (Browse Island) to 229 hours (Cartier Island) and worst-case volumes predicted to be 50.5 m^3 (Browse Island) and 3.4 m^3 (Cartier Island). The particular values and sensitivities with the potential to be exposed to shoreline hydrocarbons are: • benthic primary producer habitats/shoreline habitats (intertidal only) • EPBC-listed species (BIAs - turtles and avifauna). Given the limited range of predicted locations and expected weathering of any hydrocarbons accumulating on shorelines, any impacts to benthic and shoreline habitats (refer to Table 8-6), from a vessel collision event are expected to be localised and short term with a Minor consequence (E). Impacts to transient EPBC listed species, specifically marine turtles and avifauna (refer to Table 8-6) may include exposure to weathered diesel in excess of impact thresholds (100 g/m^2) only at Browse Island. This may result in a minor and temporary impact on a small portion of the population of a protected species and the consequence assessed as Minor (E).	Minor (E)

Identify existing design safeguards/controls

- Vessels fitted with lights, signals, AIS transponders and navigation equipment as required by the *Navigation Act 2012*.
- PSZ maintained around the MODU in accordance with the OPGGS Act
- Ongoing stakeholder consultation and notifications made to relevant stakeholders as per Section 9.8.3 and Table 9-7.

Propose additional safeguards/control measures (ALARP evaluation)

Hierarchy of control	Control measure	Used?	Justification
Elimination	Eliminate vessels.	No	Vessels are the only form of transport that can undertake the pre-drill site survey and maintain ongoing logistical support to the MODU in a fashion that is practical and cost efficient.

Substitution	Use only Group II (MGO) fuel oils, as opposed to Group IV (IFO 180 / HFO 380) fuel oils.	Yes	Limiting vessel selection to only vessels which use Group II fuel oils may require more detailed planning to avoid delays in sourcing appropriate available vessels. However, in the event of a vessel collision, marine gas oil (MGO) is less persistent than alternative heavier fuels such as heavy fuel oil (HFO) and intermediate fuel oil (IFO). Therefore, this control has been adopted.
Engineering	Drilling support vessels used will have dynamic positioning equipment.	Yes	The use of DP vessels to support the MODU and drilling activities will reduce the potential for vessel collisions. Supply vessels will also be equipped with a backup DP system as a failsafe (DP2 or greater).
	Pre-drill site survey vessel will have dynamic positioning equipment.	No	The survey vessel may not have DP capability; however, as the survey will be undertaken by a single vessel and will occur several months before the MODU arrives there is no credible vessel collision scenario within the permit areas.
Procedures and administration	Implement INPEX Browse Regional OPEP.	Yes	The INPEX Browse Regional OPEP defines the processes that will be used to maintain oil spill preparedness and implement effective response measures, in the event of a spill. For this EP, an assessment of the vessel collision WCSS against the Browse Regional OPEP Basis of Design has been conducted, as is required under BROPEP BOD/FCA, Figure 8-1 – management of change process. The vessel collision WCSS from this EP have been compared against the Browse Regional OPEP BOD response planning thresholds, (BROPEP BOD/FCA Table 4-5). The vessel collision data presented in Table 8-8 of this EP, are lower than the response planning thresholds, as presented in the BROPEP BOD/FCA Table 4-5. Therefore, the vessel collision WCSS assessed under this EP is less than the vessel collision WCSS defined in the Browse Regional OPEP BOD. As such, no revision to the spill preparedness/response arrangements defined in the Browse Regional OPEP are required.

	All vessels will use marine diesel and carry less than 250 m^3 of fuel in any single tank.	Yes	To ensure the impact and risk evaluation for a vessel collision spill remains relevant during the drilling campaign, vessels to be used during the activity will be limited to marine diesel fuel and have less than 250 m^3 of fuel in any single fuel tank.

Identify the likelihood	
Likelihood	Reported industry statistics indicate vessel failures are considered rare with 37 collisions reported out of a total of 1,200 marine incidents in Australian waters between 2005 and 2012 (most recent data) (ATSB 2013). A ship collision risk assessment was undertaken to support the INPEX Ichthys Project. The study determined collision frequencies and impact energies for passing (third-party) vessels, infield vessels and offloading tankers. The annual frequency of a collision with a passing vessel – i.e. one not within the control of INPEX – imparting at least 150 megajoules (sufficient impact energy) is 3.5×10^{-7}, or once every 2.9 million years. On this basis and given the controls that have been identified to minimise the potential for vessel collision and subsequent loss of containment, the likelihood of the consequence occurring is considered Highly Unlikely (5). If concurrent drilling operations were to occur during the activity, including the ongoing Ichthys drilling campaign in nearby WA-50-L, an increase in vessel traffic could be expected. However, given the distance (tens of km) between any concurrently operating MODUs and the controls in place the likelihood of the consequence occurring is considered to be Highly Unlikely (5).
Residual risk	Based on the worst-case consequence for all applicable hydrocarbon exposure mechanisms (surface, entrained and dissolved) Moderate (D) and a likelihood of Highly Unlikely (5) the residual risk is ranked as Moderate (8).

Residual risk summary		
Consequence	Likelihood	Residual risk
Moderate (D)	Highly Unlikely (5)	Moderate (8)

Assess residual risk acceptability
Legislative requirements The activities and proposed management measures are compliant with industry standards and with relevant Australian legislation, specifically concerning navigational safety requirements, including AMSA Marine Orders – Part 30: Prevention of Collisions, Issue 8 (Order No. 5 of 2009).

Stakeholder consultation

Stakeholders have been engaged throughout the development of the EP and the INPEX Browse Regional OPEP. Where relevant, the controls in place have been developed in consultation with relevant stakeholders (e.g. WA DoT and AMSA). The controls in place are considered to manage risks associated with a vessel collision to ALARP. During stakeholder consultation AMSA requested that all relevant notifications be adopted as controls in this EP and therefore, these requirements have been adopted. AMSA also identified that lighting of vessels should be consistent with the requirements of the COLREGS requirements. All vessels are required to comply with the *Navigation Act 2012*, and associated Marine Orders, which are consistent with the COLREGS requirements.

Conservation management plans / threat abatement plans

Several conservation management plans (refer Appendix A) identify oil spills as a key threatening process, through both direct/acute impacts of oil, as well as indirect impacts through habitat degradation (which is a potential consequence of an oil spill). The prevention of vessel collisions and reducing impacts to the marine environment through oil spill response preparedness and response (refer INPEX *Browse Regional OPEP*), demonstrates alignment with the various conservation management plans.

ALARP summary

Given the level of environmental risk is assessed as Moderate, a detailed ALARP evaluation was undertaken to determine what additional control measures could be implemented to reduce the level of impacts and risks. No additional controls, beyond those identified during the detailed ALARP assessment can reasonably be implemented to further reduce the risk of impact.

Acceptability summary

Based on the above assessment, the proposed controls are expected to effectively reduce the risk of impacts to acceptable levels because:

- the activity demonstrates compliance with legislative requirements/industry standards
- the activity takes into account stakeholder feedback
- the activity is managed in a manner that is consistent with the intent of conservation management documents
- the activity does not compromise the relevant principles of ESD
- the predicted level of impact does not exceed the defined acceptable level in that the environmental risk has been assessed as "low", the consequence does not exceed "C – Significant" and the risk has been reduced to ALARP.

Environmental performance outcomes	Environmental performance standards	Measurement criteria
No incidents of loss of hydrocarbons to the marine environment as a result of a vessel collision.	MODU/vessels will be fitted with lights, signals, AIS transponders and navigation and communications equipment, as required by the *Navigation Act 2012.*	Records confirm that required navigation equipment is fitted to MODU/vessels to ensure compliance with the *Navigation Act 2012.*
	A 500 m PSZ, issued by NOPSEMA, will be maintained around the MODU.	Gazette notice of PSZ. Records of reporting of unauthorised entry into the PSZ.
	Only vessels using Group II/MGO/marine diesel will undertake activities described in this EP.	Vessel selection records.
	Drilling support vessels used will have dynamic positioning equipment and have a backup DP system as a failsafe.	Records confirm that vessel have DP equipment and fail-safe system in place.
	All vessels will utilise only marine diesel fuel and the maximum volume of fuel contained in any tank will not exceed 250 m^3.	Oil record books.
Refer to the INPEX *Browse Regional OPEP* for environmental performance outcomes, standards and measurement criteria related to mitigative controls.		

8.4 Oil spill response and capability

INPEX has developed a regional OPEP for the Browse region which applies to the activity described in this EP. The INPEX Browse Regional OPEP (BROPEP) consists of a suite of documents as shown in Figure 8-4 and described in Table 8-10. The INPEX Browse Regional OPEP covers all INPEX Australia's exploration and production activities in the Browse region.

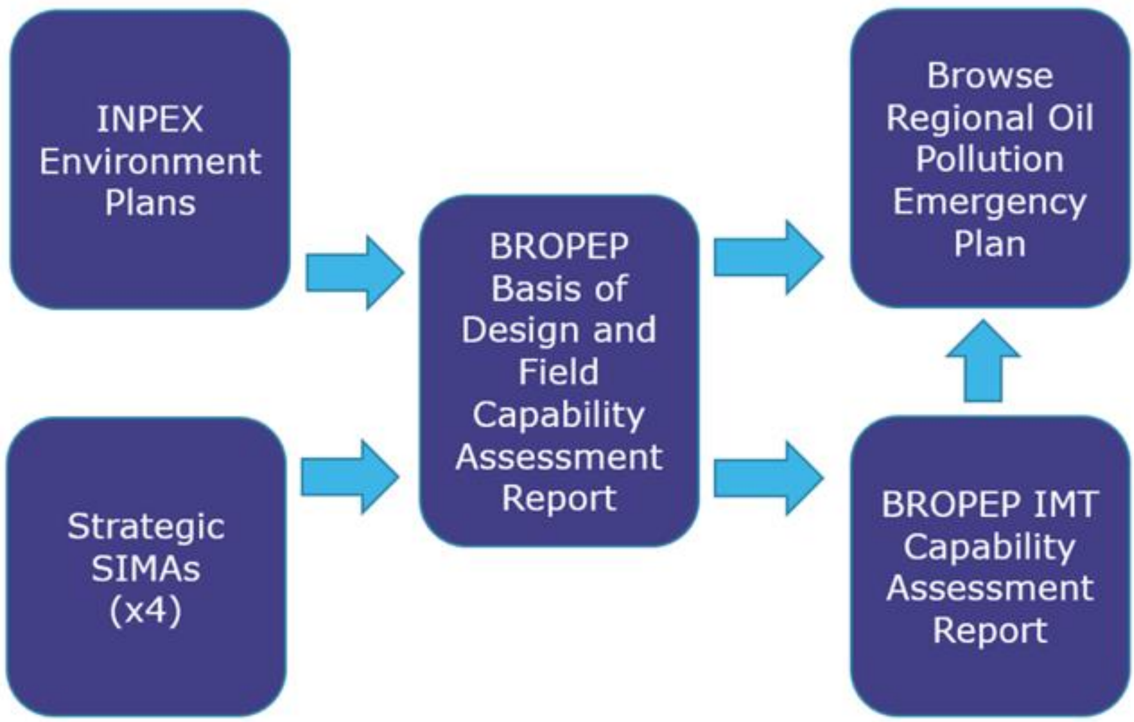


Figure 8-4: Browse regional OPEP document structure

Table 8-10: Browse regional OPEP documentation overview

Document title	Document number	Purpose
INPEX Environment Plans	N/A	All INPEX EPs contain a detailed activity description and activity-specific oil spill scenarios. Specifically, INPEX EPs include the following: • a description of the activity-specific spill scenarios (including the potential release rates, volumes, locations, hydrocarbon types, etc.) • activity-specific oil spill modelling (used to inform environmental risk assessments) • an assessment of oil spills risks/impacts on environmental values and sensitivities

Document title	Document number	Purpose
		• evaluations of controls to prevent oil pollution from the specific activity. The WCSS from all INPEX EPs are included in the INPEX Australia - Browse Regional Oil Pollution Emergency Plan - Basis of Design and Field Capability Assessment.
Strategic Spill Impact Mitigation Assessments (SIMAs): Condensate spill – instantaneous surface release Marine gas oil/diesel spill – instantaneous surface release Intermediate fuel oil/heavy fuel oil (HFO) spill – instantaneous surface release Condensate/gas well or pipeline blowout – long duration subsea release.	X060-AH-LIS-60031 X060-AH-LIS-60032 X060-AH-LIS-60033 X060-AH-LIS-60034	The four INPEX Strategic SIMA documents are pre-spill planning tools. These are used to facilitate response option selection by identifying and comparing the potential effectiveness and impacts of the various oil spill response strategies on a range of environmental values and sensitivities. The Strategic SIMAs utilise a semi-quantitative process to evaluate the impact mitigation potential of each response strategy. This method provides a transparent decision-making process for determining which response strategies are most likely to be effective at minimising oil spill impacts. The SIMA process includes environmental considerations as well as a range of shared values such as ecological, socio-economic and cultural aspects.
INPEX Australia - Browse Regional Oil Pollution Emergency Plan - Basis of Design and Field Capability Assessment (BROPEP BOD/FCA)	X060-AH-REP-70016	The BROPEP BOD/FCA presents an overview of all of INPEX Australia's offshore petroleum exploration and production activities and associated oil spill risks. It includes an evaluation of modelling outcomes from a series of selected WCSSs and presents an oil spill response field capability analysis. The BROPEP BOD/FCA includes the EPOs and EPSs relevant to the preparedness and environmental risk assessment of field response capability and arrangements and the broader BROPEP implementation strategy (i.e. reviews, management of change process, etc.).
INPEX Australia - Browse Regional Oil Pollution Emergency Plan – Incident Management Team Capability Assessment (BROPEP IMTCA)	X060-AH-REP-70015	The BROPEP IMTCA utilises the field capability assessments as inputs to evaluate the size and structure of the INPEX IMT necessary to mobilise and maintain the field capability. The BROPEP IMTCA outlines the EPOs and EPSs relevant to INPEX incident management team (IMT) capability and arrangements.

Document title	Document number	Purpose
INPEX Australia - Browse Regional Oil Pollution Emergency Plan (BROPEP)	X060-AH-PLN-70009	The BROPEP is the tool which will be utilised by the INPEX IMT during any impending/actual oil spill event. This document assists/guides the IMT through the process of notifications, gaining/maintaining situational awareness, response strategy evaluation and incident action plan development, and mobilisation of field response capabilities. The BROPEP outlines the EPOs and EPSs related to the implementation of response strategies.

An assessment of the WCSS defined in this EP has been conducted against the Browse Regional OPEP BOD, within the ALARP evaluations of the WCSS. Refer to Table 8-6 and Table 8-9.

The outcome of this assessment was that no change is required to the spill preparedness/response arrangements defined in the Browse Regional OPEP for the petroleum activity covered under this EP.

8.5 Source control capability and arrangements

Source control capability and arrangements required to conduct a successful well-kill for exploration and production wells in the Browse Basin is detailed in INPEX's Source Control Capability and Arrangements Report (D021-AH-REP-70000). This document also provides the environmental ALARP and acceptability statements and implementation strategy, to ensure the ongoing demonstration of source control capability and arrangements.

An overview of source control documentation is provided in Table 8-11 and the purpose of the Source Control Capability and Arrangements Report is to:

- Present a summary of INPEX Australia's exploration and production drilling, and operations activities in the Browse Basin.
- Present a summary of the worst credible well blowout scenarios (WCWBS) which could occur from exploration/production drilling activities and from the operation of production wells.
- Provide a detailed source control capability analysis, for the selected WCWBS.
- Define EPOs and EPSs for the source control capabilities and arrangements (preparedness), and the risk assessment of the implementation of the source control capability.
- Provide an implementation strategy for this source control arrangements and risk assessment report, including management of change processes and compliance reporting requirements.
- Ensure INPEX's description of source control capability and arrangements as related to EPs is appropriately described, in accordance with the requirements of Section 3.1 of the NOPSEMA *Source control planning and procedures* Information Paper (NOPSEMA 2021b).

Table 8-11: Source control documentation overview

Document title	Document number	Purpose
INPEX Environment Plans	N/A	All INPEX EPs contain a detailed activity description and activity-specific oil spill scenarios. Specifically, INPEX EPs include the following: • a description of the activity-specific spill scenarios (including the potential well blowout release rates, volumes, locations, hydrocarbon types, etc.) • activity-specific oil spill modelling (used to inform environmental risk assessments) • an assessment of oil spills risks/impacts on environmental values and sensitivities • evaluations of controls to prevent well blowouts.
Well Operations Management Plan	N/A	The WOMP describes the well activities and associated management systems for the exploration wells within the permit areas.
INPEX Blowout Contingency Plan (BOCP)	D020-AD-PLN-10040	The purpose of the BOCP is to provide a plan for regaining control of a blowout, not blowout prevention. The BOCP specifies how INPEX will respond to a well control event where primary well control has been lost with potential, or real, complications with secondary well control, extending to the worst case scenario of an uncontrolled blowout with significant hydrocarbon release to the environment and loss of assets.
Source Control Emergency Response Plan (SCERP)	D020-AD-PRC-10036	The SCERP is designed as a subset of the BOCP, to support response preparations to well control emergencies and establish a process for responding to safely managing them using a standard uniform approach. It includes the equipment and procedures to address a range of well control scenarios necessitating immediate mobilisation of intervention equipment and personnel.
INPEX Australia - Browse Regional Oil Pollution Emergency Plan (BROPEP) suite of documents, including: • BROPEP BOD & FCA • BROPEP IMTCA • BROPEP	X060-AH-REP-70016 X060-AH-REP-70015 X060-AH-PLN-70009	The BROPEP BOD & FCA report evaluates the oil spill field response capability required for all INPEX Australia's offshore petroleum exploration and production activities and associated oil spill risks. The BROPEP IMTCA report defines the required IMT capability needed to implement the field oil spill response. The BROPEP is the response document, used by the IMT, to activate and implement oil spill response capabilities during a spill scenario.

9 ENVIRONMENTAL MANAGEMENT IMPLEMENTATION STRATEGY

This section provides a description of the INPEX Australia BMS which captures the HSE requirements to manage HSE risks and meet legislative and corporate obligations, as applicable to the implementation of this EP and its associated performance outcomes and standards.

9.1 Overview

The BMS is a comprehensive, integrated system that includes standards and procedures necessary for the management of HSE risks. Activities to manage HSE risks are planned, implemented, verified and reviewed under an iterative "plan, do, check, act" (PDCA) cycle. The PDCA cycle enables INPEX to ensure that processes are adequately resourced and managed and that opportunities for improvement are determined and acted on.

INPEX HSE requirements are designed to meet the in-principle expectation of several standards, international management frameworks, guidelines and legislation. Of particular relevance to this EP includes the following:

- Commonwealth of Australia, Offshore Petroleum and Greenhouse Gas Storage (E) Regulations 2009
- NOPSEMA Guidance note N04750-N1344, Environment plan content requirements
- International Association of Oil and Gas Producers (IOGP) 510 Operating Management System Framework for controlling risk and delivering high performance in the oil and gas industry
- IOGP 511 Operating Management System in practice
- International Standards Organisation (ISO) 9001 Quality Management Systems
- ISO 14001 Environmental Management Systems.

The components of the BMS relevant to HSE are grouped into 13 external elements (Figure 9-1). These elements must be managed and implemented properly in order to achieve the desired HSE performance and reflect a PDCA cycle, which is applied to every aspect of the 13 elements.

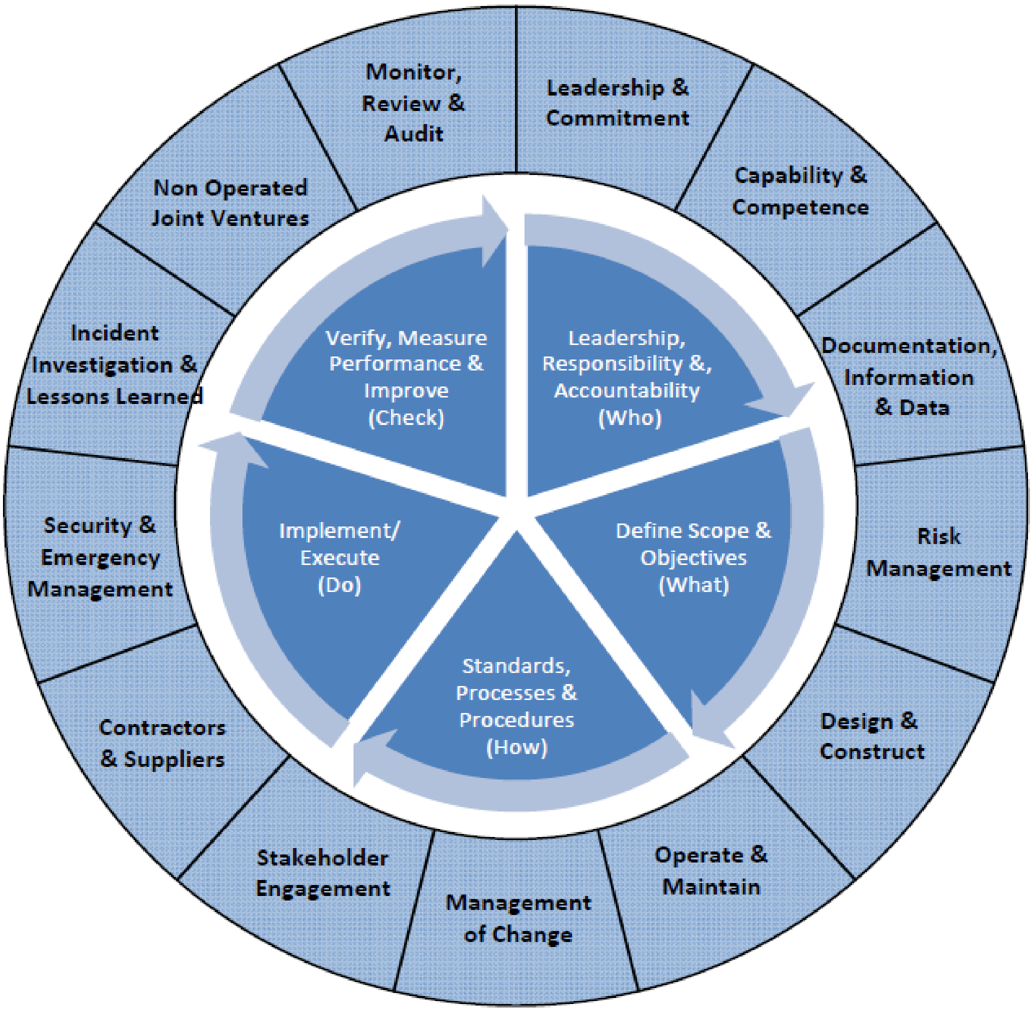


Figure 9-1: INPEX BMS: HSE requirements

9.2 Leadership and commitment

INPEX environmental performance is achieved through strong visible leadership, commitment and accountability at all levels of the organisation. Leadership includes defining performance targets and providing structures and resources to meet them. Achieving high levels of HSE performance is defined within the highest levels of management system documents (policies) and is cascaded through subsidiary documents.

The INPEX Environmental Policy (as amended from time to time) (Figure 9-2) solidifies this commitment and states the minimum expectations for environmental performance. The policy applies to all INPEX controlled activities in Australia. All personnel, including contractors, are required to comply with the policy.

The policy (as amended) is available on the INPEX intranet and displayed at all INPEX workplaces including the MODU and all contractor vessels in the permit areas. It is communicated to personnel involved in the activities, including contractors, through inductions.

INPEX

Environmental Policy

Objective

INPEX is a worldwide oil and gas exploration, development and production company committed to conducting each of its activities in a manner that is environmentally responsible.

Our objective is to develop an environment culture that is recognised as amongst "best in industry" that will exceed the performance expectations of our stakeholders.

We recognise our responsibility to adhere to the principles of sustainable development and we acknowledge that we owe a duty of care to both the natural environment and the communities in which we operate.

Strategy

To accomplish this, INPEX will:

- comply with applicable laws and regulations, environmental plans and commitments and apply appropriate INPEX standards
- maintain a culture where people are empowered to intervene to prevent environmental harm
- set, measure and review environmental performance objectives and targets and ensure appropriate management of change processes are followed
- ensure our personnel have the necessary awareness, training, knowledge, resources and support, to meet environmental objectives and targets
- identify, manage and review environmental hazards and risks associated with our current and future business activities and manage these to levels that are 'as low as reasonably practicable' (ALARP)
- implement, maintain and regularly test control measures associated with major environmental events
- maintain and regularly test emergency management processes and procedures, including with industry and government emergency response partners
- engage with and communicate openly on environmental issues with internal and external stakeholders
- provide clearly defined environmental performance expectations for our contractors and suppliers, and work collaboratively with them to attain these
- endeavour to prevent pollution and seek continual improvement with respect to emissions, discharges, wastes, energy efficiency and resource consumption
- actively promote the reduction of greenhouse gas emissions across our operations in a safe, technically and commercially viable manner
- endeavour to protect biodiversity and to contribute to increased understanding of our natural environment
- drive continual improvement in environmental performance through monitoring, auditing and reviews.

Application

This policy applies to all INPEX controlled activities in Australia and related project locations. It will be displayed at all company workplaces and on the company's intranet and it will be reviewed regularly.

Hitoshi Okawa
President Director, Australia

Rev: 3
April 2019

Figure 9-2: INPEX environmental policy

9.3 Capability and competence

INPEX appoints and maintains competent personnel to manage environmental risks and provide assurance that the INPEX Environmental Policy, objectives and performance expectations will be achieved. This applies to individual competencies established in position descriptions and competency plans that set expectations, track progress and monitor results. It also applies to the overall capability of the organisation through well-defined organisational structures and provision of resources.

9.3.1 Organisation

Figure 9-3 and Figure 9-4 illustrate the organisational structure for onshore and offshore roles for both the pre-drill site survey and the exploration drilling activity respectively. During the pre-drill site survey, the drilling superintendent will ensure the implementation of this EP with support from the survey manager and offshore resources, namely the vessel master and party chief.

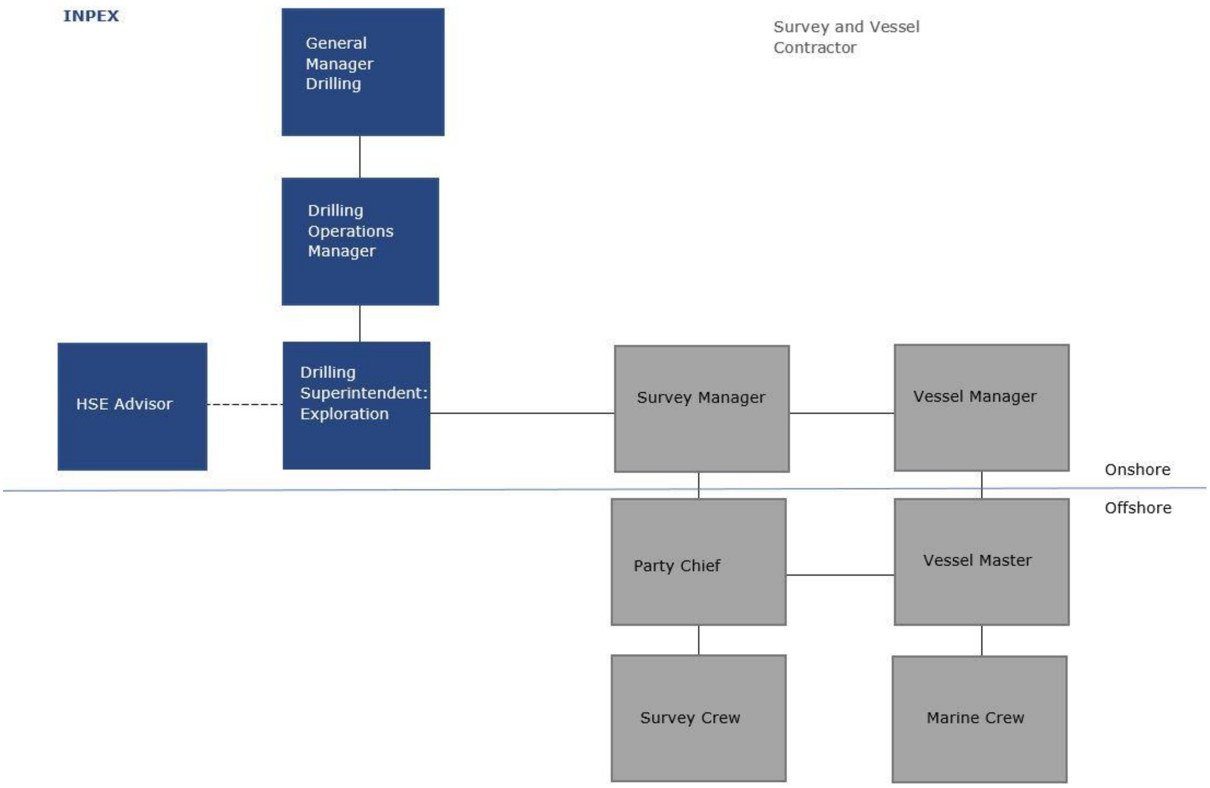


Figure 9-3: Pre-drill site survey organisational structure

Work activities for the exploration drilling will be conducted by the drilling contractor and service contractors, under the direction of the INPEX drilling supervisor via written work instructions and work programs.

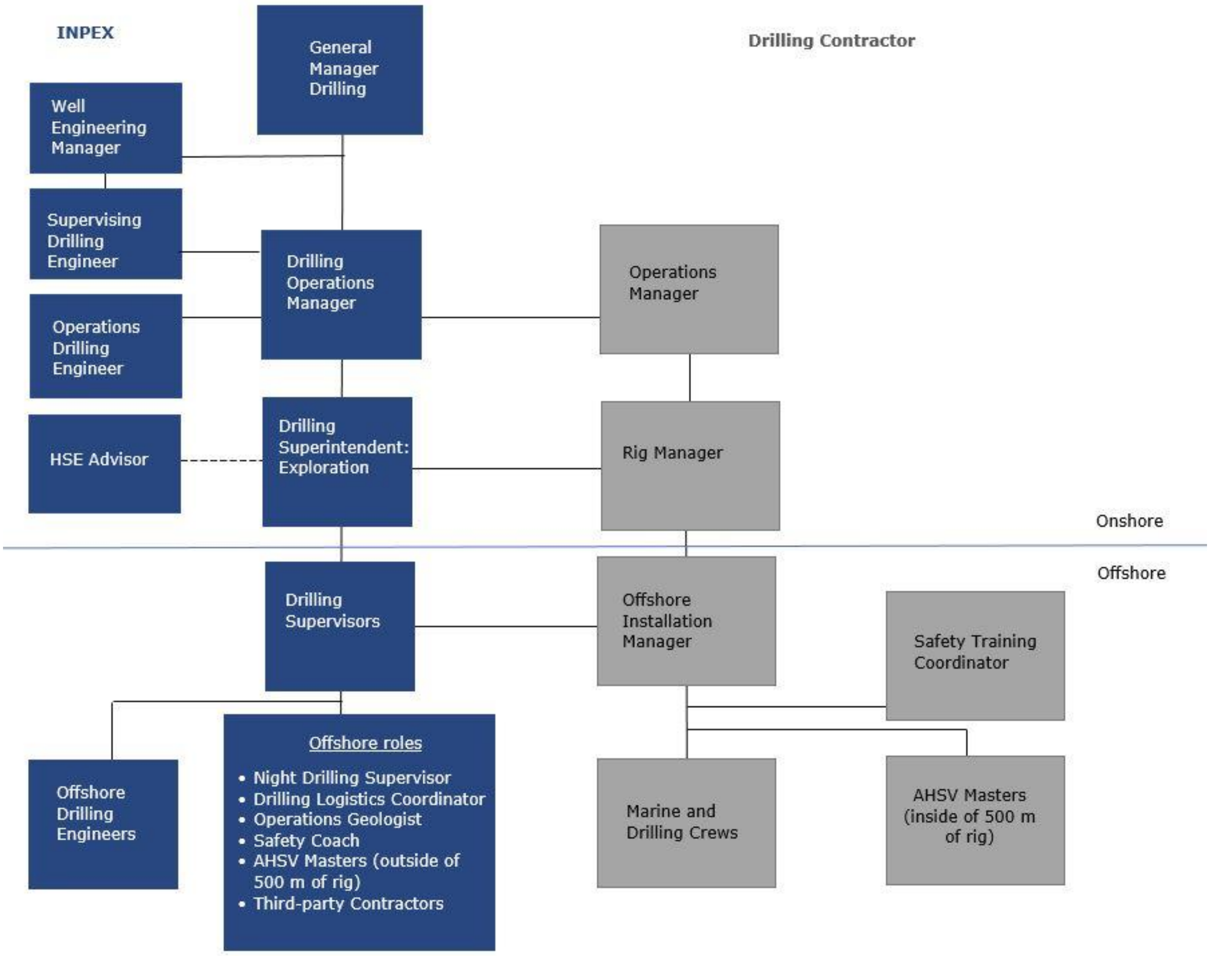


Figure 9-4: Exploration drilling organisational structure

9.3.2 Roles and responsibilities

INPEX 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. The selection process for the key INPEX personnel identified in Table 9-1 includes consideration of their previous work experience and recognised qualifications when compared with the INPEX minimum competency standards. Key personnel are provided with a position description to formalise their role and define their responsibilities.

The key roles in Table 9-1 are responsible for collecting and maintaining the required evidence and monitoring data as specified in the environmental performance standards detailed in sections 7, 8 and 9 of this EP. Additional roles and responsibilities related to the implementation of HSE requirements are also listed in Table 9-1.

Prior to mobilisation of site survey and drilling personnel (MODU and vessel), those in key roles (Table 9-1) will be informed of their respective responsibilities in relation to this EP. This information will be disseminated by INPEX (e.g. through workshops, one-on-one sessions or by email) to ensure EP/INPEX *Browse Regional OPEP* awareness and that appropriate competencies and training requirements are met.

INPEX conducts training-needs analysis for each of the key roles listed in Table 9-1 to define minimum training requirements. The analysis is used to develop training plans which document, schedule and record completion of specific HSE training for individuals.

Table 9-1: Key personnel and support roles and responsibilities

Key role	Responsibilities
INPEX General Manager Drilling (Onshore)	Ensures overall compliance with the INPEX BMS HSE requirements including environmental performance outcomes and standards.
INPEX Drilling Operations Manager (Onshore)	Ensures relevant INPEX BMS HSE requirements, including environmental performance outcomes and standards are communicated to drilling contractors. Ensures the INPEX Drilling Superintendent: Exploration is provided with the resources required to ensure environmental performance outcomes and standards are met and maintained.
INPEX Drilling Superintendent: Exploration (Onshore)	Ensures activities are undertaken in accordance with this EP. Ensures any changes to the activity that may affect the performance outcomes and environmental management procedures detailed in this EP are communicated to the INPEX HSE team. Ensures vessel masters are provided with the resources required to ensure that the commitments in this EP are undertaken. Ensures the INPEX drilling supervisor is provided with the resources required to ensure that the commitments in this EP are undertaken. Ensures reporting of environmental incidents meets external reporting requirements and INPEX incident reporting requirements. Ensures corrective actions raised from environmental audits are tracked and closed out.
INPEX Drilling Supervisor (Offshore)	Ensures contractors perform operations in a manner consistent with the performance outcomes and environmental management procedures detailed in this EP. Ensures the implementation of the INPEX Environment Policy, through application of this EP. Ensures the offshore installation manager (OIM), vessels masters and all crews adhere to the requirements of this EP. Ensures that the INPEX drilling superintendent is alerted to any changes in activities that could have a negative impact on environmental performance. Reports incidents to the INPEX Drilling Superintendent: Exploration.
INPEX HSE Adviser/ Environmental Adviser (Onshore)	Ensures that environmental audits are undertaken. Ensures that waste management and containment equipment audits are undertaken. Ensures that the OIM and vessels masters have been provided copies of personnel responsibilities as set out in this EP. Ensures that any changes to the petroleum activity that may affect EP mitigation and management measures are captured via the management of change process.

Key role	Responsibilities
Offshore Installation Manager (Offshore)	Ensures the MODU management system and procedures are implemented. Ensures personnel starting work on the MODU receive an HSE induction that meets the requirements specified in this EP. Ensures personnel are competent to undertake the work they have been assigned. Ensures emergency drills are conducted as per the MODU's schedule. Ensures the MODU's emergency response team has been given sufficient training to implement the MODU's SOPEP/SMPEP. Ensures any environmental incidents or breaches of performance outcomes, standards or criteria, are reported immediately to the INPEX Drilling Supervisor.
Vessel masters (Offshore)	Conduct vessel operations in accordance with this EP. Implement the vessel's SOPEP/SMPEP in an emergency. Implements relevant performance standards stated within this EP. Ensure that environmental incidents or breaches of performance outcomes, standards or criteria on vessels, are reported.
Support role	**Responsibilities**
All crew (Offshore)	Work in accordance with accepted MODU and vessel HSE systems and procedures. Comply with EP requirements as applicable to assigned role. Report any hazardous condition, near miss, unsafe act, accident or environmental incident immediately to supervisors. Attend HSE meetings and training when required.

9.3.3 Training and inductions

Inductions are conducted for all personnel (including INPEX representatives, contractors, subcontractors and visitors) before they start work at any of the MODUs/vessels described in this EP. Inductions cover the HSE requirements under the INPEX BMS, including information about the commitments contained in this EP. A summary of the inductions and training programs in place to ensure relevant personnel are aware of their responsibilities is presented in Table 9-2.

In addition, environmental awareness is communicated to all personnel through a number of different mechanisms including environmental alerts, environmental bulletin posts on INPEX intranet site and posters displayed at work locations.

Table 9-2: Induction and training course summary

Induction/training course	Target audience	EP relevant content
INPEX Australia HSE Induction	All new INPEX Australia employees	Overview of INPEX Environment Policy, OPGGS (E) Regulations and requirement to adhere to EP commitments.

Induction/training course	Target audience	EP relevant content
Drilling campaign induction (online or face to face)	All campaign personnel (survey and drilling activities)	Overview of the exploration drilling campaign EP including: • environmental values and sensitivities • environmental aspects/risk from offshore activities • controls to manage emissions, discharges and wastes • reporting requirements.
INPEX Australia Browse Basin Environment Plans Support Vessels Induction	All personnel working onboard support vessel for exploration drilling activities.	Overview of the management controls for emissions, discharges and wastes from support vessels (which are consistent throughout INPEX EPs) including: • environmental values and sensitivities • environmental aspects/risk from offshore activities • controls to manage emissions, discharges and wastes • reporting requirements.
INPEX Australia Browse Regional Oil Pollution Emergency Plans Induction	OIM, vessel masters and any other relevant crew.	Overview of the Browse Regional OPEP requirements related to support vessels (which are consistent throughout INPEX EPs).
INPEX Australia Support Vessels Marine Fauna Awareness Training	All vessel bridge personnel.	Overview of the marine fauna management requirements (which are consistent with this EP).

Table 9-3: Environmental performance outcome, standard and measurement criteria for induction and training

Environmental performance outcome	Environmental performance standard	Measurement criteria
INPEX personnel including staff, contractors and visitors are aware of their responsibilities under this EP.	The training and awareness material described in Table 9-2 is delivered.	Records that inductions, training and awareness material has been provided.

9.4 Documentation, information and data

INPEX implements and maintains document and records management procedures and systems. These are in place to ensure that the information required to support safe and reliable drilling operations, is current, reliable and available to those who need it. It also ensures that organisational knowledge and learning is captured and preserved to enable the effective operations of processes to maintain compliant management of HSE information.

Documents and records are stored electronically in INPEX document management systems and databases. This EP and associated documentation are maintained within a database, with current versions also available via the controlled document repository.

Records to demonstrate implementation of the INPEX BMS HSE requirements and compliance with legislative requirements and other obligations are identified and maintained for at least five years. These records include:

- written reports – including risk assessment reports, hazard and risk registers, monitoring reports, ALARP demonstrations and audit and review reports– about environmental performance or implementation strategies
- records relating to environmental performance or the implementation strategies
- records of environmental emissions and discharges
- management of change records
- incident and/or near miss investigation reports
- lessons learned records
- improvement plans (corrective actions, key performance indicators)
- records relating to training and competency in accordance with this EP.

9.5 Risk management

A robust, structured process is applied by INPEX to identify hazards and ensure that HSE risks arising from assets and operations are systematically identified, assessed, evaluated and controlled to levels as low as reasonably practicable.

The risks and impacts associated with the petroleum activity are detailed in Section 7 and Section 8. Additional risk assessments will be undertaken on an ongoing basis when triggered by any of the following circumstances:

- when there is a proposed change to the activity, as identified by an INPEX MoC request
- when identified as necessary following the investigation of an event
- when additional information about environmental impacts or risks becomes available (e.g. through better knowledge of the receptors present within the EMBA, new scientific information/papers, results of monitoring, other industry events or studies)
- if there is a change in regulations, as necessary
- during scheduled reviews of the documentation associated with this EP.

The risk assessments will be carried out in line with the assessment process described in Section 6 and are aligned to the HSE requirements of the INPEX BMS. This ensures that risks related to the activity are systematically identified, assessed, evaluated and controlled.

An environmental risk register for the activity is reviewed on a quarterly basis. The review includes assessment of any new information and other changes that have been recorded throughout the previous quarter. Where this review results in a change, the changes are documented and communicated.

9.6 Operate and maintain

9.6.1 Chemical assessment and approval

Chemicals discharged during the drilling campaign will be selected to meet both technical and environmental criteria. The environmental criteria are specified in the INPEX Chemical Assessment and Approval Guideline as summarised below:

- The chemical product is listed in the OSPAR list of substances/preparations used and discharged offshore which are considered to PLONOR. This list is based on assessment of the intrinsic properties of a chemical product and in order for a product to be included on the list the OSPAR Commission must consider that it poses little or no risk to the environment.
- The chemical product is GOLD or SILVER-rated under the OCNS CHARM model. The CHARM model calculates the ratio of predicted environmental concentration against no effect concentration. This is expressed as a HQ, which is then used to rank the product.
- The chemical product (if not CHARM-rated, e.g. inorganics, hydraulic fluids or pipeline chemicals) has an OCNS group rating of D or E. Non-CHARM products with a D or E grouping are either readily or inherently biodegradable.
- The chemical product (if not OCNS registered) is assessed as 'green' via the INPEX pseudo ranking system in line with the OCNS CHARM/ non-CHARM criteria (refer Table 9-4).

The assessment process requires that chemical products requested for use on INPEX sites or facilities which would be released to the marine environment under normal operating conditions shall be reviewed by an INPEX environmental adviser.

The INPEX pseudo ranking system, designed for those chemicals that are not OCNS registered, is a chemical assessment tool used to determine a chemical's inherent environmental hazard potential. This is determined by considering toxicity in conjunction with bioaccumulation and biodegradation potentials in line with the OCNS CHARM/non-CHARM criteria. Chemicals falling within the 'green' range are considered to present a low inherent hazard potential as shown in Table 9-4.

Table 9-4: INPEX chemical assessment tool

		Bioaccumulation					
		LogP$_{ow}$[1] <3 or BCF[2] ≤100 and with a molecular weight ≥700			LogP$_{ow}$[1] ≥3 or BCF[2] >100 and with a molecular weight <700		
Toxicity (ppm)		Biodegradation (in 28 days)					
Aquatic	Sediment	≥60%	≥20% to <60%	<20%	≥60%	≥20% to <60%	<20%
<1	<10						
1≤ to <10	10≤ to <100						
10≤ to <100	100≤ to <1000						
100≤ to <1000	1000≤ to <10000						
≥1000	≥10000						

Cells highlighted in green represent chemical characteristics associated with low environmental hazard levels.

1 Octanol–water partition coefficient.

2 Bioconcentration factor.

In addition, the assessment process is to consider whether the product, regardless of the ranking, carries with it an OCNS substitution warning. Triggering this would require a further risk assessment of the product in accordance with the INPEX risk management process, which includes consideration of the *INPEX Risk Management Standard* (0000-A0-STD-60020).

Those chemical products considered as having a moderate or above residual risk will be assessed as unsuitable for use and will not be processed for approval and use during the drilling activity. Successful chemical requests will proceed to the approval stage, conducted within the chemical product database where all relevant records are maintained.

An EPO and EPS related to the implementation of the chemical assessment procedure is presented in Table 9-5.

Table 9-5: Environmental performance outcome, standards and measurement criteria for implementation of chemical assessment and approval procedure

Environmental performance outcome	Environmental performance standard	Measurement criteria
No discharge of unapproved chemicals.	All chemicals assessed in accordance with the procedure.	Chemical assessments recorded and retained in a database.

9.6.2 Biofouling risk assessment for domestic movements

The biofouling risk assessment process for domestic vessel movements includes aspects of the vessels history with respect to IMS risk e.g. vessels origin from within Australian waters and previous locations of operation (including whether these Australian locations have reported IMS occurrences), periods out-of-water and inspections/cleaning undertaken, age of anti-fouling coatings, presence and condition of internal treatment systems etc.

While undertaking the INPEX biofouling risk assessment for domestic movements (Figure 9-5), in any instances where potential risks are identified e.g. no anti-fouling coating or extended stays in Port, the process requires INPEX to engage an independent IMS expert and if required a further risk assessment may be undertaken.

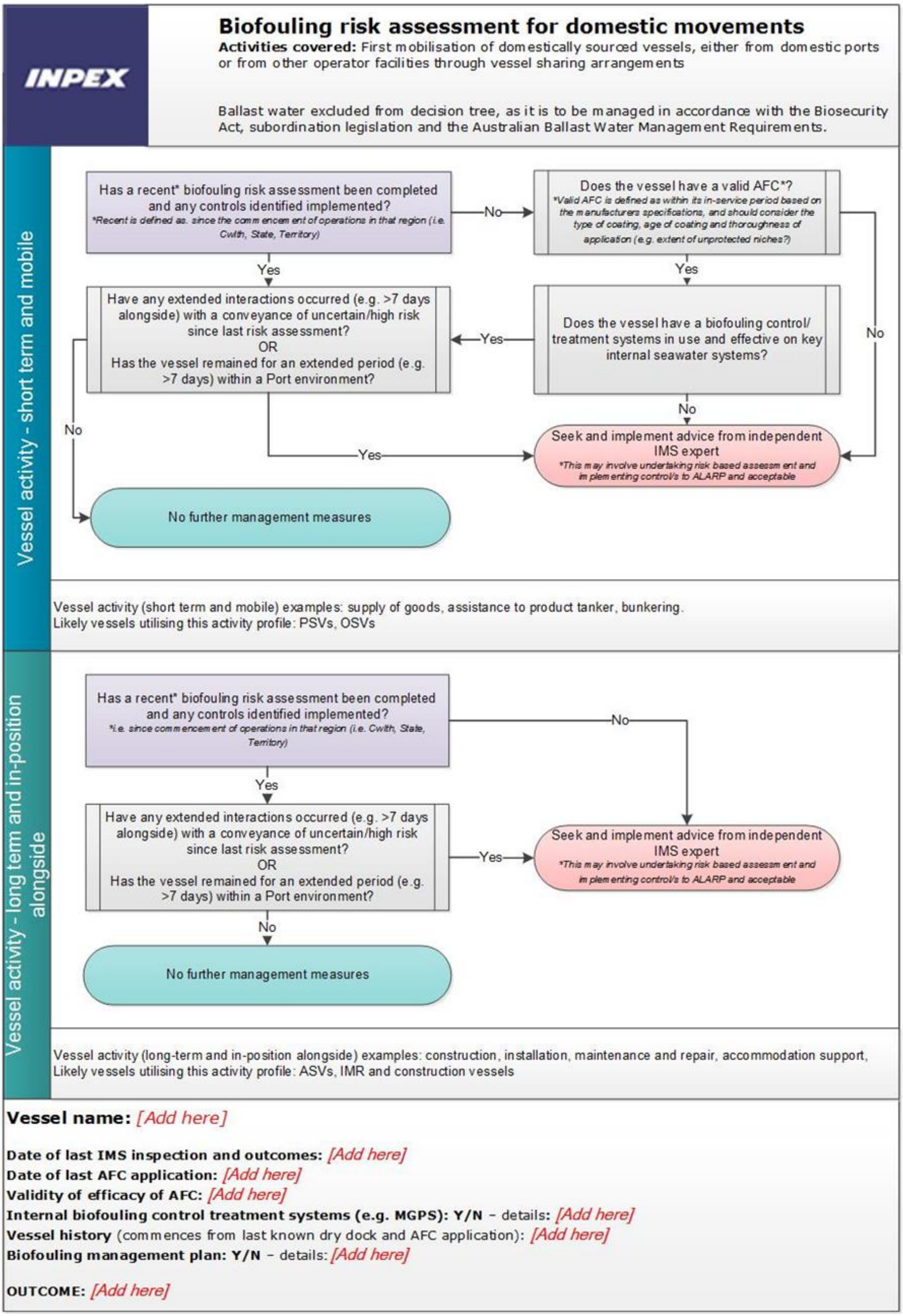


Figure 9-5: INPEX biofouling risk assessment for domestic movements

9.7 Management of change

Changes to this EP will be managed in accordance with the INPEX Australia Management of Change Standard, and related procedures and guidelines. Where a change to management of an activity is proposed, it will be logged. Internal notification will be communicated via a MoC request. The request will identify the proposed change(s) along with the underlying reasons and highlight potential areas of risk or impact. In accordance with the INPEX business rules, it is mandatory to undertake an environmental risk assessment in every case for changes that could affect the environment. The MoC request will be managed by an environmental adviser who will then determine the necessary approval/endorsement pathway, in consultation with the environmental approvals coordinator. Minor changes (such as updating a document or process) that do not invoke a revision trigger are endorsed by the VP (or delegate) and the change is implemented.

In accordance with Regulation 17 of the OPGGS (E) Regulations 2009, a revision of this EP will be submitted to NOPSEMA where:

- a change is considered to represent a new activity
- a change is considered to represent a significant modification to, or a new stage of, an existing activity
- a change will create a significant new environmental impact or risk that is not provided for in the current EP; or
- a change will result in a series of new (or increased) environmental impacts or risks that, together, will result in a significant new environmental impact or risk, or a significant increase in an existing environmental impact or risk.

The MoC request process will be periodically checked against NOPSEMA guidance to ensure ongoing compliance and will be undertaken as part of the management review process described in Section 9.13.

9.8 Stakeholder engagement

Communications with stakeholders are inclusive and effective, to facilitate the controlled transfer of relevant and appropriate HSE information. Stakeholders include INPEX Corporation, INPEX employees, contractors, regulators, external industry bodies, shareholders, joint venture participants, suppliers, customers, non-government organisations, indigenous groups, financiers and members of the community.

9.8.1 Legislative and other requirements

INPEX maintains an approvals and compliance tracking system which identifies future approval requirements and when they must be in place, as well as compliance with existing approvals. Through this system, responsible persons are provided with alerts for required actions and time frames to avoid non-compliance and ensure there are no gaps in approvals.

In addition, INPEX personnel participate in industry and regulator forums, as well as maintain up-to-date knowledge of industry practices and proposed regulatory changes. Changes to legislative and other requirements are reviewed for potential impacts to business operations and communicated, as required, to personnel managing potentially affected activities.

Updates to matters relating to the EPBC Act, including policy statements and conservation management documentation is achieved through subscription to automated email notifications provided by the DAWE. In addition, updates following the Government's independent AMP review, such as AMP management plans will also be reviewed for relevance against this EP. Where required, updates to this EP will be conducted in accordance with the MoC process described in Section 9.7.

9.8.2 Communication

INPEX HSE requirements and matters are communicated throughout the organisation. This facilitates the cascading and implementation of business policies and standards through the business, and on to contractors who work on behalf of INPEX.

INPEX and its contractors adopt a number of methods to ensure that information relating to HSE risks and impacts are communicated to personnel, including:

- daily toolbox meetings
- MODU HSE meetings
- use of noticeboards, intranet, HSE alerts and newsflashes e.g. environmental aspects and events
- internal and external reporting.

9.8.3 Ongoing stakeholder consultation

In relation to an EP Implementation Strategy, Regulation 14(9) of the OPPGS (E) Regulations 2009 specifies a requirement for consultation with relevant authorities of the Commonwealth, a state or territory, and other relevant interested persons or organisations. Any objections or claims received from stakeholders while the activity is ongoing will be considered and assessed as detailed in Section 5, using the same process and criteria described for the stakeholder consultation undertaken during the development of this EP. Mechanisms that provide ongoing opportunities for consultation with stakeholders, in relation to the implementation of this EP, are summarised in Table 9-6 and an environmental performance outcome and standard is presented in Table 9-7.

Table 9-6: Ongoing stakeholder consultation

Stakeholder	Information supplied	Frequency
Australian Hydrographic Office (Cwlth)	The AHO will be notified of the activity commencement and cessation via datacentre@hydro.gov.au, for promulgation of fortnightly Notice to Mariners.	4 weeks prior to commencement and upon completion
Australian Maritime Safety Authority (AMSA; Cwlth) Joint Rescue Coordination Centre (JRCC)	INPEX to notify AMSA JRCC for promulgation of radio-navigation warnings 24-48 hours before operations commence and upon completion of the survey (Email: rccaus@amsa.gov.au; Phone: 1800 641 792 or +61 2 6230 6811). AMSA's JRCC require the vessel names, IMO vessel numbers and call signs, and Maritime Mobile Service Identity (MMSI) numbers.	24-48 hours before operations commence and upon completion

Stakeholder	Information supplied	Frequency
NOPSEMA (Cwlth)	NOPSEMA will be notified of the activity commencement and cessation, using the Regulation 29 Notification Form available at https://www.nopsema.gov.au/environmental management/notification-and-reporting/	At least 10 days prior to commencement and within 10 days of completion
National Offshore Petroleum Titles Administrator (Cwlth) (NOPTA)	NOPTA will be notified of the activity commencement and cessation via reporting@nopta.gov.au	48 hours prior to commencement and upon completion
Department of Mines, Industry Regulation and Safety (WA)	DMIRS will be notified of the activity commencement and cessation. Notifications of any environmental incidents that could potentially impact on any land or water in State jurisdiction will also be sent to DMIRS in accordance with Section 9.11.3.	As required
AFMA and relevant fishing representatives/ licence holders	Provide updates on future developments relating to the project.	As required

Table 9-7: Environmental performance outcome, standards and measurement criteria for implementation of ongoing stakeholder consultation

Environmental performance outcome	Environmental performance standard	Measurement criteria
Where requested, relevant stakeholders will be kept informed of activities.	Ongoing stakeholder consultation with relevant stakeholders undertaken in accordance with Table 9-6.	Stakeholder consultation records.

9.9 Contractors and suppliers

Selection and management processes are in place to ensure that contractors working for, or on behalf of, INPEX are able and willing to meet the minimum business expectations of INPEX, including those related to HSE and risk management.

Contractors and suppliers are selected based on their capabilities and managed throughout the scope of works to deliver on HSE and process safety performance expectations.

The processes for pre-qualification, selection and management of suppliers and contractors are detailed within the INPEX BMS such that:

- HSE and process safety risks associated with the scope of work are identified and known
- contractors and suppliers are selected based on their organisational capability and personnel competence to execute the scope of work, including effective management of HSE and process safety risks

- roles and responsibilities, and minimum performance expectations are communicated to contractors and suppliers, and form part of contractual obligations
- contractors are partnered to deliver desired HSE and process safety performance targets, and monitored for compliance with contractual requirements
- lessons learned from each scope of work are applied to future activities.

9.10 Security and emergency management

Regulation 14(8) of the OPGGS (E) Regulations requires the implementation strategy to contain an OPEP and the provision for the OPEP to be updated. In accordance with Regulation 14 (8AA)) the OPEP must include arrangements to respond to and monitor oil pollution, including:

- the control measures necessary for a timely response to an oil pollution emergency
- the arrangements and response capability to implement a timely implementation of those controls, including ongoing maintenance of that capability
- the arrangements and capability for monitoring the effectiveness of the controls and ensuring that performance standards for those controls are met
- the arrangements and capability for monitoring oil pollution to inform response activities
- the provision for the OPEP to be updated.

These requirements are addressed through the INPEX *Browse Regional OPEP*, a summary of which is provided in Section 8.4 and Table 8-10 of this EP.

9.11 Incident investigation and lessons learned

HSE and process safety incidents and high potential hazards must be reported and investigated to identify and address the root causes, and apply lessons learned to improve designs, systems and work practices.

9.11.1 HSE performance measurement and reporting

HSE performance data is monitored in accordance with the INPEX BMS. This enables the status of conformance with HSE obligations and goals to be determined, and also ensures HSE risks are being effectively managed to support continuous improvement. HSE is regularly reviewed by senior management.

9.11.2 Environmental incident reporting – internal

INPEX refers to environmental incidents and hazards as “environmental events”, which all personnel, including contractors, are required to report as soon as is reasonably practicable. Reporting must be in accordance with the INPEX *Event Reporting and Investigation Standard* and associated procedure.

All events will be documented and reviewed for their actual and potential consequence severity levels and investigated as appropriate. Corrective or preventative actions will be identified and documented, and their completion verified in an action register. These actions may include changes to the risk registers, standards, or procedures, or the need for training, different tools or equipment. Any actions will be recorded and tracked.

9.11.3 Environmental incident reporting – external

For the purposes of regulatory reporting to NOPSEMA, an incident is classified as either "Reportable" or "Recordable" based on the definitions contained in Regulation 4 of the OPGGS (E) Regulations 2009.

A "Reportable" incident is defined as "an incident relating to the activity that has caused, or has the potential to cause, moderate to significant environmental damage." Environmental damage (or the potential to cause damage) includes social, economic and cultural features of the environment. For the purposes of this EP, such an incident is considered to have an environmental consequence level of Moderate (D) to Catastrophic (A) as defined in the INPEX Risk Matrix (Figure 6-1).

Based on the consequence assessments described in sections 7 and 8 of this EP, incidents identified as having the potential to be "Reportable" (i.e. Moderate (D) or above on the INPEX Risk Matrix) include:

- the introduction of IMS
- loss of well containment
- vessel collision.

A "Recordable" incident is defined as "a breach of an environmental performance outcome or environmental performance standard … that is not a reportable incident." In terms of the activities within the scope of this EP, it is a breach of the performance standards and outcomes listed in Section 7, Section 8 or Section 9 of this EP and the Browse Regional OPEP.

For the purposes of regulatory reporting to DAWE, any significant impact to MNES, as classified using the INPEX Risk Matrix, will be reported to DAWE.

The DNP will be notified of any oil/gas pollution incidences within or likely to impact an AMP as soon as possible (refer to INPEX *Browse Regional OPEP*).

Reportable incidents

Initial verbal notification

In the event of a reportable incident, INPEX will give NOPSEMA an initial verbal notification of the occurrence as soon as is practicable; and in any case, not later than two hours after the first occurrence of the reportable incident; or if it is not detected at the time of the first occurrence, within two hours of the time that INPEX becomes aware of the incident.

The initial verbal notification will contain:

- all material facts and circumstances concerning the reportable incident that are known or can, by reasonable search or enquiry, be found out
- any action taken to avoid or mitigate any adverse environmental impacts of the reportable incident
- the corrective action that has been taken, or is proposed to be taken, to stop, control or remedy the reportable incident.

Written notification

As soon as possible after an initial verbal notification of a reportable incident, INPEX will provide a written record of the notification to:

- NOPSEMA
- NOPTA (Cwlth)

- WA DMIRS or NT DIPL, depending on the jurisdiction.

In the event of a significant impact to MNES, INPEX will provide an initial notification to DAWE within 24 hours of becoming aware of the event.

In the event of a reportable incident, INPEX will provide a written report to NOPSEMA as soon as is practicable; and in any case, not later than three days after the first occurrence of the incident. If, within the three day period, NOPSEMA specifies an alternative reporting period, INPEX will report accordingly. The report will contain:

- all material facts and circumstances concerning the reportable incident that are known or can, by reasonable search or enquiry, be found out
- any action taken to avoid or mitigate any adverse environmental impacts of the reportable incident
- the corrective action that has been taken, or is proposed to be taken, to stop, control or remedy the reportable incident
- the action that has been taken, or is proposed to be taken, to prevent a similar incident occurring in the future.

Within seven days of giving a written report of a reportable incident to NOPSEMA, INPEX will provide a copy of the report to:

- NOPTA (Cwlth)
- WA DMIRS or NT DIPL, depending on the jurisdiction.

Following submission of the above, NOPSEMA may, by notice in writing, request INPEX to submit an additional report(s) of the incident. Where this is the case, NOPSEMA will identify the information to be contained in the report(s) or the matters to be addressed and will specify the submission date for the report(s). INPEX will prepare and submit the report(s) in accordance with the notice given.

In the event of a significant impact to MNES, INPEX will provide a written notification to DAWE (Cwlth) within three days of becoming aware of the event, and provide additional information as available, if requested by DAWE.

This includes reporting any vessel strike incidents to the National Ship Strike Database at <https://data.marinemammals.gov.au/report/shipstrike>.

Suspected or confirmed presence of any marine pest or disease will be reported to WA DPIRD within 24 hours by email (biosecurity@fish.wa.gov.au) or telephone. This includes any organism listed in the WA prevention list for introduced marine pests and any other non-indigenous organism that demonstrates invasive characteristics. For NT waters, aquatic pests will be reported by email (aquaticbiosecurity@nt.gov.au).

Recordable incidents

Reporting

In the event of a recordable incident, INPEX will report the occurrence to NOPSEMA as soon as is practicable after the end of the calendar month in which it occurs; and in any case, not later than 15 days after the end of the calendar month. The report will contain:

- a record of all the recordable incidents that occurred during the calendar month
- all material facts and circumstances concerning the recordable incidents that are known or can, by reasonable search or enquiry, be found out
- any action taken to avoid or mitigate any adverse environmental impacts of the recordable incidents

- the corrective action that has been taken, or is proposed to be taken, to stop, control or remedy the recordable incident
- the action that has been taken, or is proposed to be taken, to prevent a similar incident occurring in the future.

9.11.4 Annual performance reporting – external

In accordance with Regulation 14(2) of the OPGGS (E) Regulations 2009, INPEX will undertake a review of its compliance with the environmental performance outcomes and standards set out in this EP and will provide a written report of its findings for the reporting period to NOPSEMA on an annual basis, as agreed with NOPSEMA. The annual submission date for the environmental performance report will be 12 months after the start of the activity.

9.12 Monitor, review and audit

HSE performance must be monitored through audits, reviews, validation, verification and assurance checks, to correct at risk situations and deliver improved performance.

9.12.1 Management system audit

An audit and inspection program will be developed and implemented in accordance with the INPEX business standard for auditing. The program will include:

- self-assessment HSE audits against the INPEX BMS
- regular inspections of workplace equipment and activities
- reviews to evaluate compliance with legislative and other requirements.

Unscheduled audits may be initiated by INPEX in the event of an incident, non-compliance or for other valid reasons.

Audit teams will be appropriately qualified, experienced and competent in auditing techniques. They will include relevant technical expertise, as required, and the audit team structure will be commensurate with the scope of the audit. HSE audit and inspection findings will be summarised in a report. Non-conformances, actions and improvement plans resulting from audits will be managed in an action tracking system.

9.12.2 MODU and vessel inspections

Inspections will be undertaken to ensure that the environmental performance outcomes and standards documented in this EP can be achieved.

Pre-mobilisation HSE inspections will be conducted prior to site survey and drilling activities on relevant MODUs and vessels.

During the activity, operational compliance against relevant EPO/EPSs will be assessed and maintained through the implementation of respective monthly environmental inspection checklists.

Non-conformances and relevant findings during the inspections will be converted into actions that will be tracked within an action tracking database until closed.

9.13 Management review

Through a process of adaptive management, lessons from management outcomes will be used for continual improvement. Formal reviews of the effectiveness and appropriateness of the HSE requirements as per the INPEX BMS are performed by senior management on a periodic basis. Learnings from this process, and iterative decision-making will then be used as feedback to improve future management.

Together with the annual environmental performance report described in Section 9.11.4, EP management reviews will enable the review of environmental performance, as well the efficacy of the implementation strategy used during the activity.

Management reviews of this EP shall assess whether:

- the environmental impacts and risks of the activity continue to be identified and reduced to a level that is ALARP
- control measures detailed in this EP are effective in reducing the environmental impacts and risks of the activity to ALARP and an acceptable level
- implementation of the MoC process has remained consistent with the commitment to ensuring impacts and risks are reduced to ALARP and are acceptable
- any changes in legislation, or matters relating to the EPBC Act, including policy statements and conservation management documentation, have occurred which affect or need to be taken into consideration in relation to this EP
- any changes in NOPSEMA guidance which may affect or need to be taken into consideration in relation to this EP
- the Operational and Scientific Monitoring Program (within the Browse Regional OPEP) remains fit for purpose
- lessons learned have been communicated and, where applicable, applied across all titleholder activities, as relevant.

Where the documented findings of the EP management reviews have implications for this EP, the EP will be updated in accordance with the EP MoC process.

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Appendix A-
EPBC Act Protected Matters Reports & Species Risk Evaluation

APPENDIX A: EPBC ACT PROTECTED MATTERS REPORTS AND SPECIES RISK EVALUATION

A.1 EPBC Act protected matters reports

- WA-285-P
- WA-343-P
- EMBA
- PEZ

Australian Government

Department of Agriculture, Water and the Environment

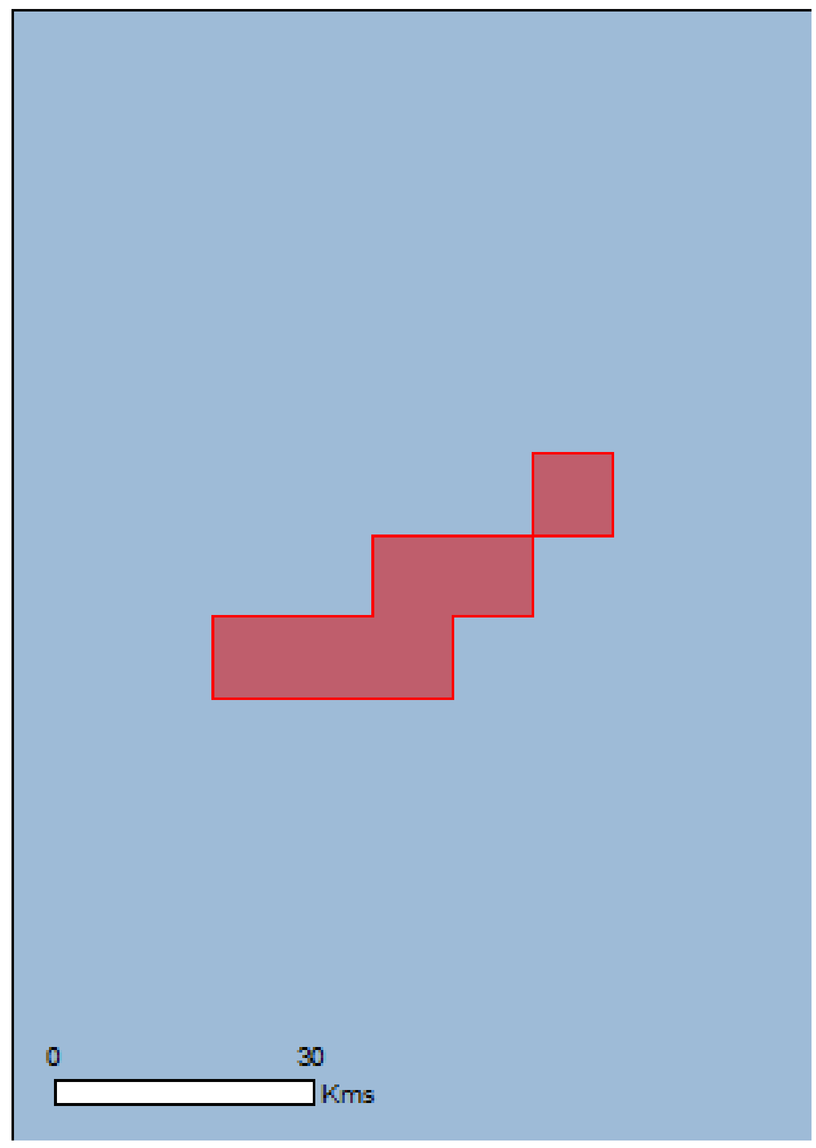
EPBC Act Protected Matters Report

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.

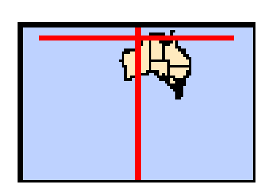
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 14/03/22 17:00:41



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:	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:	18
Listed Migratory Species:	33

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	62
Whales and Other Cetaceans:	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)	1

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
North-west

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically 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
Papasula abbotti Abbott's Booby [59297]	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
Reptiles		

Name	Status	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
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	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
Glyphis garricki Northern River Shark, New Guinea River Shark [82454]	Endangered	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	Species or species habitat may occur within area

Listed Migratory Species

[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known 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]		Foraging, feeding or related behaviour likely to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat likely to occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may 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
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	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 may occur within area
Megaptera novaeangliae Humpback Whale [38]		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

Name	Threatened	Type of Presence
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

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
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	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

Name	Threatened	Type of Presence
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known 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]		Foraging, feeding or related behaviour likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat likely to occur within area
Fish		
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		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 suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
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 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 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 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
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

Name	Threatened	Type of Presence
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
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Hydrophis coggeri Slender-necked Seasnake [25925]		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 habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
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 likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		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

Name	Status	Type of Presence
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus (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
Continental Slope Demersal Fish Communities	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

-13.915269 123.334587,-13.915268 123.417915,-13.9986 123.41791,-13.9986 123.335,-14.08194 123.33459,-14.08194 123.25125,-14.16527 123.251125,-14.16527 123.001251,-14.081938 123.001251,-14.0811937 123.167915,-13.9986 123.16792,-13.9986 123.3346,-13.91527 123.334587,-13.915269 123.33459,-13.915269 123.334587

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- -Office of Environment and Heritage, New South Wales
- -Department of Environment and Primary Industries, Victoria
- -Department of Primary Industries, Parks, Water and Environment, Tasmania
- -Department of Environment, Water and Natural Resources, South Australia
- -Department of Land and Resource Management, Northern Territory
- -Department of Environmental and Heritage Protection, Queensland
- -Department of Parks and Wildlife, Western Australia
- -Environment and Planning Directorate, ACT
- -Birdlife Australia
- -Australian Bird and Bat Banding Scheme
- -Australian National Wildlife Collection
- -Natural history museums of Australia
- -Museum Victoria
- -Australian Museum
- -South Australian Museum
- -Queensland Museum
- -Online Zoological Collections of Australian Museums
- -Queensland Herbarium
- -National Herbarium of NSW
- -Royal Botanic Gardens and National Herbarium of Victoria
- -Tasmanian Herbarium
- -State Herbarium of South Australia
- -Northern Territory Herbarium
- -Western Australian Herbarium
- -Australian National Herbarium, Canberra
- -University of New England
- -Ocean Biogeographic Information System
- -Australian Government, Department of Defence
- Forestry Corporation, NSW
- -Geoscience Australia
- -CSIRO
- -Australian Tropical Herbarium, Cairns
- -eBird Australia
- -Australian Government – Australian Antarctic Data Centre
- -Museum and Art Gallery of the Northern Territory
- -Australian Government National Environmental Science Program
- -Australian Institute of Marine Science
- -Reef Life Survey Australia
- -American Museum of Natural History
- -Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
- -Tasmanian Museum and Art Gallery, Hobart, Tasmania
- -Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Australian Government

Department of Agriculture, Water and the Environment

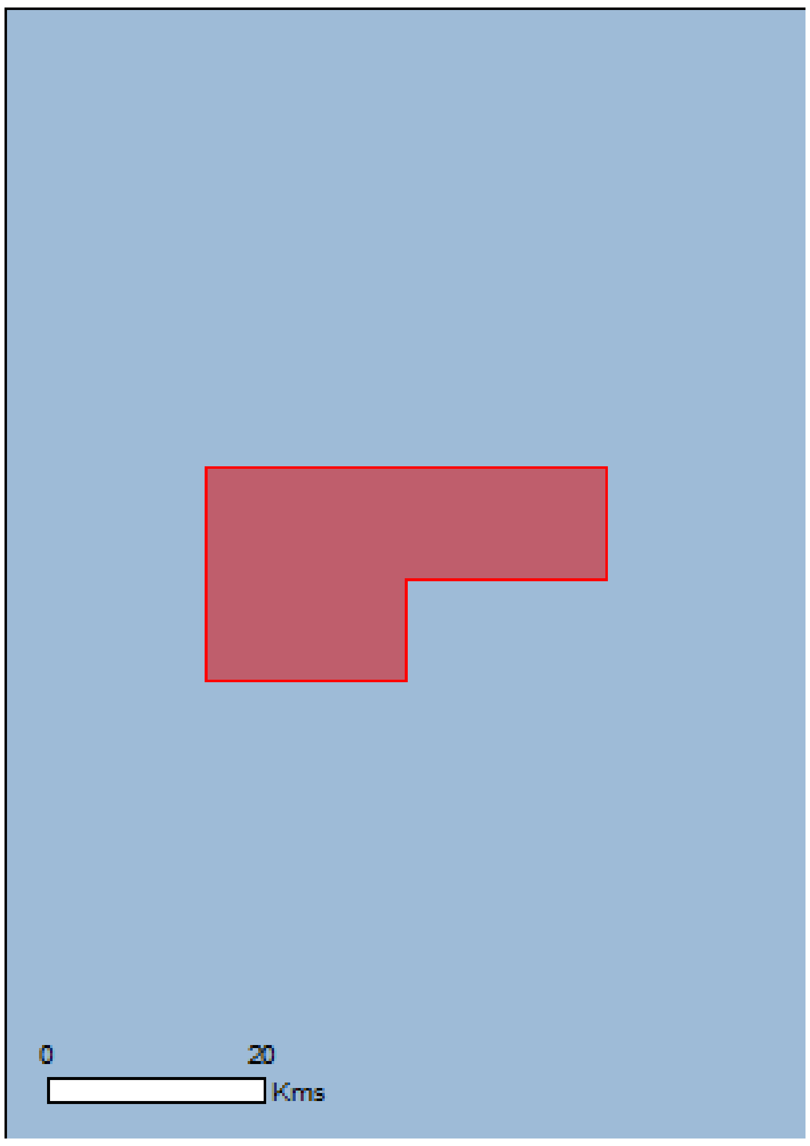
EPBC Act Protected Matters Report

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.

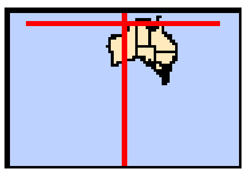
Report created: 14/03/22 16:15:22



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

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:	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:	18
Listed Migratory Species:	33

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:	60
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)	1

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
North-west

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops		
Australian Lesser Noddy [26000]	Vulnerable	Foraging, feeding or related behaviour likely to 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
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Papasula abbotti		
Abbott's Booby [59297]	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
Reptiles		

Name	Status	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
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	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		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Glyphis garricki Northern River Shark, New Guinea River Shark [82454]	Endangered	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	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known 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]		Foraging, feeding or related behaviour likely to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat likely to occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may 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
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	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 may occur within area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat likely 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

Name	Threatened	Type of Presence
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

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
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Foraging, feeding or related behaviour likely to 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

Name	Threatened	Type of Presence
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known 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]		Foraging, feeding or related behaviour likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat likely to occur within area
Fish		
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		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 suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
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 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 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 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
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

Name	Threatened	Type of Presence
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 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
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Hydrophis coggeri Slender-necked Seasnake [25925]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Lapemis hardwickii Spine-bellied Seasnake [1113]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat likely to 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	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 Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		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]		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

Name	Status	Type of Presence
		habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat may occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Extra Information

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Continental Slope Demersal Fish Communities	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

-13.32364 123.334587,-13.323638 123.667908,-13.415267 123.667915,-13.415268 123.501251,-13.498601 123.501251,-13.498602 123.334587,-13.32364 123.334587

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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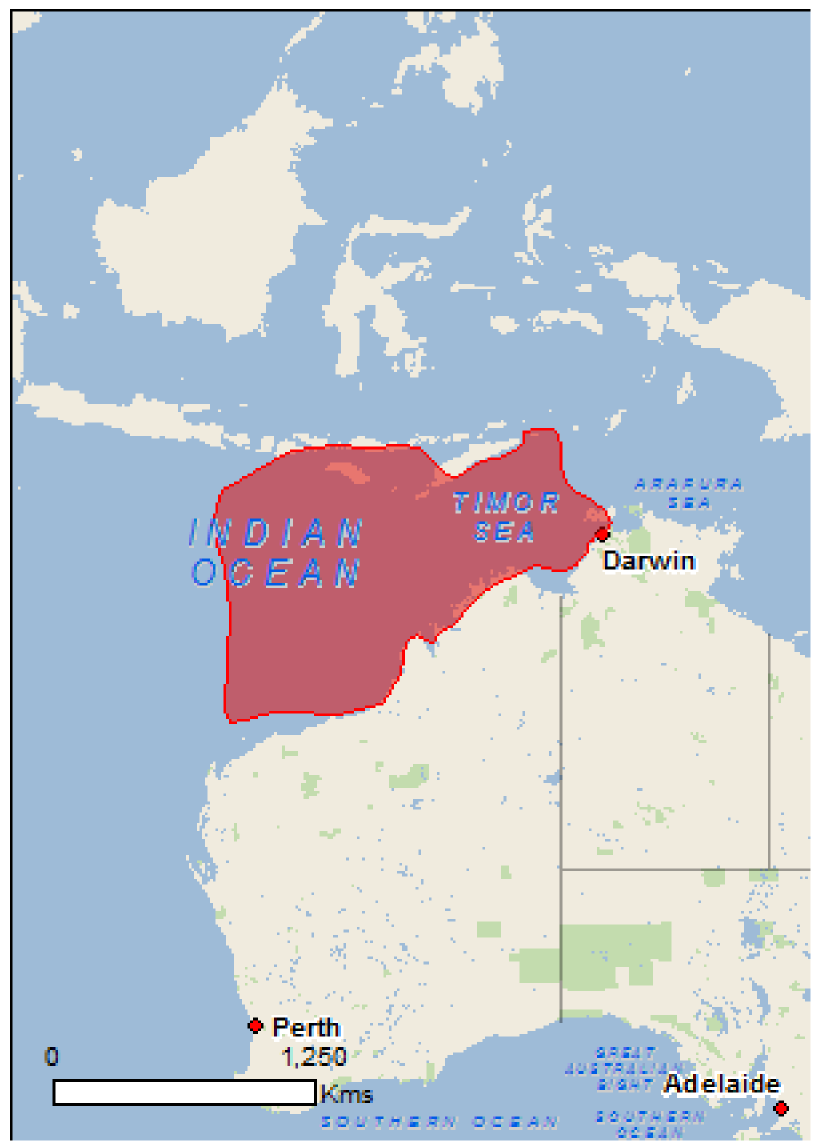
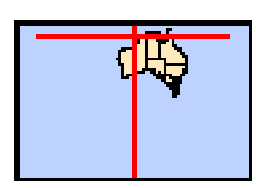


Coordinates

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:	None
National Heritage Places:	1
Wetlands of International Importance:	3
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	70
Listed Migratory Species:	89

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	4
Commonwealth Heritage Places:	4
Listed Marine Species:	156
Whales and Other Cetaceans:	30
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	18

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	33
Regional Forest Agreements:	None
Invasive Species:	30
Nationally Important Wetlands:	8
Key Ecological Features (Marine)	12

Details

Matters of National Environmental Significance

National Heritage Properties [Resource Information]

Name	State	Status
Natural		
The West Kimberley	WA	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
Roebuck bay	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
North-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
Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula	Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Breeding known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur

Name	Status	Type of Presence
		within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat known to occur within area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat known to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat known to occur within area
Falcunculus frontatus whitei Crested Shrike-tit (northern), Northern Shrike-tit [26013]	Vulnerable	Species or species habitat known to occur within area
Geophaps smithii blaauwi Partridge Pigeon (western) [66501]	Vulnerable	Species or species habitat likely to occur within area
Geophaps smithii smithii Partridge Pigeon (eastern) [64441]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Melanodryas cucullata melvillensis Tiwi Islands Hooded Robin, Hooded Robin (Tiwi Islands) [67092]	Critically Endangered	Species or species habitat known to occur within area
Mirafra javanica melvillensis Horsfield's Bushlark (Tiwi Islands) [81011]	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
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat likely to occur within area
Tyto novaehollandiae melvillensis Tiwi Masked Owl, Tiwi Islands Masked Owl [26049]	Endangered	Species or species habitat known to occur within area
Frogs		
Uperoleia daviesae Howard River Toadlet, Davies's Toadlet [85375]	Vulnerable	Species or species habitat may occur within area
Mammals		
Antechinus bellus Fawn Antechinus [344]	Vulnerable	Species or species habitat known to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Conilurus penicillatus Brush-tailed Rabbit-rat, Brush-tailed Tree-rat, Pakooma [132]	Vulnerable	Species or species habitat known to occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
Isoodon auratus auratus Golden Bandicoot (mainland) [66665]	Vulnerable	Species or species habitat likely to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat known to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat known to occur within area
Mesembriomys gouldii gouldii Black-footed Tree-rat (Kimberley and mainland Northern Territory), Djintamoonga, Manbul [87618]	Endangered	Species or species habitat likely to occur within area
Mesembriomys gouldii melvillensis Black-footed Tree-rat (Melville Island) [87619]	Vulnerable	Species or species habitat known to occur within area
Petrogale concinna canescens Nabarlek (Top End) [87606]	Endangered	Species or species habitat may occur within area
Petrogale concinna monastria Nabarlek (Kimberley) [87607]	Endangered	Species or species habitat known to occur within area
Phascogale pirata Northern Brush-tailed Phascogale [82954]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Phascogale tapoatafa kimberleyensis Kimberley brush-tailed phascogale, Brush-tailed Phascogale (Kimberley) [88453]	Vulnerable	Species or species habitat known to occur within area
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat likely to occur within area
Sminthopsis butleri Butler's Dunnart [302]	Vulnerable	Species or species habitat known to occur within area
Trichosurus vulpecula arnhemensis Northern Brushtail Possum [83091]	Vulnerable	Species or species habitat known to occur within area
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat known to occur within area
Plants		
Burmannia sp. Bathurst Island (R.Fensham 1021) [82017]	Endangered	Species or species habitat likely to occur within area
Hoya australis subsp. oramicola a vine [55436]	Vulnerable	Species or species habitat known to occur within area
Mitrella tiwiensis a vine [82029]	Vulnerable	Species or species habitat likely to occur within area
Seringia exastia Fringed Fire-bush [88920]	Critically Endangered	Species or species habitat known to occur within area
Typhonium jonesii a herb [62412]	Endangered	Species or species habitat known to occur within area
Typhonium mirabile a herb [79227]	Endangered	Species or species habitat known to occur within area
Xylopia monosperma a shrub [82030]	Endangered	Species or species habitat known to occur within area
Reptiles		
Acanthophis hawkei Plains Death Adder [83821]	Vulnerable	Species or species habitat likely to occur within area
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	Foraging, feeding or related behaviour 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	Breeding likely to occur within area

Name	Status	Type of Presence
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Sharks		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Glyphis garricki Northern River Shark, New Guinea River Shark [82454]	Endangered	Breeding likely to occur within area
Glyphis glyphis Speartooth Shark [82453]	Critically Endangered	Species or species habitat 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

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 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
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

Name	Threatened	Type of Presence
Onychoprion anaethetus Bridled Tern [82845]		Breeding known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Breeding known to occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons Little Tern [82849]		Breeding known to occur within area
Sula dactylatra Masked Booby [1021]		Breeding known to occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Sula sula Red-footed Booby [1023]		Breeding known to 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	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour 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	Breeding likely 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

Name	Threatened	Type of Presence
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
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]		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 known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	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]		Breeding known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Cecropis daurica Red-rumped Swallow [80610]		Species or species habitat may occur within area
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

Name	Threatened	Type of Presence
		habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		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 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]		Foraging, feeding or related behaviour known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Foraging, feeding or related behaviour known to occur within area
Charadrius dubius Little Ringed Plover [896]		Foraging, feeding or related behaviour known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Foraging, feeding or related behaviour known to occur within area

Name	Threatened	Type of Presence
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Roosting known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Thalasseus bergii Greater Crested Tern [83000]		Breeding known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa glareola Wood Sandpiper [829]		Foraging, feeding or related behaviour known to occur within area
Tringa incana Wandering Tattler [831]		Foraging, feeding or related behaviour 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 - Australian Government Solicitor
Defence - QUAIL ISLAND BOMBING RANGE
Defence - YAMPI SOUND TRAINING AREA

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
Ashmore Reef National Nature Reserve	EXT	Listed place
Mermaid Reef - Rowley Shoals	WA	Listed place
Scott Reef and Surrounds - Commonwealth Area	EXT	Listed place
Yampi Defence Area	WA	Listed place

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
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
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely 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]		Foraging, feeding or related behaviour 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
Charadrius bicinctus Double-banded Plover [895]		Foraging, feeding or related behaviour known to occur within area
Charadrius dubius Little Ringed Plover [896]		Foraging, feeding or related behaviour known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius 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
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]		Foraging, feeding or related behaviour known 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
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Heteroscelus incanus Wandering Tattler [59547]		Foraging, feeding or related behaviour known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area

Name	Threatened	Type of Presence
Hirundo daurica Red-rumped Swallow [59480]		Species or species habitat may 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
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat 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
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Breeding known to occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area

Name	Threatened	Type of Presence
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting 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
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat 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
Tringa glareola Wood Sandpiper [829]		Foraging, feeding or related behaviour 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

Name	Threatened	Type of Presence within area
Fish		
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys 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 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
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

Name	Threatened	Type of Presence
		area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
Hippichthys parvicarinatus Short-keel Pipefish, Short-keeled Pipefish [66230]		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]		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 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

Name	Threatened	Type of Presence
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnstone's Crocodile [1773]		Species or species habitat may 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	Breeding 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
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 inornatus Plain Seasnake [1107]		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

Name	Threatened	Type of Presence
Hydrophis pacificus Large-headed Seasnake, Pacific Seasnake [1112]		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	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Parahydrophis mertoni Northern Mangrove Seasnake [1090]		Species or species habitat may 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	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
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

Name	Status	Type of Presence
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon ginkgodens Gingko-toothed Beaked Whale, Gingko-toothed Whale, Gingko Beaked Whale [59564]		Species or species habitat may occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks	[Resource Information]
Name	Label
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)
Cartier Island	Sanctuary Zone (IUCN Ia)
Eighty Mile Beach	Multiple Use Zone (IUCN VI)
Joseph Bonaparte Gulf	Special Purpose Zone (IUCN VI)
Kimberley	Habitat Protection Zone (IUCN IV)
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)
Oceanic Shoals	Habitat Protection Zone (IUCN IV)
Oceanic Shoals	Multiple Use Zone (IUCN VI)
Oceanic Shoals	National Park Zone (IUCN II)
Oceanic Shoals	Special Purpose Zone (Trawl) (IUCN VI)
Roebuck	Multiple Use Zone (IUCN VI)

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Adele Island	WA
Balanggarra	WA
Bardi Jawi	WA
Bedout Island	WA
Browse Island	WA
Coulomb Point	WA
Dambimangari	WA
Jinmarnkur	WA
Jinmarnkur Kulja	WA
Karajarri	WA
Lacepede Islands	WA
Lawley River	WA
Lesueur Island	WA
Low Rocks	WA
Mitchell River	WA
Niiwalarra Islands	WA
Prince Regent	WA
Swan Island	WA
Tanner Island	WA
Unnamed WA28968	WA
Unnamed WA37168	WA
Unnamed WA41775	WA
Unnamed WA44669	WA
Unnamed WA44672	WA
Unnamed WA44673	WA
Unnamed WA44677	WA
Unnamed WA51162	WA
Unnamed WA51932	WA
Unnamed WA52354	WA
Unnamed WA53015	WA
Uunguu	WA
Yampi	WA
Yawuru	WA

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Bubalus bubalis Water Buffalo, Swamp Buffalo [1]		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
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
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Rattus exulans Pacific Rat, Polynesian Rat [79]		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
Brachiaria mutica Para Grass [5879]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Hymenachne amplexicaulis Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass [31754]		Species or species habitat likely to 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
Mimosa pigra Mimosa, Giant Mimosa, Giant Sensitive Plant, ThornySensitive Plant, Black Mimosa, Catclaw Mimosa, Bashful Plant [11223]		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
Pennisetum polystachyon Mission Grass, Perennial Mission Grass, Missiongrass, Feathery Pennisetum, Feather Pennisetum, Thin Napier Grass, West Indian Pennisetum, Blue Buffel Grass [21194]		Species or species habitat likely to occur within area
Prosopis spp. Mesquite, Algaroba [68407]		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
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
Ramphotyphlops braminus Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat known to occur within area

Nationally Important Wetlands

[Resource Information]

Name	State
Ashmore Reef	EXT
Bunda-Bunda Mound Springs	WA
Finniss Floodplain and Fog Bay Systems	NT
Mermaid Reef	EXT
Mitchell River System	WA
Prince Regent River System	WA
Willie Creek Wetlands	WA
Yampi Sound Training Area	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
Carbonate bank and terrace system of the Van	North
Pinnacles of the Bonaparte Basin	North
Shelf break and slope of the Arafura Shelf	North
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
Carbonate bank and terrace system of the Sahul	North-west
Continental Slope Demersal Fish Communities	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

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

-11.99 113.941,-10.514 114.451,-10.004 115.203,-9.215 116.539,-8.807 117.513,-8.606 119.408,-8.703 120.79,-8.626 122.266,-8.719 122.956,-9.878 124.049,-9.92 124.483,-9.266 125.551,-9.098 126.298,-8.752 127.045,-8.463 127.37,-8.04 127.41,-7.896 127.981,-7.936 128.668,-8.129 128.957,-8.675 129.018,-9.414 128.972,-10.161 129.209,-10.484 129.566,-10.992 130.397,-11.323 130.887,-11.868 131.215,-12.0855 131.116,-12.471 130.483,-12.627 130.417,-12.658 130.372,-12.661 130.337,-12.909 130.145,-12.947 130.137,-13.045 130.13,-13.166 130.101,-13.423 129.83,-13.686 129.68,-13.864 129.17,-13.864 128.778,-13.629 127.98,-14.211 126.851,-14.349 126.406,-14.508 126.018,-14.876 125.6,-15.235 125.171,-15.588 124.897,-15.896 124.616,-16.177 124.293,-16.432 123.867,-16.873 123.45,-16.497 122.822,-16.834 122.403,-18.232 122.151,-19.388 121.337,-19.807 119.387,-19.682 117.525,-19.682 116.879,-19.747 116.574,-20.087 115.4,-20.156 114.776,-19.646 114.507,-15.6 114.72,-13.823 114.566,-11.99 113.941

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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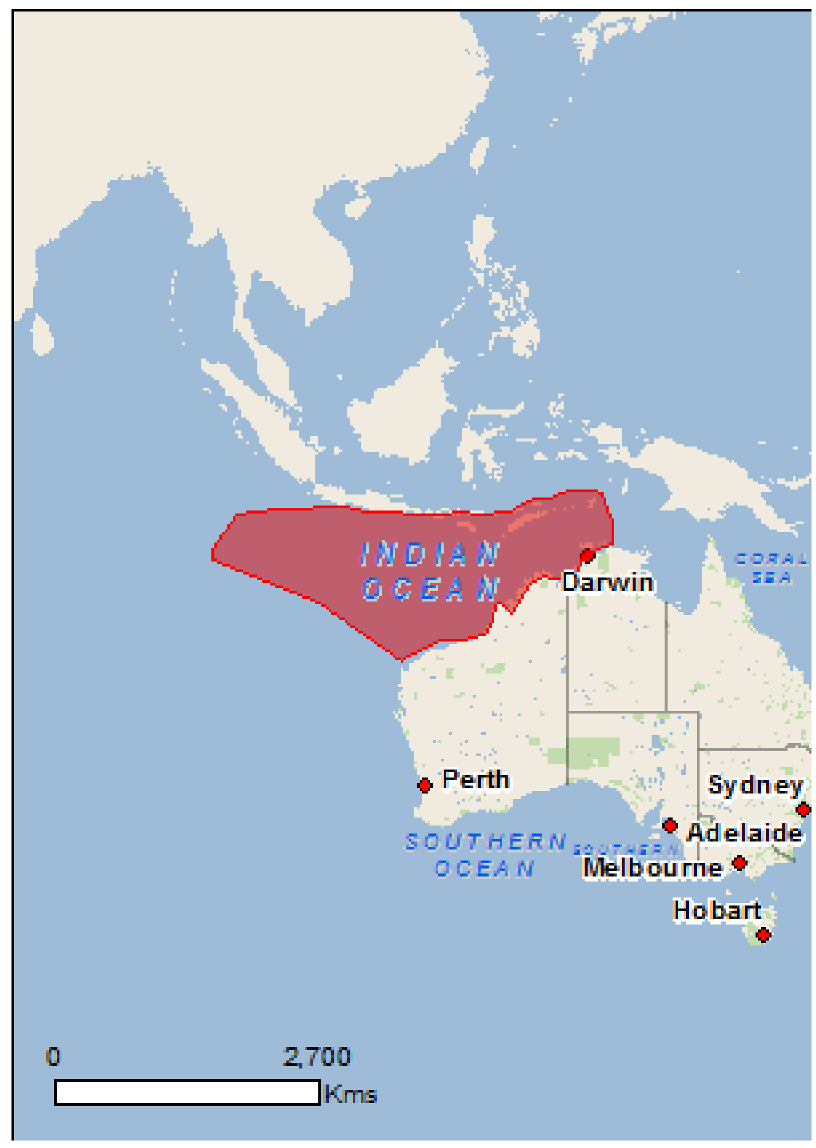
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

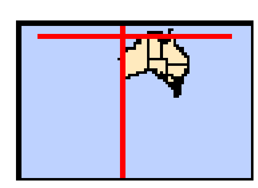
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 24/03/22 11:48:05



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:	None
National Heritage Places:	1
Wetlands of International Importance:	7
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	96
Listed Migratory Species:	94

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:	37
Listed Marine Species:	168
Whales and Other Cetaceans:	32
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	2
Australian Marine Parks:	26

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	39
Regional Forest Agreements:	None
Invasive Species:	43
Nationally Important Wetlands:	13
Key Ecological Features (Marine)	15

Details

Matters of National Environmental Significance

National Heritage Properties [Resource Information]

Name	State	Status
Natural		
The West Kimberley	WA	Listed place

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Ashmore reef national nature reserve	Within Ramsar site
Cobourg peninsula	Within Ramsar site
Eighty-mile beach	Within Ramsar site
Hosnies spring	Within Ramsar site
Pulu keeling national park	Within Ramsar site
Roebuck bay	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
North-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
Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula	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
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species

Name	Status	Type of Presence
		habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting 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	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Epthianura crocea tunneyi Alligator Rivers Yellow Chat, Yellow Chat (Alligator Rivers) [67089]	Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat known to occur within area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat known to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat known to occur within area
Falcunculus frontatus whitei Crested Shrike-tit (northern), Northern Shrike-tit [26013]	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
Geophaps smithii blaauwi Partridge Pigeon (western) [66501]	Vulnerable	Species or species habitat likely to occur within area
Geophaps smithii smithii Partridge Pigeon (eastern) [64441]	Vulnerable	Species or species habitat known to occur within area
Hypotaenidia philippensis andrewsi Buff-banded Rail (Cocos (Keeling) Islands), Ayam Hutan [88994]	Endangered	Species or species habitat known to occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Melanodryas cucullata melvillensis Tiwi Islands Hooded Robin, Hooded Robin (Tiwi Islands) [67092]	Critically Endangered	Species or species habitat known to occur within area
Mirafra javanica melvillensis Horsfield's Bushlark (Tiwi Islands) [81011]	Vulnerable	Species or species habitat known to occur within area
Ninox natalis Christmas Island Hawk-Owl, Christmas Boobook	Vulnerable	Species or species

Name	Status	Type of Presence
[66671]		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
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	Species or species habitat known 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	Breeding likely to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may 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	Species or species habitat may occur within area
Turdus poliocephalus erythropleurus Christmas Island Thrush [67122]	Endangered	Species or species habitat likely to occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat known to occur within area
Tyto novaehollandiae melvillensis Tiwi Masked Owl, Tiwi Islands Masked Owl [26049]	Endangered	Species or species habitat known to occur within area
Frogs		
Uperoleia daviesae Howard River Toadlet, Davies's Toadlet [85375]	Vulnerable	Species or species habitat may occur within area
Mammals		
Antechinus bellus Fawn Antechinus [344]	Vulnerable	Species or species habitat known to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

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
Conilurus penicillatus Brush-tailed Rabbit-rat, Brush-tailed Tree-rat, Pakooma [132]	Vulnerable	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 hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat may occur within area
Isoodon auratus auratus Golden Bandicoot (mainland) [66665]	Vulnerable	Species or species habitat likely to occur within area
Isoodon auratus barrowensis Golden Bandicoot (Barrow Island) [66666]	Vulnerable	Translocated population known to occur within area
Lagorchestes conspicillatus conspicillatus Spectacled Hare-wallaby (Barrow Island) [66661]	Vulnerable	Translocated population 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
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat known to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat known to occur within area
Mesembriomys gouldii gouldii Black-footed Tree-rat (Kimberley and mainland Northern Territory), Djintamoonga, Manbul [87618]	Endangered	Species or species habitat known to occur within area
Mesembriomys gouldii melvillensis Black-footed Tree-rat (Melville Island) [87619]	Vulnerable	Species or species habitat known to occur within area
Petrogale concinna canescens Nabarlek (Top End) [87606]	Endangered	Species or species habitat may occur within area
Petrogale concinna monastria Nabarlek (Kimberley) [87607]	Endangered	Species or species habitat known to occur within area
Phascogale pirata Northern Brush-tailed Phascogale [82954]	Vulnerable	Species or species habitat known to occur within area
Phascogale tapoatafa kimberleyensis Kimberley brush-tailed phascogale, Brush-tailed Phascogale (Kimberley) [88453]	Vulnerable	Species or species habitat known to occur within area
Pteropus natalis Christmas Island Flying-fox, Christmas Island Fruit-bat [87611]	Critically Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat likely to occur within area
Sminthopsis butleri Butler's Dunnart [302]	Vulnerable	Species or species habitat known to occur within area
Trichosurus vulpecula arnhemensis Northern Brushtail Possum [83091]	Vulnerable	Species or species habitat known to occur within area
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat known to occur within area
Plants		
Asplenium listeri Christmas Island Spleenwort [65865]	Critically Endangered	Species or species habitat known to occur within area
Burmannia sp. Bathurst Island (R.Fensham 1021) [82017]	Endangered	Species or species habitat likely to occur within area
Eucalyptus ceracea Seppelt Range Gum [3889]	Vulnerable	Species or species habitat known to occur within area
Hoya australis subsp. oramicola a vine [55436]	Vulnerable	Species or species habitat known to occur within area
Mitrella tiwiensis a vine [82029]	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
Seringia exastia Fringed Fire-bush [88920]	Critically Endangered	Species or species habitat known to occur within area
Tectaria devexa [14767]	Endangered	Species or species habitat likely to occur within area
Typhonium jonesii a herb [62412]	Endangered	Species or species habitat known to occur within area
Typhonium mirabile a herb [79227]	Endangered	Species or species habitat known to occur within area
Xylopia monosperma a shrub [82030]	Endangered	Species or species habitat known to occur within area
Reptiles		
Acanthophis hawkei Plains Death Adder [83821]	Vulnerable	Species or species habitat likely to occur within area
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

Name	Status	Type of Presence
		within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour 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
Cryptoblepharus gurrmul Arafura Snake-eyed Skink [83106]	Endangered	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
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding 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
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	Species or species habitat may occur within area
Glyphis garricki Northern River Shark, New Guinea River Shark [82454]	Endangered	Breeding likely to occur within area
Glyphis glyphis Speartooth Shark [82453]	Critically Endangered	Species or species habitat 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

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]		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
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
Onychoprion anaethetus		
Bridled Tern [82845]		Breeding known to occur within area
Phaethon lepturus		
White-tailed Tropicbird [1014]		Breeding known to occur within area
Phaethon rubricauda		
Red-tailed Tropicbird [994]		Breeding known to occur within area
Sterna dougallii		
Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons		
Little Tern [82849]		Breeding known to occur within area
Sula dactylatra		
Masked Booby [1021]		Breeding known to occur within area
Sula leucogaster		
Brown Booby [1022]		Breeding known to occur within area
Sula sula		
Red-footed Booby [1023]		Breeding known to occur within area
Thalassarche carteri		
Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat may occur within area
Migratory Marine Species		
Anoxypristis cuspidata		
Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour 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
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur

Name	Threatened	Type of Presence
		within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	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]		Breeding 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
Rhipidura rufifrons Rufous Fantail [592]		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 within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
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]		Foraging, feeding or related behaviour known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Foraging, feeding or related behaviour known to occur within area
Charadrius dubius Little Ringed Plover [896]		Foraging, feeding or related behaviour known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Foraging, feeding or related behaviour known 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]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area

Name	Threatened	Type of Presence
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius 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 Greater 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]		Foraging, feeding or related behaviour known to occur within area
Tringa incana Wandering Tattler [831]		Foraging, feeding or related behaviour 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 - Australian Government Solicitor
Commonwealth Land - Christmas Island National Park
Commonwealth Land - Pulu Keeling National Park
Defence - MT GOODWIN RADAR SITE
Defence - NORFORCE DEPOT - DERBY
Defence - QUAIL ISLAND BOMBING RANGE
Defence - YAMPI SOUND TRAINING AREA

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		

Name	State	Status
Ashmore Reef National Nature Reserve	EXT	Listed place
Christmas Island Natural Areas	EXT	Listed place
Mermaid Reef - Rowley Shoals	WA	Listed place
North Keeling Island	EXT	Listed place
Scott Reef and Surrounds - Commonwealth Area	EXT	Listed place
Yampi Defence Area	WA	Listed place
Indigenous		
Boulder Hill West Area	WA	Within listed place
Oombalai Area	WA	Within listed place
Historic		
Administration Building Forecourt	EXT	Listed place
Administrators House Precinct	EXT	Listed place
Bungalow 702	EXT	Listed place
Captain Ballards Grave	EXT	Listed place
Direction Island (DI) Houses	EXT	Listed place
Drumsite Industrial Area	EXT	Listed place
Early Settlers Graves	EXT	Listed place
Government House	EXT	Listed place
Home Island Cemetery	EXT	Listed place
Home Island Foreshore	EXT	Listed place
Home Island Industrial Precinct	EXT	Listed place
Industrial and Administrative Group	EXT	Listed place
Malay Kampong Group	EXT	Listed place
Malay Kampong Precinct	EXT	Listed place
Oceania House and Surrounds	EXT	Listed place
Old Co-op Shop (Canteen)	EXT	Listed place
Phosphate Hill Historic Area	EXT	Listed place
Poon Saan Group	EXT	Listed place
Qantas Huts (former)	EXT	Listed place
RAAF Memorial	EXT	Listed place
Settlement Christmas Island	EXT	Listed place
Six Inch Guns	EXT	Listed place
Slipway and Tank	EXT	Listed place
South Point Settlement Remains	EXT	Listed place
Type 2 Residences	EXT	Listed place
Type T Houses Precinct	EXT	Listed place
West Island Elevated Houses	EXT	Listed place
West Island Housing Precinct	EXT	Listed place
West Island Mosque	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
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur

Name	Threatened	Type of Presence
		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]		Foraging, feeding or related behaviour 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
Charadrius bicinctus Double-banded Plover [895]		Foraging, feeding or related behaviour known to occur within area
Charadrius dubius Little Ringed Plover [896]		Foraging, feeding or related behaviour known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius 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
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

Name	Threatened	Type of Presence
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Breeding known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Foraging, feeding or related behaviour known 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
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Heteroscelus incanus Wandering Tattler [59547]		Foraging, feeding or related behaviour 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
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat 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

Name	Threatened	Type of Presence
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
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat 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	Species or species habitat known to occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat may occur within area
Puffinus pacificus Wedge-tailed Shearwater [1027]		Breeding known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat 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

Name	Threatened	Type of Presence
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	Species or species habitat may occur within area
Tringa glareola Wood Sandpiper [829]		Foraging, feeding or related behaviour 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 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 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

Name	Threatened	Type of Presence
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 cinctus Girdled Pipefish [66214]		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

Name	Threatened	Type of Presence
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
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 parvicarinatus Short-keel Pipefish, Short-keeled Pipefish [66230]		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 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
Micrognathus brevirostris thorntail Pipefish, Thorn-tailed Pipefish [66254]		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]		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 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

Name	Threatened	Type of Presence
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnstone's Crocodile [1773]		Species or species habitat may 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 inornatus Plain Seasnake [1107]		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

Name	Threatened	Type of Presence
		area
Hydrophis pacificus Large-headed Seasnake, Pacific Seasnake [1112]		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	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Parahydrophis mertoni Northern Mangrove Seasnake [1090]		Species or species habitat may occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat 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
Indopacetus pacificus Longman's Beaked Whale [72]		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]		Breeding known to occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon ginkgodens Gingko-toothed Beaked Whale, Gingko-toothed Whale, Gingko Beaked Whale [59564]		Species or species habitat may occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding 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

Name	Status	Type of Presence
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)
Pulu Keeling	EXT	National Park (Commonwealth)

Australian Marine Parks [Resource Information]

Name	Label
Arafura	Multiple Use Zone (IUCN VI)
Arafura	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)
Cartier Island	Sanctuary Zone (IUCN Ia)
Christmas Island	Habitat Protection Zone (IUCN IV)
Christmas Island	National Park Zone (IUCN II)
Cocos (Keeling) Islands	Habitat Protection Zone (IUCN IV)
Cocos (Keeling) Islands	National Park Zone (IUCN II)
Eighty Mile Beach	Multiple Use Zone (IUCN VI)
Gascoyne	Multiple Use Zone (IUCN VI)
Joseph Bonaparte Gulf	Multiple Use Zone (IUCN VI)
Joseph Bonaparte Gulf	Special Purpose Zone (IUCN VI)
Kimberley	Habitat Protection Zone (IUCN IV)
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)
Oceanic Shoals	Habitat Protection Zone (IUCN IV)
Oceanic Shoals	Multiple Use Zone (IUCN VI)
Oceanic Shoals	National Park Zone (IUCN II)
Oceanic Shoals	Special Purpose Zone (Trawl) (IUCN VI)
Roebuck	Multiple Use Zone (IUCN VI)

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Adele Island	WA
Balanggarra	WA
Bardi Jawi	WA
Bedout Island	WA
Browse Island	WA
Channel Point	NT
Coulomb Point	WA
Dambimangari	WA
Garig Gunak Barlu	NT
Jinmarnkur	WA
Jinmarnkur Kulja	WA
Karajarri	WA
Lacepede Islands	WA
Lawley River	WA
Lesueur Island	WA
Low Rocks	WA
Marri-Jabin (Thamurrurr - Stage 1)	NT
Mitchell River	WA

Name	State
Montebello Islands	WA
Niiwalarra Islands	WA
Prince Regent	WA
Swan Island	WA
Tanner Island	WA
Unnamed WA28968	WA
Unnamed WA37168	WA
Unnamed WA40828	WA
Unnamed WA41080	WA
Unnamed WA41775	WA
Unnamed WA44669	WA
Unnamed WA44672	WA
Unnamed WA44673	WA
Unnamed WA44677	WA
Unnamed WA51162	WA
Unnamed WA51932	WA
Unnamed WA52354	WA
Unnamed WA53015	WA
Uunguu	WA
Yampi	WA
Yawuru	WA

Invasive Species

[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Gallus gallus Red Junglefowl, Feral Chicken, Domestic Fowl [917]		Species or species habitat likely to occur within area
Gallus varius Green Junglefowl [81207]		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 montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		

Name	Status	Type of Presence
Bos javanicus Banteng, Bali Cattle [15]		Species or species habitat likely to occur within area
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Bubalus bubalis Water Buffalo, Swamp Buffalo [1]		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
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
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Rattus exulans Pacific Rat, Polynesian Rat [79]		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
Brachiaria mutica Para Grass [5879]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Cylindropuntia spp. Prickly Pears [85131]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Hymenachne amplexicaulis Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass [31754]		Species or species habitat likely to 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
Mimosa pigra Mimosa, Giant Mimosa, Giant Sensitive Plant, ThornySensitive Plant, Black Mimosa, Catclaw Mimosa, Bashful Plant [11223]		Species or species habitat likely to 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
Pennisetum polystachyon Mission Grass, Perennial Mission Grass, Missiongrass, Feathery Pennisetum, Feather Pennisetum, Thin Napier Grass, West Indian Pennisetum, Blue Buffel Grass [21194]		Species or species habitat likely to occur within area
Prosopis spp. Mesquite, Algaroba [68407]		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
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
Lepidodactylus lugubris Mourning Gecko [1712]		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 known to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
"The Dales", Christmas Island	EXT
Ashmore Reef	EXT
Big Springs	WA

Name	State
Bunda-Bunda Mound Springs	WA
Cobourg Peninsula System	NT
Finniss Floodplain and Fog Bay Systems	NT
Hosine's Spring, Christmas Island	EXT
Mermaid Reef	EXT
Mitchell River System	WA
Prince Regent River System	WA
Pulu Keeling National Park	EXT
Willie Creek Wetlands	WA
Yampi Sound Training Area	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
Carbonate bank and terrace system of the Van	North
Pinnacles of the Bonaparte Basin	North
Shelf break and slope of the Arafura Shelf	North
Tributary Canyons of the Arafura Depression	North
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
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

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-21.59970093 113.6600037,-16.48959923 106.0490036,-12.65480042 96.3927002,-11.81809998 96.32299805,-8.715439796 98.44960022,-8.087920189 102.5630035,-7.935939789 108.5599976,-8.331959724 110.3399963,-8.571990013 117.3779984,-8.30945015 119.5130005,-8.703029633 120.7900009,-8.24341011 123.814003,-8.086230278 124.0849991,-7.664140224 125.1419983,-7.151470184 125.7450027,-7.12541008 127.1719971,-6.425720215 129.3139954,-6.482830048 131.4129944,-6.725580215 132.1130066,-7.296760082 132.3840027,-9.36841011 133.1820068,-11.18449974 133.1519928,-11.78050041 131.6699982,-12.10639954 131.0780029,-12.47130013 130.4830017,-12.62769985 130.4170074,-12.65799999 130.371994,-12.66110039 130.3370056,-12.91909981 130.2030029,-12.96170044 130.1759949,-13.0703001 130.1649933,-13.18589973 130.1430054,-13.58100033 129.9149933,-13.88580036 129.6799927,-14.2887001 129.0599976,-14.36030006 127.7929993,-14.21140003 126.8509979,-14.87629986 125.5999985,-17.4368 123.7539978,-16.49729919 122.8219986,-16.83379936 122.4029999,-18.23220062 122.151001,-19.38780022 121.336998,-19.80730057 119.387001,-19.68239975 117.5250015,-21.28389931 114.0459976,-21.59970093 113.6600037

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-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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A.2 EPBC-listed species risk evaluation table

This table was developed by:

- Searching the Species Profile and Threats Database (SPRAT) (http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl) for every species identified in the EPBC Act Protected Matters search related to this EP.
- Through the SPRAT database, identifying the relevant conservation management documents.
- Determining the relevant aspects/threats from the conservation management documents related to the activity
- Listing where the aspect/threat has been addressed in the EP.

Fauna Type	Conservation management documents	Summary of relevant aspects/threats identified from conservation management documents	Summary of relevant actions from conservation management documents	Relevant exposure / risk evaluation section of EP
EPBC-listed fishes and sharks	Whale shark management. 2013. Wildlife management program no. 57. Department of Parks and Wildlife. State of Western Australia. Threatened Species Scientific Committee. 2015. Approved Conservation Advice for *Rhincodon typus* (whale shark). Commonwealth of Australia. Department of Sustainability, Environment, Water, Population and Communities. 2013. Recovery Plan for the White Shark (*Carcharodon carcharias*). Commonwealth of Australia. Threatened Species Scientific Committee. 2014. Approved Conservation Advice for *Glyphis garricki* (northern river shark). Commonwealth of Australia. Threatened Species Scientific Committee. 2009. Commonwealth Conservation Advice on *Pristis clavata* (dwarf sawfish). Commonwealth of Australia. Threatened Species Scientific Committee. 2008. Approved Conservation Advice for *Pristis zijsron* (green sawfish). Commonwealth of Australia. Department of the Environment. 2015. Sawfish and River Sharks - Multispecies Recovery Plan. Commonwealth of Australia. Department of Environment and Energy. 2018. Threat abatement plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans. Commonwealth of Australia. Department of Sustainability, Environment, Water, Population and Communities (DSEWPac). 2012. Marine bioregional plan for the North-west Marine Region. DSEWPac, Canberra, ACT. Department of Sustainability, Environment, Water, Population and Communities (DSEWPac). 2012. Marine bioregional plan for the North Marine Region. DSEWPac, Canberra, ACT. Threatened Species Scientific Committee. 2014. Approved Conservation Advice for *Glyphis glyphis* (speartooth shark). Commonwealth of Australia. Department of the Environment. 2014. Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*).	• Waste / marine debris • Noise and vibration • Introduced Marine Species • Vessel strike • Benthic habitat degradation / seabed disturbance • Emissions and discharges • Oil spill	• Identify populations and areas of high conservation priority (sawfishes). • Ensure there is no anthropogenic disturbance / implement measures to reduce adverse impacts of habitat degradation and/or modification (northern river shark). • Ensure all future developments will not significantly impact upon sawfish and river shark habitats critical to the survival of the species or impede upon the migration of individual sawfish or river sharks. Implement measures to reduce adverse impacts of habitat degradation and/or modification. • Review and assess the potential threat of introduced species, pathogens and pollutants. • Minimise offshore developments and transit time of large vessels in areas close to marine features likely to correlate with whale shark aggregations (Ningaloo Reef,) and along the northward migration route that follows the northern WA coastline along the 200 m isobath. • Contribute to the long-term prevention of the incidence of harmful marine debris.	• EP Section 7.2 – Waste management • EP Section 7.3 - Noise and vibration • EP Section 7.4.1 - Introduction of invasive marine species • EP Section 7.4.2 - Interaction with marine fauna • EP Section 7.5 - Seabed disturbance • EP Section 7.1.3 - Routine discharges • EP Section 8 - Emergency conditions (oil spills).
EPBC-listed marine reptiles	Department of the Environment and Energy 2017. Recovery Plan for Marine Turtles in Australia, Commonwealth of Australia 2017. Threatened Species Scientific Committee. 2011. Commonwealth Conservation Advice on *Aipysurus apraefrontalis* (Short-nosed Seasnake). Commonwealth of Australia.	• Waste / marine debris • Noise and vibration • Introduced Marine Species • Vessel strike • Benthic habitat degradation / seabed disturbance • Emissions and discharges	• Manage artificial light from onshore and offshore sources to ensure biologically important behaviours of nesting adults and dispersing hatchlings can continue.	• EP Section 7.1.1 - Light emissions • EP Section 7.2 – Waste management • EP Section 7.3 - Noise and vibration • EP Section 7.4.1 - Introduction of invasive marine species • EP Section 7.4.2 - Interaction with marine fauna

Fauna Type	Conservation management documents	Summary of relevant aspects/threats identified from conservation management documents	Summary of relevant actions from conservation management documents	Relevant exposure / risk evaluation section of EP
	Threatened Species Scientific Committee. 2011. Commonwealth Conservation Advice on *Aipysurus foliosquama* (Leaf-scaled Seasnake). Commonwealth of Australia. Department of Environment and Energy. 2018. Threat abatement plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans. Commonwealth of Australia. Department of Sustainability, Environment, Water, Population and Communities (DSEWPac). 2012. Marine bioregional plan for the North-west Marine Region. DSEWPac, Canberra, ACT. Department of Sustainability, Environment, Water, Population and Communities (DSEWPac). 2012. Marine bioregional plan for the North Marine Region. DSEWPac, Canberra, ACT. Department of the Environment and Energy. 2020. Light pollution guidelines – National light pollution guidelines for wildlife: Including marine turtles, seabirds and migratory shorebirds. Commonwealth of Australia, Canberra, ACT. Department of the Environment and Energy. 2017. National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Fauna. Commonwealth of Australia, Canberra, ACT.	• Oil spill • Light emissions	• Artificial light within or adjacent to habitat critical to the survival of marine turtles will be managed such that marine turtles are not displaced from these habitats and implementation of best practice light management guidelines for developments adjacent to marine turtle nesting beaches. • Identify the cumulative impact on turtles from multiple sources of onshore and offshore light pollution. • Support retrofitting of lighting at coastal communities and industrial developments, including imposing restrictions around nesting seasons. • Manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical for survival. • Contribute to the reduction in the source of marine debris. • Ensure that spill risk strategies and response programs include management for turtles and their habitats, particularly in reference to slow to recover habitats, e.g. seagrass meadows or corals. • Implement best practices to minimise impacts to turtle health and habitats from chemical discharges. • Identify populations and areas of high conservation priority (sea snakes). • Ensure there is no anthropogenic disturbance / implement measures to reduce adverse impacts of habitat degradation and/or modification (sea snakes). • Increased reporting of vessel collision (a requirement of the EPBC Act). • Reduce risk of collision with cetaceans (and turtles) such as maintaining look out, consider reducing vessel speed and course alterations away from sightings.	• EP Section 7.5 - Seabed disturbance • EP Section 7.1.3 - Routine discharges • EP Section 8 - Emergency conditions (oil spills).
EPBC-listed seabirds and shorebirds	Department of the Environment. 2015. EPBC Act Policy Statement 3.21 - Industry guidelines for avoiding, assessing and mitigating impacts on EPBC listed migratory shorebird species. Department of the Environment. 2015. Wildlife conservation plan for migratory shorebirds. Commonwealth of Australia. Department of the Environment. 2015. Draft referral guideline for 14 birds listed as migratory under the EPBC Act. Commonwealth of Australia. Department of Sustainability, Environment, Water, Population and Communities. 2012. Species group report card - seabirds and migratory shorebirds. Supporting the marine bioregional plan for the North-west Marine Region. Prepared under the Environment Protection and Biodiversity Conservation Act 1999. Commonwealth of Australia.	• Waste / marine debris • Noise and vibration • Introduced Marine Species • Introduced Terrestrial Pests (rodents) • Benthic habitat degradation / seabed disturbance • Emissions and discharges • Oil spill • Light emissions	• Reduce risk of rodents gaining access to key vessels at key ports • Contribute to the long-term prevention of the incidence of harmful marine debris • Identify threats to important (migratory shorebird) habitat and develop conservation measures for managing them. • Avoid degradation of migratory shorebird habitat that may occur through the introduction of exotic species, changes to hydrology or water quality (including toxic inflows), fragmentation of habitat or exposure to litter, pollutants and acid sulphate soils. Minimise human disturbance, a major threat to migratory shorebirds • Best practice waste management should be implemented. •	• EP Section 7.1.1 - Light emissions • EP Section 7.1.2 - Atmospheric emissions • EP Section 7.1.3 - Routine discharges • EP Section 7.2. – Waste management • EP Section 7.3 - Noise and vibration • EP Section 7.4.1 - Introduction of invasive marine species • EP Section 8 - Emergency conditions (oil spills).

Fauna Type	Conservation management documents	Summary of relevant aspects/threats identified from conservation management documents	Summary of relevant actions from conservation management documents	Relevant exposure / risk evaluation section of EP
	Department of the Environment, Water, Heritage and the Arts. 2009. Threat abatement plan to reduce the impacts of exotic rodents on biodiversity on Australian offshore islands of less than 100 000 hectares. Commonwealth of Australia. Department of Environment and Energy. 2018. Threat abatement plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans. Commonwealth of Australia. Department of Sustainability, Environment, Water, Population and Communities (DSEWPac). 2012. Marine bioregional plan for the North-west Marine Region. DSEWPac, Canberra, ACT. Department of Sustainability, Environment, Water, Population and Communities (DSEWPac). 2012. Marine bioregional plan for the North Marine Region. DSEWPac, Canberra, ACT. Threatened Species Scientific Committee. 2016. *Calidris tenuirostris* (Great Knot) Approved Conservation Advice. Commonwealth of Australia. Threatened Species Scientific Committee. 2016. *Calidris canutus* (Red Knot) Approved Conservation Advice. Commonwealth of Australia. Threatened Species Scientific Committee. 2016. *Charadrius leschenaultii* (Greater Sand Plover) Approved Conservation Advice. Commonwealth of Australia. Threatened Species Scientific Committee. 2016. *Charadrius mongolus* (Lesser Sand Plover) Approved Conservation Advice. Commonwealth of Australia. Threatened Species Scientific Committee. 2016. *Fregata andrewsi* (Christmas Island Frigatebird) Approved Conservation Advice. Commonwealth of Australia. Threatened Species Scientific Committee. 2016. *Hypotaenidia philippensis andrewsi* (Buff-banded Rail) Approved Conservation Advice. Commonwealth of Australia. Threatened Species Scientific Committee. 2016. *Limosa lapponica menzbieri* — Northern Siberian Bar-tailed Godwit. Approved Conservation Advice. Commonwealth of Australia. Threatened Species Scientific Committee. 2015. *Calidris ferruginea* (Curlew Sandpiper) Approved Conservation Advice. Commonwealth of Australia. Threatened Species Scientific Committee. 2001. Commonwealth listing advice on *Macronectes giganteus.* Commonwealth of Australia.			

Fauna Type	Conservation management documents	Summary of relevant aspects/threats identified from conservation management documents	Summary of relevant actions from conservation management documents	Relevant exposure / risk evaluation section of EP
	Threatened Species Scientific Committee. 2015. Papasula abbotti — Abbott's Booby. Approved Conservation Advice. Commonwealth of Australia. Department of the Environment. 2015. Conservation advice *Numenius madagascariensis* (eastern curlew). Commonwealth of Australia. Department of the Environment. 2014. Conservation Advice *Phaethon lepturus fulvus* white-tailed tropicbird (Christmas Island) Commonwealth of Australia. Threatened Species Scientific Committee. 2015. *Pterodroma arminjoniana* — Round IslandPetrel. Approved Conservation Advice. Commonwealth of Australia. Threatened Species Scientific Committee. 2015. *Pterodroma mollis* — Soft-plumaged petrel. Approved Conservation Advice. Commonwealth of Australia. Threatened Species Scientific Committee. 2015. Approved Conservation Advice for *Anous tenuirostris melanops* (Australian lesser noddy). Commonwealth of Australia. Threatened Species Scientific Committee. 2002. Commonwealth Listing Advice on *Sterna albifrons sinensis* (Little Tern (western Pacific)). Commonwealth of Australia. Department of Sustainability, Environment, Water, Population and Communities. 2013. Approved Conservation Advice for *Rostratula australis* (Australian painted snipe). Canberra, ACT. Department of Sustainability, Environment, Water, Population and Communities. 2011. Approved Conservation Advice for *Sternula nereis nereis* (Fairy Tern). Canberra, ACT. Department of the Environment and Energy. 2020. Light pollution guidelines – National light pollution guidelines for wildlife: Including marine turtles, seabirds and migratory shorebirds. Commonwealth of Australia, Canberra, ACT. Draft National Recovery Plan for albatrosses and petrels. 2021. Commonwealth of Australia. Department of Sustainability, Environment, Water, Population and Communities. 2011. National recovery plan for threatened albatrosses and giant petrels 2011-2016. Commonwealth of Australia.			
EPBC-listed cetaceans	Department of the Environment. 2015. Conservation Management Plan for the Blue Whales - A Recovery Plan under the Environment Protection and	• Waste / marine debris • Noise and vibration • Introduced Marine Species • Vessel strike	• Ensure all vessel strike incidents are reported in the National Ship Strike Database.	• EP Section 7.1.3 - Routine discharges • EP Section 7.2 – Waste Management • EP Section 7.3 - Noise and Vibration

Fauna Type	Conservation management documents	Summary of relevant aspects/threats identified from conservation management documents	Summary of relevant actions from conservation management documents	Relevant exposure / risk evaluation section of EP
	Biodiversity Conservation Act 1999 (2015-2025). Commonwealth of Australia. Threatened Species Scientific Committee. 2015. Balaenoptera borealis (Sei Whale) Conservation Advice. Commonwealth of Australia. Threatened Species Scientific Committee. 2022. Listing Advice for Megaptera novaeangliae (humpback whale). Commonwealth of Australia. Threatened Species Scientific Committee. 2015. Approved Conservation Advice for Balaenoptera physalus — Fin Whale. Commonwealth of Australia. EPBC Act Regulations 2000. Part 8 Interacting with cetaceans and whale watching. Division 8.1 Interacting with cetaceans. Commonwealth of Australia. Department of Environment and Energy, 2017. Australian National Guidelines for Whale and Dolphin Watching 2017. Commonwealth of Australia. Department of Environment and Energy. 2018. Threat abatement plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans. Commonwealth of Australia. Department of Sustainability, Environment, Water, Population and Communities (DSEWPac). 2012. Marine bioregional plan for the North-west Marine Region. DSEWPac, Canberra, ACT. Department of Sustainability, Environment, Water, Population and Communities (DSEWPac). 2012. Marine bioregional plan for the North Marine Region. DSEWPac, Canberra, ACT. Department of the Environment and Energy. 2017. National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Fauna. Commonwealth of Australia, Canberra, ACT.	• Benthic habitat degradation / seabed disturbance • Emissions and discharges • Oil spill	• Ensure the risk of vessel strikes on blue whales is considered when assessing actions that increase vessel traffic in areas where blue whales occur and, if required, appropriate mitigation measures are implemented. • Protect habitat important to the survival of the species (humpback whales); assess and manage physical disturbance and development activities (such as ship-strike and pollution). • Ensure the risk of vessel strike on humpback whales is considered when assessing actions that increase vessel traffic in areas where humpback whales occur and, if required appropriate mitigation measures are implemented to reduce the risk of vessel strike. • Environmental assessment processes must ensure that existing information about coastal habitat requirements of humpback whales, environmental suitability of coastal locations, historic high use and emerging areas are taken into consideration. • Contribute to the long-term prevention of the incidence of harmful marine debris. • if a whale or dolphin surfaces in the vicinity of a vessel travelling for a purpose other than whale and dolphin watching, take all care necessary to avoid collisions. This may include stopping, slowing down and/or steering away from the animal. • Increased reporting of vessel collision (a requirement of the EPBC Act). • Reduce risk of collision with cetaceans (and turtles) such as maintaining look out, consider reducing vessel speed and course alterations away from sightings.	• EP Section 7.4.1 - Introduction of invasive marine species • EP Section 7.4.2 - Interaction with marine fauna • EP Section 7.5 - Seabed disturbance • EP Section 8 - Emergency conditions (oil spills).

Appendix B-
Stakeholder Consultation Log

	STAKEHOLDER	Date of Correspondence	Type of Correspondence	Summary of Correspondence / Objection / Claim / Query	Attachments	Assessment of Merit
Authorities						
	Australian Border Force (ABF), Broome Office (Cwth)	31/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
	Australian Border Force (ABF), Canberra Office (Cwth)	31/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
	Australian Border Force (ABF), Darwin Office (Cwth)	31/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
	Australian Communications and Media Authority (ACMA) - submarine communication cables	18/02/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
		1/03/2022	Email / Letter from stakeholder	Stakeholder thanked INPEX for opportunity to comment on proposed activity. ACMA outlined that The ACMA regulates the submarine cable regime as set out in Schedule 3A to the Telecommunications Act 1997. ACMA provided a link to website for more information about the work the ACMA does in this area including a map of all international submarine cable landings in Australia. ACMA requested INPEX to note that the project is in the vicinity of the North-West Cable System (SKIRON), a domestic submarine cable owned by Nextgen Networks/Vocus Group. ACMA encouraged INPEX to contact the operator of any submarine cables in the identified waters, if you have not already done so. ACMA encouraged INPEX to to get in contact if further information is needed.	No	Relevant matter - stakeholder has provided information relevant to the petroleum activity and/ or the stakeholders functions, interest or activities. This has been incorporated into Section 4 (Existing Environment) of the EP. The stakeholder raised no concerns or objections regading the activity
		1/03/2022	Email/letter to stakeholder from INPEX	INPEX thanked ACMA for email and guidance. INPEX advised they will initiate necessary consultation with Vocus Communications Group. INPEX requested ACMA to advise if there are any other operators we need to consult with in regards of this specific activity.	No	N/A - consultation sent by INPEX
		7/03/2022	Email / Letter from stakeholder	Stakeholder thanked INPEX for response and for acknowledging to contact Vocus Communications. Stakeholder advised they did not identify any other cables in the vicinity of this activity. Stakeholder encouraged INPEX to obtain all regulatory approvals as required for the project.	No	Not a relevant matter - general correspondence only
	Australian Fisheries Management Authority (AFMA) (Cwth)	31/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
		4/02/2022	Email/letter from stakeholder	Confirmation of reciept. AFMA stated that due to limited resources AFMA is unable to comment on individual proposals, however, it is important to continue consulting with all fishers who have entitlements to fish within the proposed area. This can be done through the relevant fishing industry associations or directly with fishers who hold entitlements in the area.	No	Relevant matter - stakeholder has provided information relevant to the petroleum activity and/ or the stakeholders functions, interest or activities. This has been incorporated into Section 7 (Impact and risk assessment) and Section 9 (Environmental management implementation strategy) of the EP. The stakeholder raised no concerns or objections regading the activity
		8/02/2022	Email/letter from INPEX	INPEX thanked AFMA for response. INPEX confirmed they will consult with fishers who have entitlements to fish within the proposed area.	No	N/A - consultation sent by INPEX
	Australian Hydrographic Office (AHO)- Department of Defence	31/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
		1/02/2022	Email/letter from stakeholder	Confirmation of reciept.	No	N/A - general corrospondence only
	Australian Maritime Safety Authority (AMSA)	28/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
		31/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
		1/02/2022	Email/letter from stakeholder	Confirmation of reciept. AMSA requested INPEX ensure that timely and relevant Maritime Safety Information (MSI) is promulgated for the area and nature of your operations. AMSA advised that to promulgate MSI, INPEX should: 1. Contact the Australian Hydrographic Office at datacentre@hydro.gov.au no less than four weeks before operations, with details relevant to the operations. The AHO will promulgate the appropriate Notice to Mariners (NTM), which will ensure other vessels receive information of your activities. 2. Notify AMSA's Joint Rescue Coordination Centre (JRCC) by e-mail to rccaus@amsa.gov.au (Phone: 1800 641 792 or +61 2 6230 6811) for promulgation of radio-navigation warnings at least 24-48 hours before operations commence. AMSA's JRCC will require the vessel details (including name, callsign and Maritime Mobile Service Identity (MMSI)), satellite communications details (including INMARSAT-C and satellite telephone numbers), area of operation, requested clearance from other vessels and any other information that may contribute to safety at sea. JRCC will also need to be advised when operations start and end. 3. Plan to provide updates to both the Australian Hydrographic Office and the JRCC on progress and, importantly, any changes to the intended operations. AMSA outlined they remind vessels of their obligation to comply with the International Rules for Preventing Collisions at Sea (COLREGs), in particular, the use of appropriate lights and shapes to reflect the nature of your operations (e.g. restricted in the ability to manoeuvre). Vessels should also ensure their navigation status is set correctly in the ship's AIS unit. AMSA informed INPEX that 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. A form for requesting customised information and data is also available via the portal (fees may apply).	No	N/A - general correspondance only
		1/03/2021	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	Relevant matter - stakeholder has provided information relevant to the petroleum activity and/ or the stakeholders functions, interest or activities. This has been incorporated into Section 9 (Environmental management implementation strategy) of the EP. The stakeholder raised no concerns or objections regading the activity

	1/03/2021	Email/letter to stakeholder from INPEX	INPEX followed up with stakeholder to ensure that they received the notification sent on the 28/01/2022.	Yes- activity fact sheet	N/A - consultation sent by INPEX
Australian Petroleum Production and Exploration (APPEA)- Oil Spill Working Group	31/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
	31/01/2022	Email/letter from stakeholder	Confirmation of receipt. Stakeholder thanked INPEX for consultation.	No	Not a relevant matter - general correspondence only
Department of Agriculture, Water and Environment (DAWE) – Biosecurity (Marine Pests) (Vessels, aircraft and personnel) (Cwth)	31/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
	31/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
	31/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
	1/02/2022	Email/letter from stakeholder	Response received. Stakeholder thanked INPEX for advice. Stakeholder requested INPEX ensure all operators of vessels involved with the exploration activities contact the department to ensure they are aware of biosecurity requirements, particularly when interacting with any Australian domestic conveyance (helicopters and supply vessels).	No	Relevant matter - stakeholder has provided information relevant to the petroleum activity and/ or the stakeholders functions, interest or activities. This has been incorporated into Section 7 (Impact and risk assessment) and Section 9 (Environmental management implementation strategy) of the EP. The stakeholder raised no concerns or objections regading the activity.
	1/02/2022	Email/letter to stakeholder from INPEX	INPEX noted operators of vessels involved will receive guidance prior start of the exploration activities to contact the department to ensure they are aware of biosecurity requirements.	No	N/A - consultation sent by INPEX
Department of Biodiversity Conservation and Attractions (DBCA) - Environmental Management Branch (WA)	27/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that are not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
	28/02/2022	Email/letter from stakeholder	DBCA thanked INPEX for providing notification. DBCA provided the following comments on matters relevant to the DBCA's Conservation and Land Management Act 1984 and Biodiversity Conservation Act 2016 related responsibilities. Browse Island Nature Reserve (R 22697) is located in the vicinity of the proposed operations. This reserve is an ecologically important area, providing habitat for a range of seabirds and a significant nesting site for green turtles (Chelonia mydas), which are protected under the Biodiversity Conservation Act 2016 (ranked vulnerable). Based on the information provided it, appears that there is potential for the area to be affected by INPEX's operations if there is a substantial hydrocarbon release and subject to particular weather or other environmental conditions. Given the ecological value of Browse Island, it is considered important that the baseline values and state of the potentially affected environment are appropriately understood and documented prior to any operations commencing that have the potential to lead to hydrocarbon releases. DBCA would like to have confidence that INPEX has established appropriate baseline survey data on the current state of areas supporting important ecological values and any current contamination, if present within the area of the potential impact of hydrocarbon releases, as identified through INPEX's modelling. Following a desktop review and risk assessment, INPEX should also collect appropriate baseline abundance and distribution data for benthic habitat and marine fauna species in the area of potential impact, including information on the key habitats used by threatened and specially protected fauna for activities like foraging, breeding and aggregating. If baseline information is not available, INPEX should thoroughly assess what baseline information is required commensurate with the level of risk associated with the proposed activities and identify suitable sources/methods to attain that information such that INPEX can ensure that any impacts on ecological values and recovery of these values can be clearly identified, monitored and remediated. DBCA undertakes monitoring in marine and terrestrial parks and reserves and publishes monitoring reports which are available on the department's website. However, INPEX should be aware that this monitoring is targeted to inform DBCA's values and objectives relating to reserve management and is not necessarily suitable to provide all baseline information required for oil spill risk assessment and management planning. DBCA encourages INPEX to acquire the necessary information to implement a Before-After, Control-Impact (BACI) framework in planning and evaluating its management response. This may include independently monitoring and collecting data where required or identifying other data sources. In developing its Environment Plan, DBCA also recommends that INPEX refer to the Commonwealth Department of Agriculture, Water and the Environment's National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds as a best-practice industry standard for managing potential impacts of light pollution on marine fauna In the event of a hydrocarbon release, it is requested that INPEX notify DBCA's Kimberley regional office as soon as practicable and provided a contact number. Note that DBCA will not implement an oiled wildlife management response on behalf of a petroleum operator except as part of a whole of government response mandated by regulatory decision makers, and any advice or assistance from DBCA, at any scale, will occur on a full cost recovery basis. INPEX should also commit to the monitoring and clean-up of any DBCA interests affected by an oil spill in consultation with DBCA. INPEX should refer to the Department of Transport's (DoT) web content regarding marine pollution, and the Offshore Petroleum Industry Guidance Note of September 2018 titled Marine Oil Pollution: Response and Consultation Arrangements. These documents provide information on the Western Australian emergency management arrangements for marine oil pollution incidents in State waters, petroleum titleholders' obligations under those arrangements, and the DoT's expectations as the jurisdictional authority for such incidences. DBCA encouraged INPEX to contact DBCA if they wish to discuss or seek clarification on the above. DBCA provided contact details (email) for INPEX to continue to provide all future notifications to.	No	Relevant matter - stakeholder has provided information relevant to the petroleum activity and/ or the stakeholders functions, interest or activities. This has been incorporated into Section 4 (Existing Environment), Section 7 (Impact and Risk Assessment), Section 8 (Emergency Conditions) and Section 9 (Environmental Management Implementation Strategy) of the EP. The stakeholder raised no concerns or objections regading the activity.
	28/02/2022	Email/letter to stakeholder from INPEX	INPEX thanked DBCA for feedback and provided the following response: **Topic 1** – baseline data In 2014, a tri-party agreement known as the Applied Research Program (ARP) between INPEX, Shell and Australian Institute of Marine Science (AIMS) was signed specifically for the collection of baseline data to ensure sufficient data was available to quantify potential impacts should a significant hydrocarbon release occur. Over a six year period AIMS and its specialist subcontractors (Commonwealth Scientific and Industrial Research Organisation, Curtin University, Monash University, University of Western Australia, ChemCentre) undertook desktop reviews as well as designed and executed baseline monitoring programs specifically for assessing potential impacts of hydrocarbons, should a spill occur. This included more 20 field surveys to a range of ecological important areas such as Browse Island, Lacepede Islands, Adele Islands, Echuca Shoal and Heywood Shoal. The baseline data collected by the ARP will be referred to in the Environment Plan for this activity. Since 2014 INPEX has maintained an Operational and Scientific Monitoring Program (OSMP) contract for its activities in the Browse Basin. This contract allows for the rapid deployment of scientific personnel to undertake a range of monitoring programs. Monitoring programs include: · Oil spill surveillance and trajectory modelling · Water and sediment quality, including ecotoxicity · Shoreline and intertidal benthos · Subtidal benthos · Plankton · Seabirds and shorebirds · Non-avian megafauna · Commercial, traditional and recreational fisheries	No	N/A - consultation sent by INPEX

				Under the OSMP contract, a suite of method statements have been developed that identify methods and techniques that may be used in the event of a hydrocarbon spill to monitor hydrocarbons and detect potential impacts. However it is worth noting exact methods and program designs will be dependent on the nature and scale of the spill. Objectives, activation and termination criteria for each OSMP will be described detailed in Oil Pollution Emergency Plan (OPEP). The OPEP will also contain details of INPEX's other standby service arrangements including oil spill clean up and oiled wildlife response. Given the proximity to Browse Island, INPEX in consultation with WA DoT has also developed the Browse Island Oil Spill Incident Management Guide (Browse Island IMG). The Browse Island IMG includes assessment of response activities on the island and responsibilities for a cross jurisdictional response with WA DoT, as WA DoT are the control agency for responses in state waters (e.g. Browse Island). **Topic 2** – Light pollution guideline INPEX has considered the guideline in the EP and makes reference to them in the ALARP assessments of light emissions in relation to marine fauna. **Topic 3** – Notification process and oiled wildlife response INPEX will include the DBCA Kimberley office phone number on the INPEX Australia Emergency contacts list. INPEX will include this notification requirement within the Notifications section of INPEX's OPEP for this activity In INPEX's OPEPs, it is acknowledged that any spill/impact to WA waters/shorelines is managed under the WA State Hazard Plan – Maritime Environmental Emergencies, with the WA DoT currently nominated as the Control Agency. Therefore, any DBCA involvement in oiled wildlife response within WA waters/shorelines will only be under the direction of the WA DoT, as Control Agency. As required under the OPGGS Act and associated regulations, INPEX maintains financial assurance against oil spill events, ensuring adequate cost-recovery associated with oil spill response. INPEX includes monitoring of impacts, and determination of secondary response actions including shoreline clean-up and oiled wildlife response, and ongoing scientific monitoring post response termination, as part of all INPEX OPEPs. This includes all potentially impacted WA waters/shorelines, including all DBCA interests. INPEX encouraged DBCA to respond if clarification is needed in regard to the above matters.		
	Department of Defence - Northern Command (DoD)	8/03/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 8 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
	Department of Industry, Science, Energy and Resources (DISER)	31/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
	NT Department of Infrastructure, Planning and Logistics - Transport - Marine Safety Branch (DIPL)	28/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
	Department of Infrastructure, Transport, Regional Development and Communications (Cwlth)	31/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
	Department of Mines, Industry Regulation and Safety (DMIRS) (WA)	31/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
		31/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
		10/02/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
		16/02/2022	Email/letter from stakeholder	Acknowledgement of reciept. DMIRS noted that the proposed activity will be assessed under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 and regulated by the National Offshore Petroleum Safety and Environmental Management Authority. DMIRS reviewed the notification and does not require any further information at this stage. DMIRS requested INPEX: 1. provide a pre-start notification confirming the start date of the proposed activity and a cessation notification to inform DMIRS upon completion of the activity. 2. ensure the environment plan includes information about the reporting of environmental incidents that could potentially impact on any land or water in State jurisdiction, including that any notifications or reports are to be sent to DMIRS DMIRS provided contact details for stakeholder correspondence for any future proposed Commonwealth petroleum activities that could potentially impact on any land or water in State jurisdictio be submitted to for consideration.	No	Relevant matter - stakeholder has provided information relevant to the petroleum activity and/ or the stakeholders functions, interest or activities. This has been incorporated into Section 7 (Impact and risk assessment) and Section 9 (Environmental management implementation strategy) of the EP. The stakeholder raised no concerns or objections regading the activity
	Department of Primary Industries and Regional Development (DPIRD) - Aquatic Environment Section (WA)	28/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -biosecurity management which is consistent with ongoing operation that INPEX consulted closely with DPIRD on. INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that are not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet & location map	
	Department of Primary Industries and Regional Development (DPIRD) - Biosecurity section formerly Department of Fisheries (DoAWE)	27/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -biosecurity management which is consistent with ongoing operation that INPEX consulted closely with DPIRD on. INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that are not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet & location map	N/A - consultation sent by INPEX
	Department of Transport (WA DoT) – Marine Safety	28/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX

		31/01/2022	Email/letter from stakeholder	Response received. WA DoT requested that if there is a risk of a spill impacting State waters from the activity, that the Department of Transport be consulted as outlined in the Department of Transport Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (July 2020), and provided a link.	No	Relevant matter - stakeholder has provided information relevant to the petroleum activity and/ or the stakeholders functions, interest or activities. This has been incorporated into Section 7 (Impact and Risk Assessment), Section 8 (Emergency Conditions) and Section 9 (Environmental Management Implementation Strategy) of the EP. The WA DoT requirement is captured in the BROPEP stakeholder notification table and other various cross-jurisdiction sections, already submitted to NOPSEMA The stakeholder raised no concerns or objection regarding the activity
	Department of Water and Environmental Regulation (DWER) Hazard Management Branch Contaminated Sites Branch	28/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
	Kimberley Ports Authority (KPA)	28/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
		4/02/2022	Email/letter from stakeholder	Response received. Stakeholder thanked INPEX for the information. Stakeholder advised they will provide the the best possible support to your operations out of the Port of Broome and fully support INPEX's offshore exploration drilling.	No	Not a relevant matter - general correspondence only
	Office of the Director of National Parks (Cwth)	27/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX outlined that no Australian Marine Park boundaries overlap with the either WA-343-P or WA-285-P and no planned aspects of the activity are expected to impact on values of any Australian Marine Park. INPEX provided a map and table outlining the distance of Australian Marine Parks to the exploration titles. INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that are not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet & location map	N/A - consultation sent by INPEX
		18/03/2022	Email/letter from stakeholder	DNP thanked INPEX for providing the factsheet about INPEX's proposed Browse Basin offshore exploration drilling in WA-285-P and WA-343-P. DNP noted that the planned activities do not overlap any Australian Marine Parks and confirmed there are no authorisation requirements from the DNP. DNP informed INPEX that to assist in the preparation of an EP for petroleum activities that may affect Australian marine parks, NOPSEMA has worked closely with Parks Australia to develop and publish a guidance note that outlines what titleholders need to consider and evaluate. DNP advised that when preparing the EP, INPEX should consider the Australian marine parks and their representativeness. DNP advised that in the context of the management plan objectives and values, INPEX should ensure that the EP: • identifies and manages all impacts and risks on Australian marine park values (including ecosystem values) to an acceptable level and has considered all options to avoid or reduce them to as low as reasonably practicable. • clearly demonstrates that the activity will not be inconsistent with the management plan. DNP advised that the North-west Marine Parks Network Management Plan 2018 (management plan) came into effect on 1 July 2018 and provides further information on values Ashmore Reef, Cartier Island and other Marine Parks located nearby or within potential any potential exposure zones. Australian marine park values are broadly defined into four categories: natural (including ecosystems), cultural, heritage and socio-economic. Information on the values for the marine parks is also located on the Australian Marine Parks Science Atlas. The DNP should be made aware of oil/gas pollution incidences which occur within a marine park or are likely to impact on a marine park as soon as possible. Notification should be provided to the 24 hour Marine Compliance Duty Officer on 0419 293 465. The notification should include: • titleholder details • time and location of the incident (including name of marine park likely to be effected) • proposed response arrangements as per the Oil Pollution Emergency Plan (e.g. dispersant, containment, etc.) • confirmation of providing access to relevant monitoring and evaluation reports when available; and • contact details for the response coordinator. Note that the DNP may request daily or weekly Situation Reports, depending on the scale and severity of the pollution incident.	No	Relevant matter - stakeholder has provided information relevant to the petroleum activity and/ or the stakeholders functions, interest or activities. This has been incorporated into Section 4.3 (Existing environment), Section 7 (Impact and risk assessment), Section 8 (Emergency conditions), Section 9.11.3 (External incident reporting) and the oil/gas notifications included in the BROPEP. The stakeholder raised no concerns or objections regading the activity.
	Shire of Wyndham East Kimberley (SWEK)	31/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
Business						
	Australian Marine Oil Spill Centre (AMOSC)	28/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
	IPB Petroleum	31/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
		10/02/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
	Oil Spill Response Limited (OSRL)	28/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
	RPS Asia-Pacific Applied Science Associates (APASA)	28/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
	Santos	10/02/2022	Email/letter to stakeholder from INPEX	INPEX requested a meeting with stakeholder. Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX

Shell	10/02/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
	10/02/2022	Email/letter from stakeholder	Confirmation of reciept. Stakeholder thanked INPEX for email and notification and advised will circulate internally.	No	N/A - general correspondance only
	1/03/2022	Email/letter from stakeholder	Response received. Stakeholder advised that the feedback received from relevant Shell internal stakeholders is that there are no further comments and no issues with the proposed INPEX Browse Basin offshore exploration drilling WA-285-P and WA-343-P. Stakeholder advised that if any further information is required INPEX shold not hesitate to get in contact.	No	N/A - general correspondance only
	1/03/2022	Email/letter to stakeholder from INPEX	INPEX thanked stakeholder for response.	No	N/A - consultation sent by INPEX
Vocus Communications Group	1/03/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 15 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
Woodside	10/02/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
Willie Creek Pearls	28/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
Maxima Pearls	28/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
Cygnet Bay Pearls	28/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
Paspaley	28/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet	N/A - consultation sent by INPEX
Western Australian Fishing Industry Council (WAFIC) Represents stakeholders in: WA fisheries • Mackerel Managed Fishery • Northern Demersal Scalefish Fishery • West Coast Deep Sea Crustacean Managed Fishery • Northern Shark Fishery • Pearl Oyster Managed Fishery • Kimberley Prawn Managed Fishery • Broome Prawn Managed Fishery • North Coast Shark Fishery Cwth fisheries • North West Slope Trawl Fishery • Western Skipjack Fishery • Western Tuna and Billfish Fisheries	27/01/2022	Email/letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details of proposed Browse Basin offshore exploration drilling activities that INPEX plans to conduct in exploration titles WA-343-P and WA-285-P, offshore north-west Australia between 2023 to 2025. Exploration activities overlap with commercial licences in the area [Northwest Slope Trawl (Commonwealth) fishery and the Northern Demersal Scale Fish (WA)]. The fact sheet summarises the activities including: - the location and schedule of activity -a description of the exploration drilling activities -safety exclusion zones in place during the conduct of the activities; and -environmental management approaches INPEX requested that stakeholders provide feedback or queries regarding the proposed activities by 1 March 2022. INPEX requested that the stakeholder advise INPEX of any provided information/comments that is not suitable for public disclosure, and advised that such information will be omitted/redacted from the published EP and provided separately and privately to NOPSEMA.	Yes - activity fact sheet & location map	N/A - consultation sent by INPEX
	8/02/2022	Email/letter from stakeholder	WAFIC re-confirmed information INPEX provided to ensure the information gets directly to the target audience.	No	N/A - general corrospondence only
	10/02/2022	Email/letter from stakeholder	WAFIC thanked INPEX for sending through information on the proposed INPEX Browse Basin offshore exploration drilling in WA-285-P and WA-343-P. WAFIC requested, in the event of unplanned discharge incident INPEX confirm the following: -Established baseline scientific data on aquatic organisms and the aquatic environment -Communication strategy and scenario/exercise training that considers the commercial fishing industry in the event of an incident -A draft framework to temporarily close a fishery either via a voluntary process or formally through legislation -Support to the commercial fishing industry with regards to traceability of fish products to manage tainting risks. -A detailed process for post spill scientific monitoring of aquatic organism and aquatic environment -Commitment for financial adjustment to the commercial fishing industry	No	Relevant matter - stakeholder has provided information relevant to the petroleum activity and/ or the stakeholders functions, interest or activities. This has been incorporated into Section 4 (Existing Environment), Section 7 (Impact and Risk Assessment), Section 8 (Emergency Conditions) and Section 9 (Environmental Management Implementation Strategy), of the EP. The stakeholder raised no concerns or objections regading the activity
	23/02/2022	Email/letter to stakeholder from INPEX	INPEX thanked WAFIC for requesting additionl information in relation to unplanned events and advised for WAFIC to let INPEX know if they require further information. INPEX response to WAFIC was as follows: -Baseline environmental studies within the Browse Basin were undertaken by Australian Institute of Marine Science (AIMS) and their research partners (CSIRO, UWA, Curtin University, Monash University, ChemCentre) as part of the Applied Research Program (ARP) over ~6.5 years. The ARP was a $15M research program with nine discrete scopes with an overarching objective of collecting baseline environmental information for the Browse Basin to allow companies to quantitatively assess the impacts of an unplanned spill. One of these scopes specifically focussed on establishing the basis to evaluate the effects of a spill on commercially important demersal fishes. INPEX continues to maintain readiness of Operational and Scientific Monitoring Programs in accordance with the relevant Oil Pollution Emergency Plans, which in the event of a major spill, would be activated to assess impacts (see 5th bullet). -INPEX Incident Management Team and Crisis Management Team conduct various oil spill exercises as part of annual IMT/CMT training. Oil spill exercises consider the risks and impacts associated with potentially affected stakeholders including fisheries, and CMT routinely practice the development of communication strategies / stakeholder engagement plans during events. -INPEX understands that the closure of a fishery would be managed via the relevant State, Territory or Commonwealth agency, responsible for the permits/licences associated with the potentially affected fisheries. There are various oil spill coordination arrangements in place, to manage communication and decision making, between a Petroleum Titleholder and relevant government agencies. The Offshore Petroleum Incident Coordination Committee (OPICC) includes all relevant Federal Government Agencies. The Joint Strategic Coordination Committee (JSCC) includes all relevant Western Australian government agencies. As such, in the event of an oil spill potentially affecting fisheries, decisions (including those regarding affected fisheries) would be made by the OPICC and/or JSCC, in consultation with INPEX. -INPEX's OSMP (which will be referred to for this Activity) includes a Scientific Monitoring program (SM12) to Determine the Impact of the Oil Spill on Commercial, Traditional and Recreational Fisheries, which may include assessment of contamination and tainting in fish products and reproductive impairment, depending on type, nature and scale of the spill.	No	N/A - consultation sent by INPEX
	3/03/2022	Email/letter from stakeholder	WAFIC thanked INPEX for response. WAFIC advised that at this stage they have no further comments regarding the proposal.	No	N/A - General correspondence

Appendix C-
Source Control Capability & Arrangements

INPEX Australia Environment Plans - Source Control Capability and Arrangements

Report

Document No.: D021-AH-REP-70000
Security Classification: Unrestricted

RECORD OF AMENDMENT

Revision	Section	Amendment
1	4.6 (Table 4-5)	Environmental performance standards defining timelines for the capping stack mobilisation to the well location and deployment plan and relief well response model activities have been included as a result of the NOPSEMA assessment of the Offshore Facility (Operation) EP
2	Table 1-1; Table 3-1; 4.2 (Table 4-1); 4.6 (Table 4-4)	Tables revised to include Holonema (WA-285-P) and Bassett Deep (WA-343-P) wells. References provided for Exploration Drilling WA-285-P and WA-343-P EP and Browse Basin Common Relief Well Design and Response Time Models Technical Note
	4.5 (Table 4-2)	Capping stack mobilisation times revised to align with the INPEX Capping Stack Logistics Plan (D020-AD-PRC-10039)

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1 INTRODUCTION

1.1 Purpose

The purpose of this document is to:

- Present a summary of INPEX Australia's exploration and production (E&P) drilling; and operations activities in the Browse Basin.
- Present a summary of the worst credible well blowout scenarios (WCWBS) which could occur from exploration/production drilling activities and from the operation of production wells.
- Provide a detailed source control capability analysis, for the selected WCWBS.
- Define environmental performance outcomes (EPO) and environmental performance standards (EPS) for the source control capabilities and arrangements (preparedness), and the risk assessment of the implementation of the source control capability.
- Provide an implementation strategy for this source control arrangements and risk assessment report, including management of change processes and compliance reporting requirements.
- Ensure INPEX's description of source control capability and arrangements as related to Environment Plans (EP) is appropriately described, in accordance with the requirements of Section 3.1 of the NOPSEMA *Source control planning and procedures* Information Paper (N-04750-IP1979).

1.2 Limitations/out of scope

Current in-force Ichthys Development Drilling Campaign WA-50-L EP (0000-AD-PLN-60003), from which the source control capability and evaluation content is derived.

This document does not include evaluation and response capability/arrangements associated with the following:

- Environmental risk assessment and spill prevention/control
  - The following elements are contained within each activity specific EP:
    - Detailed activity description
    - Activity specific oil spill hazard identification, including potential release rates, volumes, locations, hydrocarbon types etc.
    - Activity specific oil spill modelling, used to inform environmental risk assessment
    - Description and risk assessment of oil spills on environmental values and sensitivities
    - Evaluation of controls to prevent oil pollution from the described activity.
- Oil spill response
  - Oil spill response for all INPEX Australia EPs are managed under the Browse Regional Oil Pollution Emergency Plan (BROPEP) suite of documents

- Operational and scientific monitoring programs (OSMP)
  - The full OSMP capability requirement is addressed within the INPEX Australia Browse Regional Oil Pollution Emergency Plan (BROPEP) (X060-AH-PLN-70009 – Appendix A).

The inter-relationship of this document to other drilling and environmental documentation is presented in Table 1-1.

Table 1-1: Source Control Documentation Overview

Document title	Document number	Purpose
INPEX Australia Environment Plans - Source Control Capability and Arrangements Report (This document)	D021-AH-REP-70000	The EP Source Control Capability and Arrangements Report provides an evaluation of INPEX's source control capability and arrangements required to conduct a successful well-kill for exploration and production wells in the Browse Basin. This document also provides the environmental ALARP and acceptability statements and implementation strategy, to ensure the ongoing demonstration of source control capability and arrangements.
Loss of Well Integrity Response Plan (WIRP)	D021-AD-PLN-70023	The WIRP's objective is to prevent the escalation of any loss of well integrity and reinstate well integrity as soon as practicable. It: • provides an action plan to be taken in the case of a loss of well integrity from a production well; and • identifies and records the required readiness level for the preparation, equipment and services. It describes: – the requirements documented as checklists; and – checklists suitable for both planning and audit.
INPEX Well Operations Management Plans (WOMP): • INPEX Phase 2a WOMP • Holonema (WA-285-P) WOMP • Basset Deep (WA-343-P) WOMP	0000-AD-PLN-60004 D021-A7-PLN-70000 D021-A7-PLN-70001	The WOMP describes the well activities and associated management systems for drilling and completion; suspension; intervention; and inspection maintenance and repair of INPEX production and exploration wells within their respective permit and licence areas.
INPEX Blowout Contingency Plan (BOCP)	D020-AD-PLN-10040	The purpose of the BOCP is to provide a plan for regaining control of a blowout, not blowout prevention. The BOCP specifies how INPEX will respond to a well control event where primary well control has been lost with potential, or real, complications with secondary well control, extending to the worst case scenario of an uncontrolled blowout with significant hydrocarbon release to the environment and loss of assets.

Document title	Document number	Purpose
Source Control Emergency Response Plan (SCERP)	D020-AD-PRC-10036	The SCERP is designed as a subset of the BOCP, to support response preparations to well control emergencies and establish a process for responding to safely managing them using a standard uniform approach. It includes the equipment and procedures to address a range of well control scenarios necessitating immediate mobilisation of intervention equipment and personnel.
INPEX Capping Stack Logistics Plan	D020-AD-PRC-10039	The INPEX Logistics plan describes the mobilisation of the Wild Well Control international (WWCI) capping, debris clearance and dispersant equipment (Source Control Equipment) into Australia from point of origin (Singapore) through end delivery point in Australian waters.
INPEX Environment Plans • Offshore Facility Operations EP • Ichthys Development Drilling Campaign WA-50-L EP (future revision) • Exploration Drilling WA-285-P & WA-343-P EP	 X060-AH-REP-70007 0000-AD-PLN-60003 0021-AD-PLN-70000	All INPEX EPs contain a detailed activity description and activity-specific oil spill scenarios. Specifically, INPEX EPs include the following: • a description of the activity-specific spill scenarios (including the potential well blowout release rates, volumes, locations, hydrocarbon types, etc.) • activity-specific oil spill modelling (used to inform environmental risk assessments) • an assessment of oil spills risks/impacts on environmental values and sensitivities • evaluations of controls to prevent well blowouts.
INPEX Australia - Browse Regional Oil Pollution Emergency Plan (BROPEP) suite of documents, including; • Basis of Design and Field Capability Assessment Report (BROPEP BOD & FCA) • Browse Regional Oil Pollution Emergency Plan – Incident Management Team Capability Assessment Report (BROPEP IMTCA)	X060-AH-REP-70016 X060-AH-REP-70015 X060-AH-PLN-70009	The BROPEP BOD & FCA report evaluates the oil spill field response capability required for all INPEX Australia's offshore petroleum exploration and production activities and associated oil spill risks. The BROPEP IMTCA report defines the required IMT capability needed to implement the field oil spill response. The BROPEP is the response document, used by the IMT, to activate and implement oil spill response capabilities during a spill scenario.

Document title	Document number	Purpose
• Browse Regional Oil Pollution Emergency Plan.		
Browse Basin Common Relief Well Design and Response Time Models Technical Note	0021-AD-TCN-70000	The purpose of the technical note is to document common relief well design including the supporting simulation work as well as the response time models for various INPEX drilling projects.

2 INPEX AUSTRALIA EXPLORATION AND PRODUCTION ACTIVITIES OVERVIEW

INPEX Ichthys Pty Ltd, on behalf of the Ichthys Upstream Unincorporated Joint Venture Participants, is developing the Ichthys Field in the Browse Basin off the north west coast of Western Australia to produce condensate offshore for export to markets in Japan and elsewhere, and export gas for further processing at the Ichthys liquefied natural gas (LNG) plant in Darwin.

Initial development wells were drilled and the Ichthys LNG offshore facilities were installed and commissioned from 2014 through to 2018. The assets commenced production in July 2018 and now routinely ship cargoes of condensate from the FPSO to international customers and send gas to the Darwin plant via the Gas Export Pipeline.

The existing facilities consist of a subsea production system (SPS) (E.g., xmas trees (XT), manifolds, subsea control systems and umbilicals, risers and flowlines (URF), and the gas export riser base (GERB), which connect the wells to the Central Processing Platform (CPF) Ichthys Explorer and Floating Production Storage Offtake – (FPSO) Ichthys Venturer

The CPF/FPSO, GEP and onshore Ichthys LNG plant are collectively referred to as the Ichthys Project.

INPEX Australia's offshore exploration activities are focused on identification of additional petroleum reserves to tie-back into the Ichthys Project, either at the CPF/FPSO, or onto any of the five hot-tap-tees along the length of the GEP, within the Canning, Browse and Bonaparte basins. Therefore, exploration activities, including exploration/appraisal drilling, are generally located within the same geographic area as the Ichthys Project in Commonwealth waters between Broome and Darwin.

3 WORST CREDIBLE WELL BLOWOUT SCENARIOS

To determine source control capability requirements, an evaluation of current INPEX production, and planned exploration wells has been undertaken. A summary of key well data is provided in Table 3-1.

As detailed in Table 3-1, the Plover reservoir has a higher gas flowrate potential than the Brewster reservoir and is therefore the worst-case scenario from a well kill perspective (Wild Well Control 2019).

Table 3-1: Comparison of well-blowout modelling data

Model	Brewster Production Phase 1	Plover Production Drilling Phase 2	Holonema (WA-285-P)	Bassett Deep (WA-343-P)
Release location (coordinates)	13° 52′ 46.2″ S 123° 19′ 3.0″ E Approximately 35 km north west of Browse Island.	13° 54' 17.14" S 123° 09' 53.93" E Approximately 47 km north west of Browse Island.	14° 05′ 35.4″ S 123° 10′ 37.9″ E * Approximately 19 km north west of Browse Island.	13° 22′ 52.4″ S 123° 24′ 02.2″ E Approximately 68 km north of Browse Island.
Oil type	Brewster condensate	Plover condensate	Primary: Brewster condensate	Plover condensate
Reservoir pressure (psia)	6020	6683	6020	7,572
Gas flowrate (MMscf/day)	577	735	577	400
Oil flowrate (m^3/day)	3193	1082	3193	867
Release duration (days)	80	108	80	115
Total release volume (m^3)	255,475	116,856	255,475	99,705
Well bore size - internal diameter (inches)	8.5″	8.5″	8.5″	8.5″
Well blow-out modelling report	C020-AD-TCN-00023	X080-AD-TCN-10084	C020-AD-TCN-00023	0000-AD-TCN-70006

*indicative

4 SOURCE CONTROL CAPABILITY AND ARRANGEMENTS EVALUATION

As described in INPEXs EPs, should a loss of well containment event occur during a drilling activity or from a producing well, a number of source control activities may be implemented depending on the specific circumstances of the loss of well containment.

For a production well, a range of loss of well integrity events are considered within the Loss of Well Integrity Response Plan (WIRP). Tier 1, Tier 2 and Tier 3 category events as described in API RP 754 / IOGP Report 456 are covered by the WIRP. The well intervention based response options covered by the WIRP include:

- relief well and / or capping stack.
- ROV intervention (light and heavy)
- well intervention – light well intervention (LWI) (DP vessel)
- well intervention – emergency disconnect package (EDP) /lower riser package (LRP) (MODU)

Source control activities for Tier 1 and 2 category events are presented in the following section.

4.1 Relief well and capping stack response options

A relief well plan for the INPEX Brewster and Plover wells has been finalised, utilising specific well kill modelling results to complete the relief well design. The modelling considers a number of factors including well geometry, reservoir pressure, temperature, permeability and reservoir fluid properties (as described in Table 3-1).

Depending on the loss of well containment scenario other source control activities may be required to assist in regaining control such as ROV based systems for seabed debris clearance, BOP intervention and/or well capping.

4.2 Summary of relief well analysis

INPEX engaged third-party specialist to undertake a relief well and dynamic well kill study for the Brewster and Plover production wells in WA-50-L (Add Energy 2019) and the exploration well in WA-343-P (Add Energy 2022). The dynamic well kill portion of this study models a blowout rate for given subsurface and well architecture parameters and then models the kill rate for a given kill fluid density required to kill the well.

NORSOK D-010 Rev 5 (Standards Norway, 2021) Section 5.8.1 gives clear guidance on the assumptions to be used during dynamic well kill modelling and these are outlined as follows:

- expected values for reservoir parameters (pore pressure, permeability, porosity, net gross pay, etc.)
- expected top of reservoir depth
- expected productivity index / transient productivity index
- expected fluid type parameters, if oil is expected, but gas cannot be disregarded both cases shall be simulated
- mechanical skin is zero
- no restrictions in the flow path
- planned well design (hole size, casing setting depth, etc.).

The modelling and subsequent analysis of logistical requirements presented in Browse Basin Common Relief Well Design and Response Time Models Technical Note (0021-AD-TCN-70000) has determined the design for and duration, of relief well drilling for a range of Ichthys and non-Ichthys wells in the Browse Basin. These include Ichthys Brewster and Plover wells; standard or normally pressured exploration wells (i.e Holonema); and high pressure and high temperature (HPHT) wells (i.e. Bassett Deep), all with a single well kill achievable in both reservoirs. These durations are summarised and presented in the form of a response time model in Table 4-1, developed in accordance with the Australian Offshore Titleholders Source Control Guideline (APPEA 2021).

Table 4-1: Summary of time response models for Brewster and Plover reservoirs (Browse Basin Common Relief Well Design and Response Time Models Technical Note)

Activity	Brewster reservoir Ichthys (days)	Plover reservoir Ichthys (days)	Exploration standard - Holonema (days)	Exploration (HPHT) - Bassett Deep (days)
Relief well MODU mobilisation	28	28	28	28
Relief well construction	35	63	35	70
Ranging and intercept (incl. kill)	17	17	17	17
Total duration	**80**	**108**	**80**	**115**

The MODU used to drill the relief well will need a NOPSEMA accepted Safety Case Revision (SCR). A total of 28 days has been scheduled for the development, submission and acceptance of the SCR by NOPSEMA. An indicative schedule for the SCR approval is as follows:

- Day 0-1 – MODU(s) identification
- Day 1-2 – SCR development schedule created. Engagement meeting with NOPSEMA held to advise of submission schedule and request all attempts be made to assess SCR as a matter of priority
- Day 2-16 – SCR developed including HAZID with contractor personnel. Partially populated SCR template used as a starting point
- Day 16 – SCR submitted to NOPSEMA
- Day 16-23 – SCR Request For Further Written Information (RFFWI) received
- Day 26 – SCR resubmitted to NOPSEMA
- Day 28 – SCR accepted by NOPSEMA.

INPEX have prepared Scope of Validation templates for both Capping Stack Installation and Relief Well Drilling campaigns.

INPEX tracks the availability of MODUs capable of drilling a relief well on a monthly basis. The register includes whether the vessel currently has a valid Australian safety case and is provided to key source control team members. In addition, on a quarterly basis the latest edition of the register will be reviewed as part of exploration and production drilling EP quarterly risk reviews.

4.3 Relief well supply base capabilities and mud requirements

If required, drilling a relief well will necessitate supporting a MODU and other source control operations. INPEX operates an existing supply base in Broome which has previously supported a two MODU operations during the Phase 1 Ichthys development drilling campaign and will have sufficient arrangements in place for the Phase 2 Ichthys development drilling. At times, INPEX will likely also be supporting other exploration drilling operations in the region at the same time. Broome is now established as a mature oilfield supply centre with at least one liquid mud plant and cement plant in place. If additional resources or lay down area was required, INPEX operates a supply base in Darwin for its production operations which could also be utilised in the event of a source control operation.

Modelling shows that the well is killed relatively quickly (within 45 minutes) and liquid requirements are easily accommodated by typical relief well candidate MODUs operating in the country. Mud/kill fluid will be supplied through the above-mentioned supply bases.

4.4 Summary of capping stack feasibility analysis

High energy gas wells located in relatively shallow water (as seen in the Browse Basin) can present challenges with safe vertical access due to the resulting surface boil and Lower Explosion Limit (LEL) hydrocarbons associated with a well blowout. This in turn can preclude the deployment of a capping stack. This being said, INPEX are a member of a capping stack consortium and have access to a primary 15,000 psi, 18 ¾″ capping stack in Singapore and the equivalent as secondary in Aberdeen. Because of this, INPEX undertook a capping study with the provider of this stack (Wild Well Control 2019).

This study involved computational fluid dynamics modelling to show the behaviour of the stack as it is landed on a flowing well with expected Plover reservoir properties (Plover reservoir has higher gas pressure than Brewster reservoir and is therefore a worst-case scenario). The study found that "the capping stack is able to move through the discharge plume in a controlled manner and can potentially be landed on the wellhead" (Wild Well Control 2019).

The study (Wild Well Control 2019) then looked at the behaviour of the subsea plume as it rises in the water column and then the dispersion of any gas at the sea surface, in order to infer if vertical access is possible. It was determined that with assumed current and wind conditions, the plume would be displaced 50 m downstream of the well centre but the 10% LEL radius extends up to 60 m upwind. This means that, if limited to 10% LEL, the closest a construction vessel could get to the well centre is 10 m. Therefore, deployment of the capping stack could be possible subject to crane capacity on the selected construction vessel.

While direct vertical access has been determined as not possible for the modelled Plover discharge rate, there are influences that would likely reduce the discharge rate and thus enable vertical access. These are outlined as follows:

- The situation may be a drilled kick escalating to blowout meaning less net pay and possibly non-Plover reservoir (being of lower quality)
- There may be wellbore flow restrictions which are likely to occur from:
  - Drill-string remaining in the hole (drilled kick/dropped drill-string) partial closure of BOP due to activation during/after the event from MODU or vessel
  - flowing zone collapse/bridging.

4.5 Assessment of capping stack deployment duration

Opting for capping as the primary means of containment yields a reduction in the time to contain the well. An operational analysis of capping stack mobilisation by air and vessel (sea freight) has been conducted and the options detailed in the INPEX Capping Stack Logistics Plan (D020-AD-PRC-10039). Vessel mobilisation has been assessed as the quickest option and is summarised in Table 4-2 below.

Table 4-2: Deployment of capping stack – vessel freight option

Item	Maximum duration (days)	Comments
Mobilise personnel and equipment	4	Call out to arrival of crew in Singapore warehouse. Mobilise equipment including Fugro ROV skids to Kim Heng.
Source and mobilise construction vessel to Singapore (concurrent operation)	(3)	Typical response time based on market knowledge of suitably rated vessels with Australian Vessel Safety Cases. An appropriate vessel will be identified on INPEX register, updated monthly, tracking the location and availability of HLVs in the SE Asian region.
Stack up and test capping stack in Singapore and ready for load out (concurrent operation)	(3)	Based on capping stack mobilisation schedule stack-up and testing of capping stack in Singapore.

Load out capping stack on to construction vessel from Singapore	3	Based on logistics plan from provider
Transit capping stack directly to licence area	7	Typical sailing time from Singapore to well location with some minor allowance for weather on route.
Deployment of capping stack onto well and shut-in of well	7	Assumes vertical access is possible with an allowance for unfavourable metocean conditions during deployment
Total	**21**	INPEX Capping Stack Logistics Plan (D020-AD-PRC-10039)

Running in parallel with the above timeframe, a SCR for a capping stack deployment vessel would also be developed and submitted to NOPSEMA for acceptance. An indicative schedule for the SCR approval is as follows:

- Day 0-1 – vessel(s) identification
- Day 1-2 – SCR development schedule created. Engagement meeting with NOPSEMA held to advise of submission schedule and request all attempts be made to assess SCR as a matter of priority
- Day 2-12 – SCR developed including HAZID with contractor personnel
- Day 12 – SCR submitted to NOPSEMA
- Day 12-19 – SCR RFFWI received
- Day 21 – SCR resubmitted to NOPSEMA
- Day 22 – SCR accepted by NOPSEMA

INPEX tracks the availability of vessels capable of deploying a capping stack on a monthly basis. The register includes whether the vessel currently has a valid Australian safety case and is provided to key source control team members. In addition, on a quarterly basis the latest edition of the register will be reviewed as part of exploration and production Drilling EP quarterly risk reviews.

4.6 Evaluation of source control capability and arrangements

Table 4-3 presents an evaluation of the applicability of various source control options.

Table 4-4 presents further information regarding the environmental benefits and merit in improving the implementation of source control activities (i.e. implementing controls to a greater extent or within a faster timeframe and associated cost benefit considerations).

Table 4-5 presents the environmental performance outcomes, environmental performance standards and measurement criteria, related to the preparedness and implementation of source control activities.

Table 4-3: Evaluation of applicability of source control response options

Source control response technique	Likelihood of success	Considered for implementation
Site survey	Site survey involves the use a response vessel and ROV to conduct visual/sonar observations, to determine the condition of well and BOP and search for any debris, following the source control event. This information is required, to enable the source control team to conduct detailed planning for all source control activities. A detailed assessment of the logistical resources required to implement this response strategy are described in Table 4-4	Yes
Debris clearance	Debris clearance involves the use of response vessel(s) with cranes/lifting equipment and work-class ROVs, equipped with cutting tools, to cut and relocate/recover debris on the seabed, to enable other response strategies such as BOP intervention, capping stack deployment and mooring a relief well MODU to occur safety. A detailed assessment of the logistical resources required to implement this response strategy are described in Table 4-4	Yes
BOP intervention	BOP intervention involves the use of response vessels and work-class ROVs with tooling to enable an additional hydraulic power source to power some BOP functions. The BOP intervention tooling can be used to attempt to close the shear-rams of the BOP to stop the flow from the well and/or unlatch the Lower Marine Riser Package to allow its removal for the installation of the capping stack. A detailed assessment of the logistical resources required to implement this response strategy are described in Table 4-4	Yes
Capping stack	A capping stack response involves the use of a heavy lift vessel (HLV) to lower and latch the capping stack on the blowing well, to stop the flow from the well. A detailed assessment of the logistical resources required to implement this response strategy are described in Table 4-4	Yes
Capping stack – offset installation equipment	INPEX is aware of new technology developed by Saipem and marketed by Oil Spill Response Limited (OSRL) in the form of Offset Installation Equipment (OIE). The OIE is designed to deploy a capping stack on a blowing well where vertical access is not possible. It is essentially a mobile subsea crane which is used to perform debris clearance and then pick up a capping stack from a subsea parking stand and deploy it, though the discharge plume and on to a blowing well.	No

	INPEX do not believe that the proactive gaining of access to this equipment for the planned operations in WA-50-L is in line with ALARP principles for the following reasons: • Mobilisation: the equipment is stored in Trieste, Italy and is believed to include nearly 170 packages with a shipping weight of 300 t. The carrier itself is 14 m x 13 m x 10 m in dimension and as such, mobilisation can only be undertaken by sea, not by air. Further consideration has been made to assess the possibility of airfreighting the equipment. The equipment would require disassembly in order to be of an appropriate size to travel by aircraft. Disassembly of just the carrier is predicted to result in approximately 43 packages. These would then require to be transported in around 20 aircraft given the size of the packages. On this basis, the potential to airfreight the equipment in order to decrease the mobilisation time from Italy to Australia has been discounted given the time-saving gained by airfreighting is lost due to the additional time required for disassembly and reassembly. Whether by sea or air, the long mobilisation duration erodes the time saving realised by capping relative to a conventional relief well kill. • Deployment mass: the deployment mass is understood to be up to 300 t. This is roughly three times the mass of a 15,000 psi 18 ¾" BOP style capping stack. It is understood that a 400t crane is quoted as the minimum requirement for the installation vessel and it is stated that this is what was used during a field deployment trial. INPEX participated in an OIE workshop with other titleholders in May 2019, and at that time it was stated that the original equipment manufacturer of the OIE identified a minimum 600t crane vessel as being required. It was then noted from a marine advisor participating in the workshop that due to the overturning moment during the deployment of the OIE carrier, significant re-ballasting operations would be required, and this would likely necessitate a much larger vessel to maintain stability during the lift. The crane rating of such a vessel was stated at 900t. Nonetheless, despite the stated true minimum crane rating, it is noted that there are other minimum specifications, notably around the "active/passive anti roll system" and "ballasting capacity sufficient to minimise the installation and recover time of the OIS" which call for a specialised and likely large vessel. This vessel would be more specialised and larger, and thus less readily available than a vessel suitable for a standard capping stack deployment in the case of vertical access being possible. This greatly reduces the number of candidate vessels in the region, let alone those with current Australian Vessel safety cases. Less readily available means a longer response time and a further demonstration that OIE is not ALARP when compared to a relief well kill in the case were vertical access for capping is not possible. • Debris clearance capabilities: it is understood that that OIE can perform some debris clearance tasks, including lifting debris up to 160 t. While this may be sufficient to remove a LMRP from a BOP, it is unclear what capabilities exist for the clearance work prior to this operation including but not limited to the deployment of super shears to sever riser and the like, if required.	

	• Local fabrication: the OIE scope of supply excludes some significant equipment including but not limited to three gravity anchors and a subsea parking stand for the capping stack. It is understood that this fabrication would require up to 500t of steel and it is estimated that even a significant supply hub such as Darwin would struggle with the scale of this fabrication. This may drive the sourcing of this fabrication to a regional hub such as Singapore which could place this fabrication on the critical path and further erode the time saving realised by capping relative to a conventional relief well kill. • Exclusion zone: while theoretically vertical access is not required with OIE, access into 500 m is required for the initial deployment of the carrier and support operations with ROVs during capping operations. With unfavourable metocean conditions and a high energy blowout, even this may be difficult, particularly with at least 5 vessels being required (2 x anchor handers on either side of boil for initial deployment, 1 x survey, 1 x construction, 1 x air supply). Relief well planning performed for WA-50-L has spud locations 2,000 m away from the blowing well centre which is well beyond the downwind/down current extent of 10% LEL radius of 1,100 m. • Localised soil conditions: The unique carbonate shallow soils present in the Browse Basin have posed significant challenges to well structural design to date and it is understood they are out with the acceptable range verified by Saipem as part of the design validation for the OIE anchors. While this does not preclude the use of the OIE, a revised anchor design needs to be generated in order to achieve the required 50 t capacity of each of the three anchors if they are to be deployed in the Browse Basin. • Drag chain contact with seabed: For stability, the carrier requires a drag chain to be in contact with the seabed at all times. Ichthys drill centres are surrounded by a complex array of SPS infrastructure. The transit of the carrier, and its drag chain would need to be carefully evaluated, at the time of the blow-out, to determine if it was safe to attempt to run the drag chain through possible approach corridors without causing additional damage and possible gas/oil releases to the environment, through additional damage to existing subsea infrastructure. These corridors may be incompatible with the prevailing metocean conditions and the resulting surface boil location and geometry, thereby preventing the safe conduct of the activity. • Contractual arrangements: It is understood that OSRL have been unable to negotiate post event contractual terms with Saipem as the Original Equipment Manufacturer of the OIE. Existing contractual agreements only cover training and maintenance of the system however ultimately Saipem would need to operate the system. This is seen to be a significant issue as such contracts would need to be brokered during mobilisation.	

	The OIE is an extremely complex spread of equipment and as outlined above, comes with attendant risks, any of which if realised, may preclude its deployment. Fortunately, the system has not been used to respond to an actual source control event but that makes it, as yet, unproven. Comparing this with a well-established source control method of intersection with a relief well and dynamic well kill, it is seen that the proactive gaining of access to OIE is not ALARP for operations in WA-50-L or other near-by exploration drilling activities.	
Relief well	A relief well can be drilled to intercept the original wellbore close to the reservoir. Kill fluid is then pumped through the relief well into the original well-bore, to provide an overbalance pressure to the reservoir, and stop the flow of hydrocarbons from the well. To conduct the relief well, a MODU with support vessels is required. In addition, extra vessels with additional drilling fluid and pumping equipment may be required, for the well kill activity. Following the well kill, the MODU will use the relief well to isolate and abandon both wells. A detailed assessment of the logistical resources required to implement this response strategy are described in Table 4-4	Yes
Use of relief well injection spool	INPEX is aware of new technology developed by Trendsetter Engineering in the form of the Relief Well Injection Spool (RWIS). The RWIS is a spool piece with side outlets installed below the BOP of the relief well which facilitates the connection of more surface pumping resources. These additional resources can deliver greater kill fluid rates to the relief well. As all WA-50-L development wells can be killed with a single relief well using mud pumping resources available on standard MODUs, the use of the relief well injection spool would not be required.	No
Subsea dispersant injection	SSDI involves the use of an ROV, to inject dispersant directly into the hydrocarbon stream flowing from the damaged well. The outcome of SSDI is a significant increase of entrainment of oil in the water column. By increasing the proportion of hydrocarbons becoming entrained, there will be a reduction in hydrocarbons arriving on the ocean surface, and an associated reduction in hydrocarbons evaporating into the atmosphere. Modelling results (RPS 2019) indicates that under a worst-case blowout scenario, VOC concentrations (from oil evaporating into the atmosphere) are likely to exceed safe exposure thresholds within 1 km of the release location. The workforce onboard vessels conducting source control activities such as BOP intervention, debris clearance and capping stack installation could therefore be exposed to VOCs, and if gas monitoring indicated exposure had exceeded the VOC thresholds, the vessel would be required to cease the activity move out of the area. In effect, VOC exposure may impact the feasibility of debris clearance/capping stack installation and ultimately limit available source control options to drilling a relief well.	Yes

	Modelling results (RPS 2019) also concluded that SSDI would eliminate the risk of VOCs exceeding exposure thresholds. Therefore, the use of SSDI to significantly reduce the VOC risk to source control vessels/workers may contribute to the feasibility of capping stack, instead of a well kill via relief well, which would take several more months to achieve. A detailed assessment of the logistical resources required to implement this response strategy are described in Table 4-4.	

Table 4-4: Source control arrangements and capability evaluation

Source control element	Can a greater response effort be implemented?	Can the time to respond be improved?	Justification for increased response effort/reduced response time
A vessel with an observation or work-class ROV is required to undertake the site survey and record / report visual observations of the well location and surrounding area and will be in Broome within 7 days. The location and availability of support vessels with ROVs will be tracked on a register which is updated on a monthly basis.	Only a single vessel with a single ROV is required for site survey activities. Additional vessels and/or ROV's will not result in any better information being provided to the source control team, to facilitate ongoing source control planning. Therefore, a single vessel and ROV is appropriate.	A support vessel with ROV would be identified from within Australia and would be expected to arrive and commence mobilisation activities in Broome, within 7 days. INPEX's drilling support vessels and Ichthys Field support vessels are not required to be equipped with ROVs. The cost of maintaining a vessel with full ROV spread and ROV crew at all times on a support vessel is estimated to be ~$65,000 a day and not considered ALARP given the cost and many vessels with ROVs can be made available on short notice within the region. Typically, several support vessels with ROVs are located in the NW region, with additional vessels around Australia / SE Asian region capable of completing the site survey. To track and identify capable support vessels and ROVs, the most practicable option is to maintain an up to date register of suitable available support vessels.	No additional site survey response capability required.
A Construction Support Vessel (CSV) with lifting equipment of 150t lifting capacity and work-class ROVs will be utilised, if required, for debris clearance and will be in WA-50-L within 17 days.	Only a single CSV equipped with work class ROVs and lifting equipment rated for 150t is required for debris clearance.	A CSV with lifting equipment rated for approximately 150t with a work-class ROV would be identified and contracted from within Australia or the SE Asian region within 10 days and would arrive in the licence area within 17 days.	No additional debris clearance vessel response capability required.

Source control element	Can a greater response effort be implemented?	Can the time to respond be improved?	Justification for increased response effort/reduced response time
The location and availability of a CSV with suitable lifting equipment and work-class ROVs will be tracked on a register which is updated on a monthly basis. The status of vessel safety cases will also be maintained on the register.		A vessel with a reduced lifting capacity may be used for debris clearance if available and post debris clearance planning using the information presented by the site survey team. Identification and contracting/mobilisation will typically commence when initial source control planning begins. Response time could be improved by maintaining a CSV on stand-by. However, until site survey activities have been conducted and results evaluated by the source control team, it is unknown if debris clearance is even required. Therefore, the large costs of maintaining a CSV on stand-by (~$225,000 per day) are not considered ALARP, especially given CSVs with ROVs can be made available within the region. To ensure the availability, the most practicable option is to maintain an up to date register of suitable, available vessels and their safety case status.	
Debris clearance ROV tooling is required for debris clearance activities. The AMOSC subsea first response tool-kit (SFRT), is located in Perth and will be in Broome within 3 days. Wild Well Control Inc (WWCI) debris clearance equipment is available in	Debris clearance equipment such as drill pipe and riser cutting shears are specifically designed tools for specific tasks, which typically only need to be utilised once during the debris clearance activity. Primary and redundancy equipment is available through the AMOSC and WWCI contracts. There is no benefit to increasing the quantities or capabilities of debris clearance equipment.	Debris clearance equipment will be mobilised when the initial source control planning begins. The AMOSC SFRT can be mobilised, by road to Broome, within 3 days. The WWCI debris clearance equipment can be mobilised by air to Broome within 5 days.	No additional debris clearance tooling capability required.

Source control element	Can a greater response effort be implemented?	Can the time to respond be improved?	Justification for increased response effort/reduced response time
Singapore, with back-up equipment based in the United Kingdom. Primary equipment will be in Broome within 5 days.		The debris clearance tooling will likely arrive in Broome before the debris clearance vessel, and whilst site survey and initial source control planning is still occurring. If the debris clearance vessel is mobilising directly to the licence area, a small charter vessel can rapidly mobilise the debris clearance tooling from Broome to WA-50-L. Therefore, maintaining additional debris clearance equipment in Broome is not considered ALARP.	
Support vessel with work-class ROVs and BOP intervention tooling (hot stabs) are required for the BOP intervention activity. The location and availability of support vessels with work-class ROVs will be tracked on a register which is updated on a monthly basis and a support vessel with work-class ROVs and BOP intervention tooling will be in Broome within 10 days.	Only a single vessel equipped with a work-class ROV is required for BOP intervention. BOP intervention uses standard hot-stabs, routinely used on offshore facilities. This type of tooling is readily available and will be mobilised with the BOP intervention vessel and ROV spread. There is only a single BOP during well drilling, therefore additional vessels and ROVs will provide no benefit to the BOP intervention activity.	A support vessel with work-class ROV will mobilise from within Australia and commence mobilisation activities in Broome (including gas detection system), within 10 days. Depending on the outcome of site survey activities, debris clearance may be required prior to attempting BOP intervention. However, under some circumstances, BOP intervention could occur without debris clearance. Therefore, mobilisation within 10 days is appropriate. If the site survey vessel is using a work-class ROV instead of an observation class ROV, the site survey vessel with work-class ROV would be capable of attempting BOP intervention, eliminating the requirement to mobilise a second vessel. INPEX's drilling support vessels and Ichthys Field support vessels are not required to be equipped with ROVs.	No additional BOP intervention tooling response capability required.

Source control element	Can a greater response effort be implemented?	Can the time to respond be improved?	Justification for increased response effort/reduced response time
		The cost of maintaining a vessel with a work class ROV and ROV crew at all times is estimated to be ~$65,000 a day and is not considered ALARP (given the cost and the availability of vessels with ROVs can be made available on short notice within the region). Typically, several support vessels with work-class ROVs are located in the NW region, with additional vessels around Australia / SE Asian region with the capability of completing a BOP intervention. To ensure the availability, the most practicable option is to maintain an up to date register of suitable, available support vessels.	
Capping stack – primary located in Singapore and secondary in the United Kingdom will be mobilised from Singapore and be available on location within 21 days.	INPEX are a member of a capping stack consortium and have access to a primary 15,000 psi, 18 ¾" capping stack in Singapore and the equivalent as secondary in Aberdeen. INPEX and WWCI have reviewed the capping stack interface with the selected BOP, and have identified the required connections and its availability, and that anticipated pressures are within the operating parameters of the capping stack. INPEX are also conducting a landing study, to plan how to safely lower and latch the capping stack onto the BOP. As there is only a single BOP, only a single capping stack is required.	A breakdown of the individual steps and durations for capping stack mobilisation are provided in Table 4-2 and Table 4-4. An operational assessment and deployment planning study conducted by WWCI, determined a one (1) day difference between air and sea freight logistics options (longer by air). In addition, various uncertainties and risks to schedule were identified with the air freight option including handling restrictions at airports and wharfs. Another significant concern for stack up and testing of the capping stack in Australia is the reduced presence of original equipment manufacturer (OEM) and access to parts.	No additional capping stack response capability required.

Source control element	Can a greater response effort be implemented?	Can the time to respond be improved?	Justification for increased response effort/reduced response time
	As INPEX have access to primary and back-up capping stacks, sufficient redundancy is available, should any issues arise during stack up, testing, mobilisation, deployment and activation of the primary capping stack.	As a result, the capping stack will be stacked up and tested in Singapore due to the established infrastructure and Subject Matter Experts (SMEs) based in Singapore. WWCI conduct an annual stack up of the capping stack capturing lessons learned to improve the preparation time for mobilisation to field.	
A HLV with a work class ROV and minimum lifting capacity of 120t would be mobilised to Singapore, to receive the capping stack and ancillary equipment, then deploy to the licence area. The HLV will be used to land the capping stack on the blowing well and be on location within 21 days. INPEX will maintain a register, updated on a monthly basis, of the location and availability of all HLVs in the SE Asian region. The register will maintain status of safety cases.	As there is only a single BOP and single capping stack, only a single HLV is required.	A breakdown of the individual steps and durations for capping stack mobilisation including sourcing of an appropriate HLV vessel are provided in Table 4-4 Identification and contracting/mobilisation and planning will commence when initial source control planning begins. Response time could be improved by maintaining a HLV on stand-by. However, until site survey and other activities have been conducted and results evaluated by the source control team, it is unknown if capping stack deployment will be possible. Therefore, the large costs of maintaining a HLV on stand-by (~$225,000 per day) are not considered ALARP, especially given HLVs with ROVs can be made available within the region. To ensure the availability, the most practicable option is to maintain an up to date register of suitable, available HLVs and their safety case status.	No additional HLV response capability required.

Source control element	**Can a greater response effort be implemented?**	**Can the time to respond be improved?**	**Justification for increased response effort/reduced response time**
A single MODU would be required to drill a relief well in an absolute worst-case scenario. INPEX will maintain a register, updated on a monthly basis, of the location and availability of all MODUs internationally. The register will maintain status of safety cases. The register will include: • name, contractor, stacking status (cold/warm/on contract/yard) • operator (if on contract) • type • water depth capability • BOP pressure rating and # ram cavities • maximum personnel on board • mud pump, crane, helideck, variable deck load and top drive specifications	Approximate relief well locations have been identified around each drill centre in the WA-50-L licence area. Metocean and seasonal environmental conditions will be considered in final relief well location selection. Preliminary designs have been completed for optimal interception of a blowing well and completing a dynamic kill for the worst-case scenario.	The time to contain the well has been conservatively assessed as 80 days (Brewster); 108 days (Plover) and 115 days (Plover HTHP) based on an absolute worst-case discharge. The relief well design and plan will be optimized to intersect the blowing well and to complete a dynamic kill. The relief well cannot be drilled to a shallower depth (less drilling time), and intercept the original well at a shallower depth, as there would not be sufficient hydrostatic head pressure and drilling fluid weight in a shallower relief well to successfully kill the original well. Should the original MODU still be functional (however without BOP), a study would be conducted, and if practicable to implement, to have the MODU pre-drill the top-hole section of the relief well, prior to the arrival of the relief well drilling rig. INPEX has signed the APPEA MoU for mutual assistance between Titleholders. This MoU requires Titleholders to make 'best endeavours' to release and transfer drilling units and well-site services between operators in a source control event.	No additional relief well response capability required.

Source control element	Can a greater response effort be implemented?	Can the time to respond be improved?	Justification for increased response effort/reduced response time
• base oil, bulk and liquid mud storage capacities • vessel safety case status and jurisdiction. INPEX will also maintain its subscription to the APPEA MoU.			
Relief well long-lead items (LLIs) and equipment has been identified, e.g. casing and well-head. INPEX drilling logistics team maintain a register of all drilling equipment to ensure relief well stocks are available.	The required consumables are available and tracked, as part of routine Ichthys development drilling. Specifically, spares maintained include: • wellhead system • conductor • surface casing • intermediate casing • relief well conduit Miscellaneous equipment such as crossovers can be manufactured locally within Australia in relatively short timeframes. This would be undertaken using pre-existing arrangements that INPEX has in place for the manufacture of such consumables.	The response time to access the relief well equipment (including miscellaneous equipment items such as crossovers etc that may be required and can be fabricated locally), will not be a critical path activity during the relief well drilling, as a standard logistics supply chain for INPEX development drilling activities, involving the Drilling Supply Base in Broome (and back-up base in Darwin) and standard supply vessels, will continue to be utilised.	No additional relief well long lead equipment capability required.

Source control element	**Can a greater response effort be implemented?**	**Can the time to respond be improved?**	**Justification for increased response effort/reduced response time**
A single SSDI spread would be required to implement SSDI. This equipment includes the dispersant stockpile and injection wands. (Note – support vessels with work-class ROVs for SSDI are the same types of vessels as those required for BOP intervention).	There is no requirement for additional/duplicate SSDI spreads. A single SSDI spread will be able to successfully inject dispersant into the well stream at the optimal ratio of approximately 100:1, which has been demonstrated to reduce VOC concentrations below safe levels (RPS 2019). Injecting additional dispersant into the well-stream will not result in any greater/beneficial reduction in VOC concentrations in the atmosphere. Based on a worst-case oil release rate of 20,000 bbl/day (3193 m^3/day), at 100:1 treatment ratio, the dispersant requirement is 32 m^3/day. For a worst case (complex) activity, 30 days of SSDI could be required. Therefore, a worst-case total of ~1000 m3 dispersant could be required. SSDI would generally not be required to commence mobilisation onto a vessel in Broome until approximately day 10 of a response (aligning with BOP intervention/debris clearance mobilisation activities).	SSDI will only be activated when modelled and/or field measurements predict that VOC concentrations are likely to be exceeded during other source control activities such as BOP intervention, debris clearance or capping stack deployment and installation. The SFRT/SSDI spread is located in Western Australia and maintained by AMOSC. This equipment is rapidly able to be mobilised to Broome, the SFRT / SSDI spread is not anticipated to be on the critical path. As such, response time for SSDI spread readiness/mobilisation is determined to be appropriate/ALARP.	No additional SSDI capability required.

Source control element	Can a greater response effort be implemented?	Can the time to respond be improved?	Justification for increased response effort/reduced response time
	The SSDI spread maintained by AMOSC in WA includes 500 m3 of Slick-Gone-NS dispersant and can be mobilised to Broome within 10 days. Therefore, 50% of the total worst-case dispersant requirement for a worst credible SSDI response can be mobilised outside of critical path timeframes. Additional Australian and global dispersant stockpiles can be mobilised, should it be estimated that the AMOSC 500 m3 will be used up. Additional dispersant would not be required until a minimum of ~day 25 of the response, and therefore any additional dispersant stocks could be easily mobilised by vessel or aircraft to Broome within the required timeframe. INPEX maintains access to the global dispersant stockpile through INPEX Corporations membership with OSRL. Therefore, INPEX has access to sufficient dispersant for a worst case (30 day) SSDI activity.		

Table 4-5: Environmental performance outcomes, standards and measurement criteria for source control preparedness arrangements

Environmental Performance Outcome	Environmental Performance Standard	Measurement Criteria
INPEX will be prepared and ready to respond to source control events.	INPEX will maintain registers as described in Table 4-4 updated on a monthly basis, of the location and availability of support vessels, CSVs, HLVs and MODUs, including their capabilities (ROVs/crane capacity etc) and safety case status and jurisdiction.	Vessel and MODU registers.
	INPEX will maintain a register of relief well long lead items.	Relief well long lead items register.
	INPEX will maintain contracts for suitable debris clearance equipment. Debris clearance equipment will be able to be mobilised to Broome within 5 days.	Records of contracts for debris clearance equipment.
	INPEX will maintain a contract for a SSDI spread, which can be mobilised to Broome within 10 days. The SSDI spread will contain a minimum of 500 m^3 of dispersant.	Records of contract for SSDI spread.
	INPEX will maintain its OSRL membership, to ensure access to the global dispersant stockpile.	Records of INPEX OSRL membership.
	INPEX will maintain contracts for suitable capping stack equipment. The capping stack equipment will be: • identified as fit for purpose, capable of being lowered and latched onto the selected BOP, utilising a single HLV • rated to achieve a well-kill, based on the expected pressures of the reservoir • primary stack available to be mobilised onto a HLV within 5 days • primary and secondary capping stack maintained in a suitable state of readiness.	Records of contracts for capping stack equipment.

Environmental Performance Outcome	**Environmental Performance Standard**	**Measurement Criteria**
	INPEX will continue to subscribe to the APPEA MoU.	Record of APPEA MoU.
	INPEX will participate in the DISC steering committee for the development and submission of a SC template for a generic vessel including the activity of deploying a capping stack from this vessel.	Meeting minutes and records of attendance.
	Source control team will maintain preparedness through training and exercises to validate source control logistical arrangements and ensure the source control team: • understand the source control planning documents/procedures • understand their defined roles and responsibilities • validate communications with external source control service providers.	Records of training and exercises for the source control team.
	INPEX will maintain a contract with WWCI, for the provision of personnel to: • provide technical expertise to the INPEX source control team • provide in-field supervision of source control activities.	WWCI contract.
	Prior to spudding; source control documentation will be approved and in place in accordance with the WOMP, including: • Drilling Browse Basin Emergency Response Plan • Source Control Emergency Response Plan • Blowout Contingency Plan – Browse Basin Wells • Well Control Modelling Service Report	Records confirm source control planning documentation was approved prior to spudding.

Environmental Performance Outcome	Environmental Performance Standard	Measurement Criteria
	• Capping Stack Deployment and Installation Procedure.	
INPEX will re-gain control of a well within 80 days (Brewster)/108 days (Plover)/115 days (HPHT) of any source control event, through implementation of the environmental performance standards.	In the event of a loss of well control, conduct a site survey of well-head infrastructure, to inform source control planning activities. A vessel to undertake the site survey will be mobilised to Broome within 7 days.	Records of site survey.
	In the event conditions allow for the safe deployment and installation of the capping stack, INPEX will mobilise, deploy and install the capping stack in accordance with response time model detailed Table 4-2: Deployment of capping stack – vessel freight option	Records of capping stack feasibility report. Daily drilling report.
	INPEX will mobilise relief well MODU and drill, intercept and regain control of the well, in accordance with the time frames detailed in Table 4-1: Summary of time response models for Brewster and Plover reservoirs (Browse Basin Common Relief Well Design and Response Time Models Technical Note)	Daily drilling report.
	The source control team will utilise the source control planning documentation to develop and implement a source control plan. The source control plan will: • evaluate, define and schedule source control activities • utilise the asset registers to identify and safely mobilise suitable assets within the minimum timeframe possible • evaluate the potential to use the site survey vessel/ROV for BOP Intervention • evaluate the potential to use the original MODU to drill top-hole sections for any relief wells.	Source control plan documentation.

Environmental Performance Outcome	**Environmental Performance Standard**	**Measurement Criteria**
	The source control team will develop a SIMOPs plan, to support the source control plan. The SIMOPs plan will specify: • licence area entry requirements, including DP checks • exclusion zones • minimum vessel separations • communications requirements and frequencies SIMOPs planning meetings.	Records confirm SIMOPs plan developed and implemented.
No incidents of loss of hydrocarbons to the marine environment as a result of a vessel collision during source control activities.	If debris clearance and wet-storage is required, the source control team will use existing site survey data to identify temporary wet storage areas which are not sensitive benthic habitats.	Records confirm any identified wet-storage areas do not contain sensitive benthic habitats.
Impacts to the shallow water column through use of SSDI will be reduced to ALARP through the implementation of the Environmental Performance Standard.	SSDI will only be activated when: • Air quality monitoring and/or modelling determines there is a credible risk of atmospheric VOC concentrations exceeding safe exposure thresholds for source control activities; and • There is a requirement to conduct source control activities in the zone where atmospheric VOCs may present a hazard to the safety of workers, and • Air quality monitoring and/or modelling of gas levels and lower explosive limits determines source control activities including SSDI could be safety conducted.	Records of: • Air quality monitoring and/or modelling demonstrating a credible risk of atmospheric VOC concentrations exceeding safe exposure thresholds for source control activities • SSDI injection occurring concurrently with source control activities.
	SSDI injection concentration will initially be set at 100:1 (based on best estimate of well flow-rate at the time of the blow-out).	Records of SSDI injection ratio Records of atmospheric VOC concentration monitoring during source control activities.

Environmental Performance Outcome	Environmental Performance Standard	Measurement Criteria
	Effectiveness of SSDI will be monitored through ongoing measurement of VOC concentrations on the surface, by source control vessels. If VOC exposure thresholds are exceeded, SSDI ratio will be incrementally increased, until VOC concentrations are below safe exposure thresholds.	

5 IMPLEMENTATION

An implementation strategy is described within all INPEX EPs. The implementation strategy addresses the following:

- overview of the INPEX Business Management System, including HSE management systems/processes
- leadership and commitment including Environment Policy
- capability and competency including the organisational team and responsibilities associated with the implementation of the EP
- documentation, information and data management related to the EP
- risk management process used within the EP
- operate and maintain; specific processes/systems required for EP implementation
- management of change, including the specific change management process for the EP
- stakeholder engagement, including processes for ongoing engagement and consultation with stakeholders potentially affected by the EP
- contractors and suppliers, including selection and management processes
- security and emergency management
- incident investigation and lessons learned, which also includes monthly and annual performance reporting.
- monitor, review and audit; defining the processes to ensure ongoing compliance and continual improvement of the EP
- management review, including senior management review of the EP.

Within the implementation strategy of each EP, only some elements are relevant to this document. The following are considered necessary to include as stand-alone processes within this document:

- source control arrangements testing
- review of source control arrangements process
- management of change process
- annual performance reporting requirements
- management review process.

The details of these are provided in the following sections.

5.1 Source control arrangements testing

Environmental performance outcomes, standards and measurement criteria relating to testing of source control arrangements associated with INPEX exploration and production wells in the Browse Basin are presented in Table 5-1.

Table 5-1: Environmental performance outcome, standards and measurement criteria for testing response arrangements

Environmental performance outcome	Performance standards	Measurement criteria
INPEX will be prepared and ready to respond to source control events.	INPEX IMT and drilling source control team will conduct a well blow-out exercise in the Browse Basin biennially. The objectives of this exercise will include as a minimum: practice the interface between the source control team and IMT • source control team verification of availability of rigs, vessels and equipment • source control team verification of logistics plan • to verify source control response timelines as specified in Table 4-4.	Exercise records demonstrate that a Browse Basin well-kill exercise has been conducted biennially.
	INPEX source control team will conduct an annual source control logistics desktop validation exercise. The objectives of this exercise will include: • source control team verification of availability of rigs, vessels and other required source control equipment, specified in Table 4-4. • source control team verification of a logistics plan which meets the source control response timelines specified in Table 4-4.	Exercise reports demonstrate objectives have been tested annually.

5.2 Review of source control arrangements and risk assessment

An environmental risk register for each EP is maintained and will be reviewed and updated quarterly. The quarterly environmental risk review process will be implemented to assess internal and external changes that may affect the performance outcome and standards as associated with the activity. Changes could include availability of source control response MODUs/vessels or other source control relevant information.

This document will be reviewed following any events requiring its activation, in order to identify any lessons learned, or other relevant triggers for review.

Environmental performance outcomes, standards and measurement criteria relating to source control capability and arrangements reviews and updates to this document are presented in Table 5-2.

Table 5-2: Environmental performance outcome, standards and measurement criteria for updating this source control document

Environmental performance outcome	Performance standards	Measurement criteria
INPEX will be prepared and ready to respond to source control events.	This document will be reviewed and updated if necessary, following any INPEX source control team exercise or incident in which any source control capability used/activated.	Records demonstrate a review and update (if necessary) of this document.
	If new source control related information, which could affect source control capability and arrangements (such as MODU/vessel availability issues) is identified through the quarterly risk review process, the information will be assessed using New Information Risk Assessments and/or the Management of Change process. Depending on the outcome of the risk assessment and/or change assessment, this document will be updated as necessary.	Records demonstrate quarterly risk reviews consider source control risk elements.
	This document will be reviewed and updated if necessary, based on findings from the annual management review and annual performance report.	Records demonstrate a review and update (if necessary) of this document.

5.3 Management of Change

Changes to INPEX documents are managed in accordance with a business-wide standard, and related procedures and guidelines. Where a change to management of an activity is proposed, it will be logged. Internal notification will be communicated via a management of change (MoC) request. The request will identify the proposed change(s) along with the underlying reasons and highlight potential areas of risk or impact. In accordance with the INPEX business rules, it is mandatory to undertake an environmental risk assessment in every case for changes that could affect the environment, including source control risks and response arrangements.

The MoC request will be managed by an environmental adviser who will then determine the necessary approval/endorsement pathway, in consultation with the environmental approvals coordinator. Minor changes (such as updating a document or process) that do not invoke a revision trigger are made in document reviews from time to time.

In accordance with Regulation 17 of the OPGGS (E) Regulations 2009, a revision of an EP will be submitted to NOPSEMA where:

- a change is considered to represent a new activity
- a change is considered to represent a significant modification to, or a new stage of, an existing activity
- a change will create a significant new environmental impact or risk
- a change will result in a series of new (or increased) environmental impacts or risks that, together, will result in a significant new environmental impact or risk, or a significant increase in an existing environmental impact or risk.

The MoC request process will be periodically checked against NOPSEMA guidance to ensure ongoing compliance and will be undertaken as part of the management review process described in Section 0.

As this documents is an integrated element EPs associated with exploration and production wells, the MoC process is also applicable to this documents. Therefore, where an MoC is required for changes to this document, the INPEX EP MoC template will be used to formally record/document the change.

When a new or revised EP is required to be re-submitted to NOPSEMA, and the new or revised EP also requires/results in changes to this document, the updated version of this document will be submitted, with the new/revised EP, to NOPSEMA.

5.4 Annual performance reporting

In accordance with Regulation 14(2) of the OPGGS (E) Regulations 2009, INPEX will undertake a review of its compliance with the environmental performance outcomes and standards set out in this document and will provide a written report of its findings to NOPSEMA on an annual basis.

The annual reporting period for this document will be from the 01 January to 31 December of each calendar year. The submission date for the environmental performance report will be 01 April each calendar year.

Any findings from the Annual Performance Report will be included on an INPEX action tracking register.

5.5 Management review

Management reviews of this document shall assess whether:

- control measures detailed in this document are effective in maintaining source control preparedness and response capability to an ALARP and acceptable level
- implementation of the MoC process has been applied consistently and appropriately, ensuring source control preparedness and response capability and arrangements remain ALARP and at acceptable levels, commensurate with INPEX's activities and source control risks
- any changes in legislation, NOPSEMA guidance or other matters relating to source control preparedness and response have been taken into consideration in relation to this document.

Where the documented findings of the management reviews have implications for this document, it will be updated in accordance with Table 5-2.

6 REFERENCES

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